Scientific and Technical Aerospace Reports

STAR

Volume 37
June 21, 1999

National Aeronautics and
Space Administration
Langley Research Center

**Scientific and Technical
Information Program Office**

The NASA STI Program Office . . . in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.

- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.

- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.

- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at ***http://www.sti.nasa.gov***

- E-mail your question via the Internet to help@sti.nasa.gov

- Fax your question to the NASA STI Help Desk at (301) 621-0134

- Telephone the NASA STI Help Desk at (301) 621-0390

- Write to:
  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

Introduction

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

- NASA, NASA contractor, and NASA grantee reports;
- Reports issued by other U.S. Government agencies, domestic and foreign institutions, universities, and private firms;
- Translations in report form;
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses.

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

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

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

SCAN Goes Electronic!

If you have electronic mail or if you can access the Internet, you can view biweekly issues of *SCAN* from your desktop absolutely free!

Electronic SCAN takes advantage of computer technology to inform you of the latest worldwide, aerospace-related, scientific and technical information that has been published.

No more waiting while the paper copy is printed and mailed to you. You can view *Electronic SCAN* the same day it is released—up to 191 topics to browse at your leisure. When you locate a publication of interest, you can print the announcement. You can also go back to the *Electronic SCAN* home page and follow the ordering instructions to quickly receive the full document.

Start your access to *Electronic SCAN* today. Over 1,000 announcements of new reports, books, conference proceedings, journal articles...and more—available to your computer every two weeks.

Timely
Flexible
Complete
FREE!

For Internet access to *E-SCAN*, use any of the following addresses:

http://www.sti.nasa.gov
ftp.sti.nasa.gov
gopher.sti.nasa.gov

To receive a free subscription, send e-mail for complete information about the service first. Enter **scan@sti.nasa.gov** on the address line. Leave the subject and message areas blank and send. You will receive a reply in minutes.

Then simply determine the SCAN topics you wish to receive and send a second e-mail to **listserv@sti.nasa.gov**. Leave the subject line blank and enter a subscribe command, denoting which topic you want and your name in the message area, formatted as follows:

Subscribe SCAN–02–01 Jane Doe

For additional information, e-mail a message to **help@sti.nasa.gov**.

Phone: (301) 621-0390

Fax: (301) 621-0134

Write: NASA STI Help Desk
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

Looking just for *Aerospace Medicine and Biology* reports?

Although hard copy distribution has been discontinued, you can still receive these vital announcements through your *E-SCAN* subscription. Just **Subscribe SCAN-AEROMED Jane Doe** in the message area of your e-mail to **listserv@sti.nasa.gov**.

New Feature!
subscribe SCAN-AEROMED

Table of Contents

Subject Divisions

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

A. Aeronautics
B. Astronautics
C. Chemistry and Materials
D. Engineering
E. Geosciences
F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social Sciences
J. Space Sciences
K. General

Indexes

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

Subject Term Index

Personal Author Index

Document Availability

Select **Availability Info** for important information about NASA Scientific and Technical Information (STI) Program Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

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 1

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 3

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 4

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 5

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

06 Aircraft Instrumentation N.A.

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

07 Aircraft Propulsion and Power 8

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 10

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) 12

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

Subject Categories of the Division B. Astronautics

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

12 Astronautics (General) N.A.

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

13 Astrodynamics 14

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

14 Ground Support Systems and Facilities (Space) 15

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

15 Launch Vehicles and Space Vehicles 16

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

16 Space Transportation 18

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 22

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 24

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

20 Spacecraft Propulsion and Power 25

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) 28

24 Composite Materials 28

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

25 Inorganic and Physical Chemistry 30

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

26 Metallic Materials 38

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

27 Nonmetallic Materials 47

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

28 Propellants and Fuels 51

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 55

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) 56

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

32 Communications and Radar 59

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 62

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 66

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 76

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 89

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

37 Mechanical Engineering 91

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

38 Quality Assurance and Reliability 92

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 98

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 103

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 106

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 114

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

47 Meteorology and Climatology 120

Includes weather forecasting and modification.

48 Oceanography 124

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 128

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

53 Behavioral Sciences 132

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

54 Man/System Technology and Life Support 132

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) 134

60 Computer Operations and Hardware 136

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

61 Computer Programming and Software 137

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

62 Computer Systems 146

Includes computer networks and special application computer systems.

63 Cybernetics 150

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 152

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 153

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

66 Systems Analysis 154

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics 155

Includes topology and number theory.

Subject Categories of the Division H. Physics

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

70 Physics (General) 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 160

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 163

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

74 Optics 167

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

75 Plasma Physics 171

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

76 Solid-State Physics 190

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

77 Thermodynamics and Statistical Physics N.A.

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

Subject Categories of the Division I. Social Sciences

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

80 Social Sciences (General) N.A.

Includes educational matters.

81 Administration and Management 194

Includes management planning and research.

82 Documentation and Information Science 195

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 200

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

85 Urban Technology and Transportation 201

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

Subject Categories of the Division J. Space Sciences

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

88 Space Sciences (General) 201

89 Astronomy 202

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

90 Astrophysics 214

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 219

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

92 Solar Physics 220

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

93 Space Radiation 221

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

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

99 General 224

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

Document Availability Information

The mission of the NASA Scientific and Technical (STI) Program Office is to quickly, efficiently, and cost-effectively provide the NASA community with desktop access to STI produced by NASA and the world's aerospace industry and academia. In addition, we will provide the aerospace industry, academia, and the taxpayer access to the intellectual scientific and technical output and achievements of NASA.

Eligibility and Registration for NASA STI Products and Services

The NASA STI Program offers a wide variety of products and services to achieve its mission. Your affiliation with NASA determines the level and type of services provided by the NASA STI Program. To assure that appropriate level of services are provided, NASA STI users are requested to register at the NASA Center for AeroSpace Information (CASI). Please contact NASA CASI in one of the following ways:

E-mail:	help@sti.nasa.gov
Fax:	301-621-0134
Phone:	301-621-0390
Mail:	ATTN: Registration Services NASA Center for AeroSpace Information 7121 Standard Drive Hanover, MD 21076-1320

Limited Reproducibility

In the database citations, a note of limited reproducibility appears if there are factors affecting the reproducibility of more than 20 percent of the document. These factors include faint or broken type, color photographs, black and white photographs, foldouts, dot matrix print, or some other factor that limits the reproducibility of the document. This notation also appears on the microfiche header.

NASA Patents and Patent Applications

Patents and patent applications owned by NASA are announced in the STI Database. Printed copies of patents (which are not microfiched) are available for purchase from the U.S. Patent and Trademark Office.

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the U.S. Patent and Trademark Office.

NASA patent application specifications are sold in both paper copy and microfiche by the NASA Center for AeroSpace Information (CASI). The document ID number should be used in ordering either paper copy or microfiche from CASI.

The patents and patent applications announced in the STI Database are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

National Aeronautics and Space Administration
Associate General Counsel for Intellectual Property
Code GP
Washington, DC 20546-0001

Sources for Documents

One or more sources from which a document announced in the STI Database is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below, with an Addresses of Organizations list near the back of this section. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source.

Avail: NASA CASI. Sold by the NASA Center for AeroSpace Information. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the citation. Current values are given in the NASA CASI Price Code Table near the end of this section.

Note on Ordering Documents: When ordering publications from NASA CASI, use the document ID number or other report number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in Energy Research Abstracts. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center—Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU International topic categories can be obtained from ESDU International.

Avail: Fachinformationszentrum Karlsruhe. Gesellschaft für wissenschaftlich-technische Information mbH 76344 Eggenstein-Leopoldshafen, Germany.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, CA. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration (JBD-4), Public Documents Room (Room 1H23), Washington, DC 20546-0001, or public document rooms located at NASA installations, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: NTIS. Sold by the National Technical Information Service. Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) are available. For information concerning this service, consult the NTIS Subscription Section, Springfield, VA 22161.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free.

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INlS) representative in their country, or by applying directly to the issuing organization.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed on the Addresses of Organizations page. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Addresses of Organizations

British Library Lending Division
Boston Spa, Wetherby, Yorkshire
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, DC 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

European Space Agency–
Information Retrieval Service ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International
27 Corsham Street
London
N1 6UA
England

Fachinformationszentrum Karlsruhe
Gesellschaft für wissenschaftlich–technische
Information mbH
76344 Eggenstein–Leopoldshafen, Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

(NASA STI Lead Center)
National Aeronautics and Space Administration
Scientific and Technical Information Program Office
Langley Research Center – MS157
Hampton, VA 23681

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, CA 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, MI 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library National Center
MS 950
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, AZ 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, CO 80225

NASA CASI Price Code Table

(Effective July 1, 1998)

Code	U.S., Canada, & Mexico	Foreign
A01	$ 8.00	$ 16.00
A02	12.00	24.00
A03	23.00	46.00
A04	25.50	51.00
A05	27.00	54.00
A06	29.50	59.00
A07	33.00	66.00
A08	36.00	72.00
A09	41.00	82.00
A10	44.00	88.00
A11	47.00	94.00
A12	51.00	102.00
A13	54.00	108.00
A14	56.00	112.00
A15	58.00	116.00
A16	60.00	120.00
A17	62.00	124.00
A18	65.50	131.00
A19	67.50	135.00
A20	69.50	139.00
A21	71.50	143.00
A22	77.00	154.00
A23	79.00	158.00
A24	81.00	162.00
A25	83.00	166.00
A99	Contact NASA CASI	

Code	U.S., Canada, & Mexico	Foreign
E01	$101.00	$202.00
E02	109.50	219.00
E03	119.50	238.00
E04	128.50	257.00
E05	138.00	276.00
E06	146.50	293.00
E07	156.00	312.00
E08	165.50	331.00
E09	174.00	348.00
E10	183.50	367.00
E11	193.00	386.00
E12	201.00	402.00
E13	210.50	421.00
E14	220.00	440.00
E15	229.50	459.00
E16	238.00	476.00
E17	247.50	495.00
E18	257.00	514.00
E19	265.50	531.00
E20	275.00	550.00
E21	284.50	569.00
E22	293.00	586.00
E23	302.50	605.00
E24	312.00	624.00
E99	Contact NASA CASI	

Payment Options

All orders must be prepaid unless you are registered for invoicing or have a deposit account with the NASA CASI. Payment can be made by VISA, MasterCard, American Express, or Diner's Club credit card. Checks or money orders must be in U.S. currency and made payable to "NASA Center for AeroSpace Information." To register, please request a registration form through the NASA STI Help Desk at the numbers or addresses below.

Handling fee per item is $1.50 domestic delivery to any location in the United States and $9.00 foreign delivery to Canada, Mexico, and other foreign locations. Video orders incur an additional $2.00 handling fee per title.

The fee for shipping the safest and fastest way via Federal Express is in addition to the regular handling fee explained above—$5.00 domestic per item, $27.00 foreign for the first 1-3 items, $9.00 for each additional item.

Return Policy

The NASA Center for AeroSpace Information will replace or make full refund on items you have requested if we have made an error in your order, if the item is defective, or if it was received in damaged condition, and you contact CASI within 30 days of your original request.

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

E-mail: help@sti.nasa.gov
Fax: (301) 621-0134
Phone: (301) 621-0390

Rev. 7/98

Federal Depository Library Program

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 53 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 53 regional depositories. A list of the Federal Regional Depository Libraries, arranged alphabetically by state, appears at the very end of this section. These libraries are not sales outlets. A local library can contact a regional depository to help locate specific reports, or direct contact may be made by an individual.

Public Collection of NASA Documents

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in the STI Database. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents FIZ–Fachinformation Karlsruhe–Bibliographic Service, D-76344 Eggenstein-Leopoldshafen, Germany and TIB–Technische Informationsbibliothek, P.O. Box 60 80, D-30080 Hannover, Germany.

Submitting Documents

All users of this abstract service are urged to forward reports to be considered for announcement in the STI Database. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those you will transmit to NASA, DOD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to:

ATTN: Acquisitions Specialist
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320.

Reprints of journal articles, book chapters, and conference papers are also welcome.

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on a public sale at the NASA Center for AeroSpace Information. Copyrighted publications will be announced but not distributed or sold.

Federal Regional Depository Libraries

ALABAMA
AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Dept.
7300 University Dr.
Montgomery, AL 36117–3596
(205) 244–3650 Fax: (205) 244–0678

UNIV. OF ALABAMA
Amelia Gayle Gorgas Library
Govt. Documents
P.O. Box 870266
Tuscaloosa, AL 35487–0266
(205) 348–6046 Fax: (205) 348–0760

ARIZONA
DEPT. OF LIBRARY, ARCHIVES, AND PUBLIC RECORDS
Research Division
Third Floor, State Capitol
1700 West Washington
Phoenix, AZ 85007
(602) 542–3701 Fax: (602) 542–4400

ARKANSAS
ARKANSAS STATE LIBRARY
State Library Service Section
Documents Service Section
One Capitol Mall
Little Rock, AR 72201–1014
(501) 682–2053 Fax: (501) 682–1529

CALIFORNIA
CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 942837 – 914 Capitol Mall
Sacramento, CA 94337–0091
(916) 654–0069 Fax: (916) 654–0241

COLORADO
UNIV. OF COLORADO – BOULDER
Libraries – Govt. Publications
Campus Box 184
Boulder, CO 80309–0184
(303) 492–8834 Fax: (303) 492–1881

DENVER PUBLIC LIBRARY
Govt. Publications Dept. BSG
1357 Broadway
Denver, CO 80203–2165
(303) 640–8846 Fax: (303) 640–8817

CONNECTICUT
CONNECTICUT STATE LIBRARY
231 Capitol Avenue
Hartford, CT 06106
(203) 566–4971 Fax: (203) 566–3322

FLORIDA
UNIV. OF FLORIDA LIBRARIES
Documents Dept.
240 Library West
Gainesville, FL 32611–2048
(904) 392–0366 Fax: (904) 392–7251

GEORGIA
UNIV. OF GEORGIA LIBRARIES
Govt. Documents Dept.
Jackson Street
Athens, GA 30602–1645
(706) 542–8949 Fax: (706) 542–4144

HAWAII
UNIV. OF HAWAII
Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948–8230 Fax: (808) 956–5968

IDAHO
UNIV. OF IDAHO LIBRARY
Documents Section
Rayburn Street
Moscow, ID 83844–2353
(208) 885–6344 Fax: (208) 885–6817

ILLINOIS
ILLINOIS STATE LIBRARY
Federal Documents Dept.
300 South Second Street
Springfield, IL 62701–1796
(217) 782–7596 Fax: (217) 782–6437

INDIANA
INDIANA STATE LIBRARY
Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204–2296
(317) 232–3679 Fax: (317) 232–3728

IOWA
UNIV. OF IOWA LIBRARIES
Govt. Publications
Washington & Madison Streets
Iowa City, IA 52242–1166
(319) 335–5926 Fax: (319) 335–5900

KANSAS
UNIV. OF KANSAS
Govt. Documents & Maps Library
6001 Malott Hall
Lawrence, KS 66045–2800
(913) 864–4660 Fax: (913) 864–3855

KENTUCKY
UNIV. OF KENTUCKY
King Library South
Govt. Publications/Maps Dept.
Patterson Drive
Lexington, KY 40506–0039
(606) 257–3139 Fax: (606) 257–3139

LOUISIANA
LOUISIANA STATE UNIV.
Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803–3312
(504) 388–2570 Fax: (504) 388–6992

LOUISIANA TECHNICAL UNIV.
Prescott Memorial Library
Govt. Documents Dept.
Ruston, LA 71272–0046
(318) 257–4962 Fax: (318) 257–2447

MAINE
UNIV. OF MAINE
Raymond H. Fogler Library
Govt. Documents Dept.
Orono, ME 04469–5729
(207) 581–1673 Fax: (207) 581–1653

MARYLAND
UNIV. OF MARYLAND – COLLEGE PARK
McKeldin Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 405–9165 Fax: (301) 314–9416

MASSACHUSETTS
BOSTON PUBLIC LIBRARY
Govt. Documents
666 Boylston Street
Boston, MA 02117–0286
(617) 536–5400, ext. 226
Fax: (617) 536–7758

MICHIGAN
DETROIT PUBLIC LIBRARY
5201 Woodward Avenue
Detroit, MI 48202–4093
(313) 833–1025 Fax: (313) 833–0156

LIBRARY OF MICHIGAN
Govt. Documents Unit
P.O. Box 30007
717 West Allegan Street
Lansing, MI 48909
(517) 373–1300 Fax: (517) 373–3381

MINNESOTA
UNIV. OF MINNESOTA
Govt. Publications
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624–5073 Fax: (612) 626–9353

MISSISSIPPI
UNIV. OF MISSISSIPPI
J.D. Williams Library
106 Old Gym Bldg.
University, MS 38677
(601) 232–5857 Fax: (601) 232–7465

MISSOURI
UNIV. OF MISSOURI – COLUMBIA
106B Ellis Library
Govt. Documents Sect.
Columbia, MO 65201–5149
(314) 882–6733 Fax: (314) 882–8044

MONTANA
UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812–1195
(406) 243–6700 Fax: (406) 243–2060

NEBRASKA
UNIV. OF NEBRASKA – LINCOLN
D.L. Love Memorial Library
Lincoln, NE 68588–0410
(402) 472–2562 Fax: (402) 472–5131

NEVADA
THE UNIV. OF NEVADA LIBRARIES
Business and Govt. Information Center
Reno, NV 89557–0044
(702) 784–6579 Fax: (702) 784–1751

NEW JERSEY
NEWARK PUBLIC LIBRARY
Science Div. – Public Access
P.O. Box 630
Five Washington Street
Newark, NJ 07101–7812
(201) 733–7782 Fax: (201) 733–5648

NEW MEXICO
UNIV. OF NEW MEXICO
General Library
Govt. Information Dept.
Albuquerque, NM 87131–1466
(505) 277–5441 Fax: (505) 277–6019

NEW MEXICO STATE LIBRARY
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827–3824 Fax: (505) 827–3888

NEW YORK
NEW YORK STATE LIBRARY
Cultural Education Center
Documents/Gift & Exchange Section
Empire State Plaza
Albany, NY 12230–0001
(518) 474–5355 Fax: (518) 474–5786

NORTH CAROLINA
UNIV. OF NORTH CAROLINA – CHAPEL HILL
Walter Royal Davis Library
CB 3912, Reference Dept.
Chapel Hill, NC 27514–8890
(919) 962–1151 Fax: (919) 962–4451

NORTH DAKOTA
NORTH DAKOTA STATE UNIV. LIB.
Documents
P.O. Box 5599
Fargo, ND 58105–5599
(701) 237–8886 Fax: (701) 237–7138

UNIV. OF NORTH DAKOTA
Chester Fritz Library
University Station
P.O. Box 9000 – Centennial and University Avenue
Grand Forks, ND 58202–9000
(701) 777–4632 Fax: (701) 777–3319

OHIO
STATE LIBRARY OF OHIO
Documents Dept.
65 South Front Street
Columbus, OH 43215–4163
(614) 644–7051 Fax: (614) 752–9178

OKLAHOMA
OKLAHOMA DEPT. OF LIBRARIES
U.S. Govt. Information Division
200 Northeast 18th Street
Oklahoma City, OK 73105–3298
(405) 521–2502, ext. 253
Fax: (405) 525–7804

OKLAHOMA STATE UNIV.
Edmon Low Library
Stillwater, OK 74078–0375
(405) 744–6546 Fax: (405) 744–5183

OREGON
PORTLAND STATE UNIV.
Branford P. Millar Library
934 Southwest Harrison
Portland, OR 97207–1151
(503) 725–4123 Fax: (503) 725–4524

PENNSYLVANIA
STATE LIBRARY OF PENN.
Govt. Publications Section
116 Walnut & Commonwealth Ave.
Harrisburg, PA 17105–1601
(717) 787–3752 Fax: (717) 783–2070

SOUTH CAROLINA
CLEMSON UNIV.
Robert Muldrow Cooper Library
Public Documents Unit
P.O. Box 343001
Clemson, SC 29634–3001
(803) 656–5174 Fax: (803) 656–3025

UNIV. OF SOUTH CAROLINA
Thomas Cooper Library
Green and Sumter Streets
Columbia, SC 29208
(803) 777–4841 Fax: (803) 777–9503

TENNESSEE
UNIV. OF MEMPHIS LIBRARIES
Govt. Publications Dept.
Memphis, TN 38152–0001
(901) 678–2206 Fax: (901) 678–2511

TEXAS
TEXAS STATE LIBRARY
United States Documents
P.O. Box 12927 – 1201 Brazos
Austin, TX 78701–0001
(512) 463–5455 Fax: (512) 463–5436

TEXAS TECH. UNIV. LIBRARIES
Documents Dept.
Lubbock, TX 79409–0002
(806) 742–2282 Fax: (806) 742–1920

UTAH
UTAH STATE UNIV.
Merrill Library Documents Dept.
Logan, UT 84322–3000
(801) 797–2678 Fax: (801) 797–2677

VIRGINIA
UNIV. OF VIRGINIA
Alderman Library
Govt. Documents
University Ave. & McCormick Rd.
Charlottesville, VA 22903–2498
(804) 824–3133 Fax: (804) 924–4337

WASHINGTON
WASHINGTON STATE LIBRARY
Govt. Publications
P.O. Box 42478
16th and Water Streets
Olympia, WA 98504–2478
(206) 753–4027 Fax: (206) 586–7575

WEST VIRGINIA
WEST VIRGINIA UNIV. LIBRARY
Govt. Documents Section
P.O. Box 6069 – 1549 University Ave.
Morgantown, WV 26506–6069
(304) 293–3051 Fax: (304) 293–6638

WISCONSIN
ST. HIST. SOC. OF WISCONSIN LIBRARY
Govt. Publication Section
816 State Street
Madison, WI 53706
(608) 264–6525 Fax: (608) 264–6520

MILWAUKEE PUBLIC LIBRARY
Documents Division
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 286–3073 Fax: (414) 286–8074

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

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 37, JUNE 21, 1999

01
AERONAUTICS (GENERAL)

19990041594 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 401
May 28, 1999; 52p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL401; NAS 1.21:7037/SUPPL401; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Author

Data Bases; Bibliographies; Aeronautical Engineering

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.

19990041266 La Sapienza Univ., Dept. of Mechanics and Aeronautics, Rome, Italy
DNS Study of Stability of Trailing Vortices
Orlandi, P., La Sapienza Univ., Italy; Carnevale, G. F., Scripps Institution of Oceanography, USA; Lele, S. K., Stanford Univ., USA; Shariff, K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 187-208; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Three-dimensional numerical simulations are used to investigate the possibility of diminishing the strength of trailing vortices. Direct numerical simulation is first used to reproduce results of recent laboratory experiments on the short-wave cooperative instability for two counter-rotating vortices. The effect of perturbing the vortices by internal and external density perturbations is considered. It is found that perturbing trailing vortices with temperature variations may be a useful means of initiating the short-wave instability and ultimately causing the cross diffusion of vorticity necessary to destroy the coherence and strength of the trailing vortices.

Author

Direct Numerical Simulation; Three Dimensional Models; Aircraft Wakes; Vortex Alleviation; Turbulent Wakes; Vortices; Computerized Simulation; Flow Stability

19990041725 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Abteilung Operative Planung, Cologne, Germany
Performance Improvement of Transonic Airfoils Through Contour Modifications in the Shock Region ***Die Leistungsverbesserung Transsonischer Profile Durch Konturmodifikationen im Stossbereich***
Knauer, Andreas, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; 1998; ISSN 1434-8454; 130p; In German
Report No.(s): DLR-FB-98-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The modification of the shock and the shock/boundary-layer interaction on transonic airfoils through passive and active shock control and through contour bumps in the shock region was investigated. The effect of passive shock control and boundary-layer suction on the model VA-2 was examined at Reynolds numbers Re = 2.5 x 10(exp 6) in the Mach number range 0.715 less than or equal to Ma less than or equal to 0.775. Through the use of these methods drag reductions, gains in lift and furthermore a delay

of the buffet-onset were observed. On the ADIF airfoil parameter studies of contour bumps in the shock region at Re = 25 x 10(exp 6) in the Mach number range 0.72 less than or equal to Ma less than or equal to 0.8 were conducted. In these studies the MSES 2.1 code was 9 used. The influence of the geometric parameters symmetry, height, position and extension were detected. In the calculations drag reductions from design to dragrise conditions were observed. The designed model was tested at Reynolds numbers Re = 8 x 10(exp 6) in the Cryogenic Ludwieg Tube in Gottingen. The results of the calculations were verified; in a wide range considerable drag reductions were achieved. Furthermore the influence of the displacement thickness on the effect of the bumps was detected.
Author
Airfoils; Transonic Flow; Shock Wave Interaction; Drag; Displacement; Boundary Layers

19990041926 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Nonlinear Pre-Filter to Prevent Departure and/or Pilot-Induced Oscillations (PIO) Due to Actuator Rate Limiting
Chapa, Michael J.; Mar. 1999; 155p; In English
Report No.(s): AD-A361655; AFIT/GAE/ENY/99M-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Closed loop instability caused by excess phase lag induced by actuator rate limiting has been suspected in many aircraft departures from controlled flight and pilot-induced oscillations (PIO). As part of the joint Air Force Institute of Technology Test Pilot School (AFITITPS) program, a nonlinear rate limiter pre-filter (RLPF) was developed to minimize the phase lag induced by rate limiting. RLFF performance was evaluated inside the feedback path, but primary emphasis was on the pilot command path. Closed loop computer and motion-based flight simulation were conducted to prepare for the flight test. The HAVE FILTER flight test project was flown using the NF-16D Variable Stability in-flight Simulator Test Aircraft (VISTA) aircraft and evaluated using a software rate limit (SWRL) with and without an RLPF on the pilot command path. A programmable heads-up-display (HUD) was used to generate a fighter tracking task. Flight test results showed the SWRL was useful in preventing departure and/or PIO. However, with low SWRL settings (is less than 40 deg/sec) handling qualities deficiencies were uncovered due to sluggish initial pitch response. The RLPF plus SWRL combination resulted in more departure and/or PIO protection than the SWRL alone. But with low SWRL settings (is less than 40 deg/sec) significant handling qualities deficiencies were sometimes found.
DTIC
Aerodynamic Stability; Controllability; Pilot Induced Oscillation; Flight Control; Feedback Control; Stability Tests

19990042028 Iowa State Univ. of Science and Technology, Ames, IA USA
Numerical Computation of the Chemically Reacting Flow around the National Aero-Space Plane ***Final Report, 1 Feb. 1992 - 31 Jan. 1999***
Tannehill, J. C., Iowa State Univ. of Science and Technology, USA; 1999; 10p; In English
Contract(s)/Grant(s): NAG2-776; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final report summarizes the research accomplished. The research performed during the grant period can be divided into the following major areas: (1) Computation of chemically reacting Supersonic combustion ramjet (scramjet) flowfields. (2) Application of a two-equation turbulence model to supersonic combustion flowfields. (3) Computation of the integrated aerodynamic and propulsive flowfields of a generic hypersonic space plane. (4) Computation of hypersonic flows with finite-catalytic walls. (5) Development of an upwind Parabolized Navier-Stokes (PNS) code for thermo-chemical nonequilibrium flows.
Derived from text
Navier-Stokes Equation; National Aerospace Plane Program; Computational Fluid Dynamics; Supersonic Combustion Ramjet Engines; Hypersonic Flow; Laminar Flow; Three Dimensional Flow; Hypersonic Nozzles; Inviscid Flow; Nonequilibrium Flow; Turbulence Models; Acoustic Velocity

19990042054 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Characteristics and Development of the Aerodynamic Database of the X-34 ReUSAble Launch Vehicle
Pamadi, Bandu N., NASA Langley Research Center, USA; Brauchman, Gregory J., NASA Langley Research Center, USA; 1999; In English; Atmospheric Reentry Vehicles and Systems, 16-18 Mar. 1999, Arcachon, France; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An overview of the aerodynamic characteristics and the process of developing the preflight aerodynamic database of the NASA/ Orbital X-34 reUSAble launch vehicle is presented in this paper. Wind tunnel tests from subsonic to hypersonic Mach numbers including ground effect tests at low subsonic speeds were conducted in various facilities at the NASA Langley Research Center. The APAS (Aerodynamic Preliminary Analysis System) code was used for engineering level analysis and to fill the gaps

in the wind tunnel test data. This aerodynamic database covers the range of Mach numbers, angles of attack, sideslip and control surface deflections anticipated in the complete flight envelope.
Author
Aerodynamic Characteristics; X-34 ReUSAble Launch Vehicle; Wind Tunnel Tests

19990042101 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Wing in Ground Effect Craft Review
Holloran, Michael; O'Meara, Sean; Feb. 1999; 88p; In English
Report No.(s): AD-A361836; DSTO-GD-0201; DODA-AR-010-831; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

It has long been recognized that flight close to a boundary surface is more aerodynamically efficient than flight in the free-stream. This has led to the design and construction of craft specifically intended to operate close to the ground and fly in ground effect. A great range of Wing in Ground effect Craft (WIGs) have been manufactured ranging from 2 seat recreational vehicles to 500 tone warcraft. Despite this WIGs have never enjoyed great commercial or mIlitary success. The Maritime Platform Division of Defence Science and Technology Organization (DSTO) commissioned The Sir Lawrence Wackeft Centre for Aerospace Design Technology to conduct a design review of WIG craft This review considers all elements of WIG design and operation, including performance, limitations, control, stability, operational requirements, regulation, manufacture and technological risk. The review highlights the research required to overcome the weaknesses of WIG craft, the advantages that they may offer and the possible uses of WIG craft in the Australian military.
DTIC
Ground Effect (Aerodynamics); Wings; Design Analysis; Aircraft Design; Aerospace Systems

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.

19990041359 Federal Aviation Administration, Fire Safety Section, Atlantic City, NJ USA
Full-Scale Test Evaluation of Aircraft Fuel Fire Burnthrough Resistance Improvements *Final Report*
Marker, T. R.; Jan. 1999; 48p; In English
Report No.(s): PB99-130072; DOT/FAA/AR-98/52; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the research and full-scale tests undertaken by the Federal Aviation Administration (FAA) to evaluate the fuselage burnthrough resistance of transport category aircraft that are exposed to large postcrash fuel fires. Twenty-eight full-scale tests were conducted in a reUSAble fuselage test rig to determine the effectiveness of thermal-acoustical insulation improvements in preventing or delaying the fuselage burnthrough. The testing showed that the method of attaching the insulation to the fuselage structure had a critical effect on the effectiveness of the insulation material. In addition, the composition of the insulation bagging material, normally a thermoplastic film, was also shown to be an important factor. A number of fiberglass insulation modifications and new insulation materials were shown to be effective in varying degrees. For example, a heat-treated, oxidized polyacrylonitrile fiber (OPF) encased in a polyimide bagging material prevented burnthrough for over 8 minutes. When constructed with current insulation materials, which were shown to fail in as little as 2 minutes, effective fire barriers such as the OPF insulation offer the potential of saving lives during a postcrash fire accident in which the fuselage remains intact.
NTIS
Fuselages; Fires; Combustion; Flammability; Full Scale Tests

19990041956 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Strategic Effects of Airpower and Complex Adaptive Agents: An Initial Investigation
Tighe, Thomas R.; Mar. 1999; 133p; In English
Report No.(s): AD-A361595; AFIT/GOA/ENS/99M; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

US airpower theory and doctrine depend on the concept that the destruction of a few key targets or centers of gravity can unravel the enemy's physical ability to wage war or break his will to prosecute the war. This synergistic decimation of the enemy's effectiveness and resistance to our political will is known as Strategic Effects. These strategic effects are very difficult to quantify and are not directly accounted for in current DoD computer models. Since these computer models are used to aid with decisions about force structure and budget priorities, many believe that the Air Force's greatest potential contribution to modern joint war-

fare is going unrecognized and under financed. This thesis explores military theory and current doctrine to define a method quantifying strategic effects. This method is based upon the Observe-Orient-Decide-Act (OODA) decision cycle. Next, current modeling techniques, and specifically the campaign level model, THUNDER, are examined for applicability to model strategic effects as defined. Finally, a proof of concept model is developed to study the advantage associated with OODA loop exploitation. This simple model uses Java-based, multi-threaded, autonomous, complex adaptive agents to demonstrate the non-linear (synergistic) results of OODA loop exploitation. These results are similar to the anticipated effects of strategic attack and provide a solid foothold from which the study and modeling of strategic effects can begin.
DTIC
Computerized Simulation; Gravitation; Warfare; Autonomy

19990042207 Federal Aviation Administration, Airport Technology Research and Development Branch, Atlantic City, NJ USA
Simulator Evaluation of Land and Hold-Short Operation (LAHSO) Lighting Configurations
Katz, E. S.; Dec. 1998; 58p
Report No.(s): PB99-126906; DOT/FAA/AR-TN/97/86; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The evaluation was directed specifically towards identifying which lighting pattern(s) would effectively indicate to the pilot of a landing aircraft the location of the hold-short point. Configurations containingred in-pavement and elevated holding point lights, along with pulsing-white in-pavement taxi-speed warning lights, were determined to be most appropriate for installations using control tower operation of the lights for each landing or takeoff.
NTIS
Boeing 727 Aircraft; Aircraft Landing; Air Traffic Control; Airfield Surface Movements

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.

19990041329 Norwegian Defence Research Establishment, Kjeller, Norway
Results from Testing PLGR+96FED GPS Receiver at NY Alesund in February, 1998
Kandola, Ornulf, Norwegian Defence Research Establishment, Norway; Nov. 11, 1998; 51p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 697/134
Report No.(s): FFI/RAPPORT-98/05746; ISBN 82-4640-0310-9; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
PLGR (Precision Lightweight GPS Receiver) is a handheld, single frequency, military Global Position System (GPS) navigation receiver. As part of a recent international test programme the Norwegian Army Materiel Command tasked Forsvarets forskningsinstitutt (the Norwegian Defence Research Establishment, NDRE) to run high latitude accuracy tests at Ny Alesund, Svalbard. The test site is located at 78 deg. 55 min. N, 11 deg. 55 min. E. Two keyed PLGRs were used. One PLGR was set up to have the WAGE (Wide Area GPS Enhancement) function enabled. The results and findings from the test are presented in the report.
Author
Performance Tests; Data Acquisition; Global Positioning System; Accuracy

19990041835 Civil Aeromedical Inst., Oklahoma City, OK USA
GPS User-Interface Design Problems *Final Report*
Williams, Kevin W., Civil Aeromedical Inst., USA; April 1999; 14p; In English
Report No.(s): DOT/FAA/AM-99/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper is a review of human factors problems associated with the user-interface design of a set of Global Positioning System (GPS) receivers, certified for use in aircraft for instrument non-precision approaches. The paper focuses on design problems associated with the interfaces and specific inconsistencies across the set of interfaces that could cause confusion or errors during operation. Some specific problems addressed involve the layout and design of knobs and buttons; control labeling inconsistencies across units; the placement and use of warnings; feedback, or the lack thereof; and the integration of specific flying tasks while

using the receivers. Recommendations for solving some of the problems are provided, as well as suggestions to the FAA, GPS manufacturers, and pilots regarding the future development and use of these products.
Author
Human Factors Engineering; Instrument Approach; Feedback; Design Analysis

19990042411 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Precise Point Positioning for the Efficient and Robust Analysis of GPS Data from Large Networks
Zumberge, J. F., Jet Propulsion Lab., California Inst. of Tech., USA; Heflin, M. B., Jet Propulsion Lab., California Inst. of Tech., USA; Jefferson, D. C., Jet Propulsion Lab., California Inst. of Tech., USA; Watkins, M. M., Jet Propulsion Lab., California Inst. of Tech., USA; Webb, F. H., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Mar. 10, 1997; ISSN 0148-0227; Volume 102, No. B3, pp. 5005-5017; In English
Report No.(s): Paper 96JB03860; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

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

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.

19990041193 CSA Engineering, Inc., Palo Alto, CA USA
Non-Linear Finite Element Analysis of Viscoelastic Materials
Negaard, Gordon; Jul. 1998; 19p; In English
Contract(s)/Grant(s): F33615-94-C-3200
Report No.(s): AD-A361168; CSA-ASIAC-TR-98-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many aircraft structures and engine components are subjected to extreme aero-vibroacoustic environments, including high g-loads. High cycle fatigue due to resonant vibrations on these components causes cracking and other degradation that reduces both operational capability and life. It would be useful if viscoelastic materials could be used to damp the vibration of such structures, however the behavior of a viscoelastic material in an extremely high g-loading is not well understood. The objective of this study was to investigate the need to account for the non-linear material characteristics of viscoelastic materials in order to obtain accurate stress distribution predictions. This will contribute to understanding the appropriate analytical procedure(s) for use in designing viscoelastic damping material into gas-turbine blades.
DTIC
Composite Materials; Viscoelasticity; Nonlinear Systems; Finite Element Method; Viscoelastic Damping; Resonant Vibration

19990041249 Goodrich (B. F.) Aerospace, Aerostructures Group, Bedford, MA USA
X-33 Thermal Protection System
X-33 Flight Operations Center; April 1999; 42p; In English; See also 19990041246; Original contains color illustrations
Contract(s)/Grant(s): RTMCA-96-RHR-0001; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report is a summary of the achievements and progress to date of the BFGoodrich Aerospace (BFG) X-33 Thermal Protection System (TPS) team. BFGoodrich Aerospace is responsible for the design, development, qualification and build of the Thermal Protection System for the X-33 SSTO Flight Vehicle. Significant tangible progress has been made this past year as the program evolves rapidly into the manufacturing and assembly stage. During the past year the vehicle has reached final configuration, and baseline trajectories have been established. The vehicle aerothermal environment database was updated to

the vehicle configuration and the appropriate dispersion factors. All major design issues have been resolved. This has allowed BFG to move forward with final TPS definition components such as the Body Flap, Elevon, and Leeward Aeroshell split lines between AFRISI and FRISI, and the split lines in the windward metallic TPS. In achieving closure on key technical issues many trajectories have been assessed both with the use of preliminary indicators and with detail analyses as shown in the December 1998 analysis review. Qualification for flight analysis is well underway. Major and critical tests have been successfully concluded in the past year helping to validate the TPS systems both from a component level and from an integrated system level. The tests conducted at the High Temperature Tunnel (HTT) at NASA Langley concluded with multiple runs on the metallic and leeward thermal blankets including off-nominal design. The combined environments test, a significant integrated system level test, was also successfully concluded. Other tests, all focused at validating the thermal protection system, have been successful, and will be discussed in detail in the body of this report. Maintainability aspects of the metallic TPS panel designs have been demonstrated as meeting all of the X-33 and RLV goals. Demonstrations were carried out with both flat and curved panel arrays, with actual installation on the vehicle using the installed flight hardware standoff brackets. Curved honeycomb demonstration panels were successfully fabricated enveloping and validating the capability to fabricate the complete range of panels. BFGoodrich has made progress in manufacturing the TPS systems. All vehicle body standoffs have been delivered. The installation of the standoff brackets to the thermal protection substructure has been demonstrated, with panel installation, validating the tooling and installation philosophy. Insulation plugs for the body standoff brackets have also been delivered along with approximately 50% of the standoff brackets for the canted fin. Metallic honeycomb panels are in production. BFG has made significant progress towards developing acceptance criteria and production processes to increase production rate and yield. to date 48 flat panels have been delivered. BFGoodrich has receipt of the first Metallic isogrid panels from suppliers. The majority of the leeward aeroshell graphite honeycomb panels have been fabricated. Many have been fit checked on the FAJ and/or the vehicle. Refractory composite parts are in production at our supplier, C-Cat.
Derived from text
X-33 ReUSAble Launch Vehicle; Thermal Protection; Single Stage to Orbit Vehicles; Thermal Insulation; Dynamic Structural Analysis

19990041251 NASA Marshall Space Flight Center, Huntsville, AL USA
[X-33 Research by NASA Centers]
X-33 Flight Operations Center; April 1999; 84p; In English; See also 19990041246; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A03, Microfiche

Lockheed Martin Skunk Works has compiled an Annual Performance Report of the X-33/RLV Program. This report consists of individual reports from all industry team members, as well as NASA team centers. This portion of the report is comprised of overviews of each NASA Center's contribution to the program during the period 1 Apr. 1998 - 31 Mar. 1999.
CASI
X-33 ReUSAble Launch Vehicle; Systems Engineering; Systems Integration

19990041825 Naval Postgraduate School, Monterey, CA USA
Development of a UAV Track Injection and Imagery Presentation System
Cameron, Andrew R.; Cherry, John D.; Mar. 1999; 199p; In English
Report No.(s): AD-A361950; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Navy is increasingly using advanced Unmanned Air Vehicles (UAVs) to perform critical missions. UAVs have grown in capability, while the Navy's underlying Command and Control structure has changed little to take advantage of the advances in technology. While UAVs are rapidly developing the potential to be effective combat tools, learning how to utilize this potential in an integrated Command and Control environment is hampered by a lack of UAV connectivity. This thesis develops a methodology for using UAV telemetry data packets to inject tracks of the UAV into a Command and Control system such as the Global Command and Control System (GCCS), and provide near-real-time imagery delivery from the UAV to tactical end users via a network such as the Secret Internet Protocol Router Network (SIPRNET). Focus is on the development of a proof-of-concept system utilizing the Naval Postgraduate School's Systems Technology Battle Lab (STBL) and the Center for interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Altus UAV. Through the developing of this system, the Altus UAV can serve as a research tool for flirther development of Command and Control doctrine for operational UAVs.
DTIC
Command and Control; Control Systems Design; Telemetry; Information Systems

19990041832 Naval Postgraduate School, Monterey, CA USA

Unmanned Aerial Vehicle/Remotely Piloted Aircraft Design Selection Based on Service-Stated Meteorological/Oceanographic Requirements

Stanton, Robert J.; Mar. 1999; 100p; In English

Report No.(s): AD-A362157; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

A decision tool for choosing most efficient unmanned aerial vehicles (UAV's)/remotely piloted aircraft (RPA) for Meteorological/ Oceanographic (METOC) data collection is presented. A Microsoft Access database query (written in Structured Query Language) links RPA flight performance parameters to individualized METOC Elements of Measurement, a subset of a larger Joint Service METOC Requirements database table, presented elsewhere in the thesis in full. Successful aircraft performance parameters include vast controllability/ programmability ranges, flexible (including shipboard) launches and recoveries, atmospheric profiling capabilities, hover ability, long endurance and airframes free of propeller or rotor wash. A sampling of existing (or planned) airborne METOC instrumentation, their ranges and accuracies are included, in database form, for further reference. DTIC

Remotely Piloted Vehicles; Requirements; Aircraft Performance; Aircraft Design; Pilotless Aircraft; Flight Characteristics

19990041833 Cessna Aircraft Co., Wichita, KS USA

Supplemental Inspection Document Development Program for the Cessna Model 402 ***Final Report, Oct. 1995 - Mar. 1998***

Chan, Larry; Foster, Everett; Gamble, Beth; Townsend, Dan; Mar. 1999; 71p; In English

Contract(s)/Grant(s): DTFA03-95-C-00044

Report No.(s): AD-A362174; DOT/FAA/AR-98/66; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document is the final report covering the results of a 2-year program. The program was funded through the Federal Aviation Administration (FAA) William J. Hughes Technical Center at Atlantic City International Airport under FAA contract number DTFA03-95-00044. The Cessna Model 402 was selected by the FAA due to the relatively high percentage of this aircraft in the regional airline fleet The program focused on developing a supplementary inspection document (SID) for all variants of the Cessna Model 402 based on state-of-the-art damage tolerance analysis techniques. The Cessna Model 402 was designed and certified prior to the advent of Federal Aviation Regulations which require the aircraft structure to be substantiated fail safe and/or meet certain damage tolerance requirements. Hence, there was minimal design data available to use with state-of-the-art analytical methods. Therefore, new development tests, service experience, and applications of current technology in the areas of loads, stress, fatigue, and fracture mechanics were used to identify and establish structural inspections and modifications necessary to maintain safety and to provide for continuing structural integrity and airworthiness. These items were done and the SID was developed in three phases. Phase I of the SID development program consisted of three tasks: (1) Identification of the Principle Structural Elements (PSE), (2) Identification of the Critical Areas of the Principle Structural Elements, and (3) Development of a Stress Spectrum for Each Critical Area, Phase 2 of the SID development program consisted of seven tasks: (1) Collect Material Property Data, (2) Establishment of Initial Flaw Sizes for Each Critical Location, (3) Determine Inspectable Flaw Sizes for Each Critical Location, (4) Perform Crack Growth Analysis for Each Critical Area, (5) Establish Supplemental Inspection Threshold for Each Critical Area, and (6) Establish Repeat Inspection Interval for Each Critical Area.

DTIC

Aircraft Structures; Aircraft Reliability; Fracture Mechanics; Structural Failure; Commercial Aircraft

19990042109 California Polytechnic State Univ., Aeronautical Engineering Dept., San Luis Obispo, CA USA

Multidisciplinary Design and Analysis for Commercial Aircraft

Cummings, Russell M., California Polytechnic State Univ., USA; Freeman, H. JoAnne, California Polytechnic State Univ., USA; April 1999; 19p; In English

Contract(s)/Grant(s): NGT-10012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multidisciplinary design and analysis (MDA) has become the normal mode of operation within most aerospace companies, but the impact of these changes have largely not been reflected at many universities. On an effort to determine if the emergence of multidisciplinary design concepts should influence engineering curricula, NASA has asked several universities (Virginia Tech, Georgia Tech, Clemson, BYU, and Cal Poly) to investigate the practicality of introducing MDA concepts within their undergraduate curricula. A multidisciplinary team of faculty, students, and industry partners evaluated the aeronautical engineering curriculum at Cal Poly. A variety of ways were found to introduce MDA themes into the curriculum without adding courses or

units to the existing program. Both analytic and educational tools for multidisciplinary design of aircraft have been developed and implemented.
Author
Aeronautical Engineering; Aircraft Design; Commercial Aircraft; Systems Engineering; Structural Design

19990042183 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Workshop on Helicopter Health and USAge Monitoring Systems, Melbourne, Australia, Part 2
Forsyth, Graham F., Editor; Feb. 1999; 144p; In English
Report No.(s): AD-A361831; DSTO-GD-0197-PT-2; DODA-AR-010-839; No Copyright; Avail: CASI; A07, Hardcopy; A02, 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; Maintenance

19990042365 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Synchronous Averaging of Helicopter Tail Rotor Gearbox Vibration: Phase Reference Considerations
Blunt, D. M., Defence Science and Technology Organisation, Australia; October 1998; 49p; In English
Report No.(s): DSTO-TR-0739; DODA-AR-010-666; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Synchronous averaging requires an accurate phase reference (tachometer) signal. In helicopter transmissions, such a signal can usually be obtained or derived from an engine or main rotor gearbox accessory, but is not as readily available for the tail rotor gearbox. This report examines whether a separate tail rotor gearbox phase reference signal is necessary by investigating the relative jitter, due to dynamic tail drive shaft twist, between phase reference signals obtained from the main and tail rotor gearboxes in a S-70A-9 Black Hawk helicopter.
Author
Helicopter Tail Rotors; Vibration; Synchronism; Transmissions (Machine Elements)

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.

19990041250 Boeing North American, Inc., Rocketdyne Div., Canoga Park, CA USA
X-33/RLV Program Aerospike Engines
X-33 Flight Operations Center; April 1999; 60p; In English; See also 19990041246; Original contains color illustrations
Report No.(s): RD99-251; No Copyright; Avail: CASI; A04, Hardcopy; A03, Microfiche

Substantial progress was made during the past year in support of the X-33/RLV program. X-33 activity was directed towards completing the remaining design work and building hardware to support test activities. RLV work focused on the nozzle ramp and powerpack technology tasks and on supporting vehicle configuration studies. On X-33, the design activity was completed to the detail level and the remainder of the drawings were released. Component fabrication and engine assembly activity was initiated, and the first two powerpacks and the GSE and STE needed to support powerpack testing were completed. Components fabrication is on track to support the first engine assembly schedule. Testing activity included powerpack testing and component development tests consisting of thrust cell single cell testing, CWI system spider testing, and EMA valve flow and vibration testing. Work performed for RLV was divided between engine system and technology development tasks. Engine system activity

focused on developing the engine system configuration and supporting vehicle configuration studies. Also, engine requirements were developed, and engine performance analyses were conducted. In addition, processes were developed for implementing reliability, mass properties, and cost controls during design. Technology development efforts were divided between powerpack and nozzle ramp technology tasks. Powerpack technology activities were directed towards the development of a prototype powerpack and a ceramic turbine technology demonstrator (CTTD) test article which will allow testing of ceramic turbines and a close-coupled gas generator design. Nozzle technology efforts were focused on the selection of a composite nozzle supplier and on the fabrication and test of composite nozzle coupons.
Derived from text
X-33 ReUSAble Launch Vehicle; Aerospike Engines; Rocket Engine Design; Engine Parts; Propulsion System Performance

19990041883 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Abteilung Unternehmensorganisation, Cologne, Germany
Interaction of Secondary Flow and Cooling Air in Filmcooled Turbine Nozzles ***Wechselwirkung von Sekundaerstroemung und Kuehlluft in Filmgekuehlten Turbinenstatoren***
Langowsky, Claudia, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 1997; ISSN 1434-8454; 132p; In German
Report No.(s): DLR-FB-97-50; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Film cooling is an effective method of blade surface cooling. to satisfy not only the thermal but also the aerodynamic demand of minimum loss production, the detailed knowledge of the interaction between cooling air and the main flow is necessary. In this work the effect of cooling air ejection on the aerodynamics of the cascade flow and its loss production is studied experimentally with varied blowing ratios and locations. Furthermore, the mixing process of the cooling air jets among the influence of the secondary flow is investigated. to be able to analyse the different superimposed effects (radial pressure gradient, secondary flow) various measurement techniques are used. By means of additional numerical flow simulation origins of the experimental indicated effects could be figured out.
Author
Film Cooling; Nozzle Flow; Radial Flow; Surface Cooling; Secondary Flow; Pressure Gradients

19990042110 NASA Dryden Flight Research Center, Edwards, CA USA
The Use of a Lidar Forward-Looking Turbulence Sensor for Mixed-Compression Inlet Unstart Avoidance and Gross Weight Reduction on a High Speed Civil Transport
Soreide, David, Boeing Defense and Space Group, USA; Bogue, Rodney K., NASA Dryden Flight Research Center, USA; Ehernberger, L. J., NASA Dryden Flight Research Center, USA; Seidel, Jonathan, NASA Lewis Research Center, USA; July 1997; 18p; In English; Joint Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 529-50-24-00-RR-00-000
Report No.(s): NASA-TM-1997-104332; NAS 1.15:104332; H-2186; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Inlet unstart causes a disturbance akin to severe turbulence for a supersonic commercial airplane. Consequently, the current goal for the frequency of unstarts is a few times per fleet lifetime. For a mixed-compression inlet, there is a tradeoff between propulsion system efficiency and unstart margin. As the unstart margin decreases, propulsion system efficiency increases, but so does the unstart rate. This paper intends to first, quantify that tradeoff for the High Speed Civil Transport (HSCT) and second, to examine the benefits of using a sensor to detect turbulence ahead of the airplane. When the presence of turbulence is known with sufficient lead time to allow the propulsion system to adjust the unstart margin, then inlet un,starts can be minimized while overall efficiency is maximized. The NASA Airborne Coherent Lidar for Advanced In-Flight Measurements program is developing a lidar system to serve as a prototype of the forward-looking sensor. This paper reports on the progress of this development program and its application to the prevention of inlet unstart in a mixed-compression supersonic inlet. Quantified benefits include significantly reduced takeoff gross weight (TOGW), which could increase payload, reduce direct operating costs, or increase range for the HSCT.
Author
Atmospheric Turbulence; Supersonic Transports; Aircraft Design; Commercial Aircraft; Civil Aviation

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.

19990041925 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Solving an Inverse Control Problem using Predictive Methods
Davis, Chad J.; May 1999; 74p; In English
Report No.(s): AD-A361653; AFIT/GAE/ENY/99M-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Model Predictive Control is the class of control methods that optimizes a specified performance index in order to minimize the weighted future output deviations from a setpoint trajectory. This thesis applies MPC in the inverse sense -- known aircraft outputs are applied in the performance index as setpoints in an attempt to determine what control histories caused those outputs. Using this method, aircraft mishap investigators could then have a means of determining what the control surface deflections were throughout an incident since Flight Data Recorder data does not include control surface deflections. The actual Flight Data Recorder data from aircraft mishaps are utilized as proof of concept.
DTIC
Control Theory; Flight Simulation; Transport Aircraft; Prediction Analysis Techniques; Control Surfaces

19990042142 NASA Langley Research Center, Hampton, VA USA
Transonic Flutter Suppression Control Law Design Using Classical and Optimal Techniques with Wind-Tunnel Results
Mukhopadhyay, Vivek, 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 99-1396; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using (1) classical, (2) linear quadratic Gaussian (LQG), and (3) minimax techniques are described. A unified general formulation and solution for the LQG and minimax approaches, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf. The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.
Author
Active Control; Control Theory; Feedback Control; Unsteady Aerodynamics; Separated Flow; Transonic Flow; Transonic Flutter

19990042175 Old Dominion Univ., Norfolk, VA USA
Effect of Apex Flap Deflection on Vertical Tail Buffeting
Massey, Steven J., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; 1998; In English; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): AIAA Paper 98-0762; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A computational study of the effect of vortex breakdown location on vertical tail buffeting is conducted. The position of the breakdown is modified by employing an apex flap deflected by an experimentally determined optimal angle. The delayed breakdown flow and buffeting response is then compared to the nominal undeflected case. This multidisciplinary problem is solved sequentially for the fluid flow, the elastic tail deformations and the grid displacements. The fluid flow is simulated by time accurately solving the unsteady, compressible, Reynolds-averaged Navier-Stokes equations using an implicit, upwind, flux-difference splitting finite volume scheme. The elastic vibrations of the tails are modeled by uncoupled bending and torsion beam equations. These equations are solved accurately in time using the Galerkin method and a five-stage Runge-Kutta-Verner scheme. The grid for the fluid dynamics calculations is continuously deformed using interpolation functions to disperse the displacements smoothly throughout the computational domain. An angle-of-attack of 35 deg.is chosen such that the wing primary-vortex cores experience

vortex breakdown and the resulting turbulent wake flow impinges on tile vertical tails. The dimensions and material properties of the vertical tails are chosen such that the deflections are large enough to insure interaction with the flow, and the natural frequencies are high enough to facilitate a practical computational solution. Results are presented for a baseline uncontrolled buffeting case and a delayed breakdown case in which the apex flap has been deflected 15 deg. The flap was found to be very effective in delaying the breakdown, increasing the location from 50%c to 94%c, which resulted in a 6% increase in lift coefficient and pitching moment. However, the integrated buffet loads and tip responses were roughly equivalent for the two cases.
Author
Deflection; Flapping; Buffeting; Computation; Vortex Breakdown; Flux Difference Splitting; Interpolation; Tail Assemblies

19990042176 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Effectiveness of Flow Control for Alleviation of Twin-Tail Buffet
Sheta, Essam F., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; Yang, Zhi, Old Dominion Univ., USA; 1998; In English; 1998 World Aviation, 28-30 Sep. 1998, Anaheim, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): Rept-985501; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Effectiveness of active flow control for twin- tail buffet alleviation is investigated. Tangen- tial leading-edge blowing (TLEB) and flow suction along the vortex cores (FSVC) of the lead- ing edges of the delta wing are used to delay the vortex breakdown flow upstream of the twin tail. The combined effect of the TLEB and FSVC is also investigated. A parametric study of the effects of the spanwise position of the suction tubes and volumetric suction flow rate on the twin-tail buffet response are also investigated. The TLEB moves the path of leading-edge vortices laterally towards the twin tail, which increases the aero- dynamic damping on the tails. The FSVC effectively delays the breakdown location at high angles of attack. The computational model consists of a sharp-edged delta wing of aspect ratio one and swept-back flexible twin tail with taper ratio of 0.23. This complex multidisciplinary problem is solved sequentially using three sets of equations for the fluid flow, aeroelastic response and grid deformation, on a dynamic multi-block grid structure. The computational model is pitched at 30 deg. angle of attack. The freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. The model is investigated for the inboard position of the twin tails, which corresponds to a separation distance between the twin tails of 33% of the wing span.
Author
Effectiveness; Flow Measurement; Buffeting; Research; Vortex Breakdown; Free Flow; Fluid Flow; Flow Distribution; Dynamic Response; Deformation

19990042177 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Effect of Configuration Pitching Motion on Twin Tail Buffet Response
Sheta, Essam F., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; 1998; In English; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): AIAA Paper 98-0520; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The effect of dynamic pitch-up motion of delta wing on twin-tail buffet response is investigated. The computational model consists of a delta wing-twin tail configuration. The computations are carried out on a dynamic multi-block grid structure. This multidisciplinary problem is solved using three sets of equations which consists of the unsteady Navier-Stokes equations, the aeroelastic equations, and the grid displacement equations. The configuration is pitched-up from zero up to 60 deg. angle of attack, and the freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. With the twin tail fixed as rigid surfaces and with no-forced pitch-up motion, the problem is solved for the initial flow conditions. Next, the problem is solved for the twin-tail response for uncoupled bending and torsional vibrations due to the unsteady loads on the twin tail and due to the forced pitch-up motion. The dynamic pitch-up problem is also solved for the flow response with the twin tail kept rigid. The configuration is investigated for inboard position of the twin tail which corresponds to a separation distance between the twin tail of 33% wing chord. The computed results are compared with the available experimental data.
Author
Aerodynamic Configurations; Pitching Moments; Buffeting; Tail Assemblies; Bending Vibration; Delta Wings

19990042372 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
Merged Vision and GPS Control of a Semi-Autonomous, Small Helicopter ***Final Report, 1 Apr. 1996 - 30 Sep. 1997***
Rock, Stephen M., Stanford Univ., USA; April 1999; 20p; In English
Contract(s)/Grant(s): NCC2-967; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report documents the activities performed during the research period from April 1, 1996 to September 30, 1997. It contains three papers: Carrier Phase GPS and Computer Vision for Control of an Autonomous Helicopter; A Contestant in the 1997 International Aerospace Robotics Laboratory Stanford University; and Combined CDGPS and Vision-Based Control of a Small Autonomous Helicopter.
CASI
Global Positioning System; Computer Vision; Helicopters; Autonomous Navigation; Automatic Flight Control; Flight Management Systems; Helicopter 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).

19990041970 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Evaluation and Comparison of the Ace and Brace Airfield Models
Wiliams, David W.; Mar. 1999; 93p; In English
Report No.(s): AD-A361628; AFIT/GOA/ENS/99M-10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Airfields are a critical aspect of our military's ability to project power or respond to crises throughout the world. It is crucial that mobility planners have an effective means to estimate the capacity of these airfields. The objective of this research is to examine common mobility metrics and evaluate existing means of measuring them. Currently, Air Mobility Command has two models, the Airfield Capacity Estimator (ACE) and the Base Resource and Capabilities Estimator (BRACE), that were designed to estimate the resource requirements and capacities of an airfield. This study offers a critical evaluation and comparison of the two models. Discrepancies of the models are highlighted, as well as possible improvements. Additional possible uses are also demonstrated, including a method in which the two models can be used together to enhance their overall results and increase the user's knowledge of an airfield's capabilities and limitations.
DTIC
Estimates; Statistical Analysis; Emergencies

19990041972 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling and Analysis of Aerial Port Operations
Albrecht, Timothy W.; Mar. 1999; 136p; In English
Report No.(s): AD-A361631; AFIT/GOR/ENS/99M-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The focus of this thesis effort is gaining useful insight into aerial port operations by employing an animated simulation. Understanding airfield capacity, resources, and functioning allows greater accuracy and efficiency in both planning for future force structures and matching mobility assets with commanders' objectives. Two current simulations, ACE (Airfield Capacity Estimator) and BRACE (Base Resource Allocation and Capabilities Estimator), model mobility activities at the base level with some deficiencies. The model proposed by this thesis, APOM (Aerial Port Operations Model), will provide the mobility analyst an animated simulation with two, new measures of aerial port operations; a real-time estimate of airfield capacity subject to changing levels of airfield resources, and an instantaneous count of serviced aircraft (service MOG). Additionally, APOM will offer an expanded utility to the mobility analyst by modeling a ground transportation network associated with the aerial port.
DTIC
Airports; Computerized Simulation; Transportation Networks; Statistical Analysis; Resource Allocation

19990041978 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Report on the First-Generation NIST Convective Heat Flux Calibration Facility
Holmberg, D. G.; Womeldorf, C. A.; Dec. 1998; 24p; In English; American Society of Mechanical Engineers/Japan Society of Mechanical Engineers Thermal Engineering Joint Conference (5th), San Diego, CA., March 15-19, 1999, 15-19 Mar. 1999, San Diego, CA, USA
Report No.(s): PB98-150071; NISTIR-6197; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the first-generation heated-plate design and performance. An uncertainty analysis of the reference heat flux is presented and repeatability test results are given in support of the uncertainty analysis. Planned tests and development of the second generation heated plate are mentioned.
NTIS
Heat Flux; Calibrating; Test Facilities; Convective Heat Transfer

19990042053 NASA Langley Research Center, Hampton, VA USA
The Joint Winter Runway Friction Measurement Program
Yager, Thomas J., NASA Langley Research Center, USA; 1999; In English; Federal Aviation Administration Technology Transfer, 11-15 Apr. 1999, Atlantic City, NJ, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper provides background information, scope and objectives of a 5-year, Joint National Aeronautics & Space Administration (NASA)/Transport Canada (TC)/Federal Aviation Administration (FAA) Winter Runway Friction Measurement Program which has just completed its fourth winter season of testing. The test equipment, test sites, test results and accomplishments, the extent of the friction database compiled and future plans are described. The primary objective of this effort is to perform instrumented aircraft and ground vehicle tests aimed at identifying a ”common number” that ground vehicle devices would report. This number denoted the International Runway Friction Index (IRFI) will be related to aircraft stopping performance. Several related studies are described including the effects of contaminant type on aircraft impingement drag and the effectiveness of various runway/aircraft chemical types and application rates. NASA considers the success of this program critical to insure adequate ground performance capability in adverse weather conditions for future aircraft as well as improving the safety of current aircraft ground operations.
Author
Aerodynamic Drag; Data Bases; Friction Measurement; Ground Tests; Runways; Safety

19990042302 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
A Serial Communication Interface for Data Acquisition Instrumentation in a Wind Tunnel
Spataro, M., Defence Science and Technology Organisation, Australia; Kent, S., Defence Science and Technology Organisation, Australia; November 1998; 30p; In English
Report No.(s): DSTO-TR-0740; DODA-AR-010-669; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL) has used a proprietary Bidirectional Parallel Interface (BPI) bus for data collection from instrumentation since 1989. As part of the ongoing development of the LSWT data acquisition system it was decided that a more reliable and faster communication scheme was required. This report describes the unique system of hardware and software developed to enable the VMEbus-based instrumentation modules to communicate with a Host computer over an ethernet network.
Author
Data Acquisition; Computer Networks; Computer Programs; Computers

19990042368 Schafer (W. J.) Associates, Inc., Arlington, VA USA
Support to the Smart Munitions Test Suite white Sands Missile Range
Feb. 1999; 18p; In English
Contract(s)/Grant(s): N00014-97-D-2014/001
Report No.(s): AD-A361675; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Schafer Corporation is providing support to the White Sands Missile Range (WSMR) National Range Development Directorate. This activity is directly in support of the Smart Munitions Test Suite (SMTS) which is a unique asset developed by WSMR to enhance the Test and Evaluation Community’s ability to evaluate weapons systems by combining test with modeling and simulation. Reduced test budgets have lead to fewer field tests resulting in both a greater reliance in simulation to fill in the test matrix and enhancing the value of those tests performed. With fewer tests being performed each test must have its success maximized and this too enhances the value of simulation especially for mission rehearsal. SMTS performs all of the necessary functions to maximize the weapons system evaluation process. Developed at WSMR the SMTS is designed to meet the specific challenges of today’s test environment. Using a modular command and control architecture, the SMTS, which is completely mobile, can be rapidly configured to support a broad range of missions. Specialized SMTS capabilities include a powerful, transportable modeling and simulation capability that emphasizes pre-mission planning and rehearsal. The heart of SMTS is real-time acquisition and tracking capability based on an optimal real-time fusion of radar, optics, Global Positioning System (GPS), and other sensors all of which can handle up to 80 objects simultaneously. Finally, the SMTS provides a self-contained ability to reduce

trajectory data, including automated film data reduction, on the test site itself. All of these features, along with the ability to support expert system man-in-the-loop fly-bys (with heads-up display), ensure a very diverse set of applications. The SMTS consists of the following subsystems: Master Control Van Data Acquisition and Analysis Van Enhanced Multiple Object Tracking Radar Smart Munitions Trac
DTIC
Ammunition; Data Acquisition; Data Reduction; Command and Control

19990042393 NASA Langley Research Center, Hampton, VA USA
Hybrid IR-Gas Heater for Automated Tow Placement
Grenoble, Ray W., Old Dominion Univ., USA; Johnston, Norman J., NASA Langley Research Center, USA; Tiwari, S. N., Old Dominion Univ., USA; Marchello, Joseph M., Old Dominion Univ., USA; 43rd International SAMPE Symposium and Exhibition; 1998; Volume 43, Book 2, pp. 1966-1979; In English, 31 May - 4 Jun. 1998, Anaheim, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A hybrid infrared-hot gas heat source has been developed and tested for the NASA Langley Tow Placement Facility. The IR heat source provides supplemental heat to the nip region. The additional heat is intended to reduce the need for conduction heating by the compaction roller, which causes (he roller to stick to the panel surface. Initial bench scale testing was performed to identify the most effective means of focusing IR energy into the nip region. A compact lamp and reflector that placed the lamp as close to the nip point as possible was found to deliver the highest heat flux in the nip region. A prototype heater was installed on the NASA Langley tow placement robot. Panels placed with a 400 C (sticking) compaction roller gave DCB initiation toughness numbers comparable to those reported for autoclave processed panels but were found to have unexpectedly high void contents. Placement with compaction roller temperatures that prevented roller sticking resulted in mode I fracture toughness approximately 70% that reported for autoclave processed panels. The variability in strength among specimens placed with reduced roller temperature was found to be greatly reduced, which implies that use of supplemental nip point heat may improve the robustness of the tow placement process. Use of the IR heat source permitted placement with a compaction roller temperature that would have resulted in negligible interfacial strength with the hot gas torch alone. The roller temperature reductions eliminated the need for the robot operator to attend placement operations.
Author
Infrared Radiation; Heat Sources; Compacting; Rollers; Panels; High Temperature Gases

13
ASTRODYNAMICS

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

19990041360 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Bi-Impulsive Orbital Transfers Between Coplanar Orbits with Time Limit
Rocco, Evandro Marconi, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; deOliveiraeSouza, Marcelo Lopes, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 8p; In English; Astrodynamics Specialist, 10-12 Aug. 1998, Boston, MA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): INPE-7034-PRE/2978; AIAA Paper 98-4549; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this work, we consider the problem of two-impulse orbital transfers between coplanar elliptical orbits with minimum fuel consumption but with a time limit for this transfer. This time limit imposes a new characteristic to the problem that rules out the majority of transfer methods. Then, we used the equations presented by D. F. Lawden, extended them to other constraints and solved those equations to develop a software for orbital maneuvers. This software can be used in future missions developed by INPE. The original method developed by Lawden was presented without numerical results and considers only the case where the initial and final points of the maneuver are known. The software developed extends this method to the case where only one point is known and to the case where the two points are free. The four possible cases were tested with success.
Author
Orbital Maneuvers; Transfer Orbits; Impulses

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

19990041198 NASA Marshall Space Flight Center, Huntsville, AL USA
Payload Operations
Cissom, R. D., NASA Marshall Space Flight Center, USA; Melton, T. L., NASA Marshall Space Flight Center, USA; Schneider, M. P., NASA Marshall Space Flight Center, USA; Lapenta, C. C., NASA Marshall Space Flight Center, USA; 1999; 6p; In English; Space Technology and Applications International Forum (STAIF-99), 31 Jan. - Feb. 4 1999, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this paper is to provide the future ISS scientist and/or engineer a sense of what ISS payload operations are expected to be. This paper uses a real-time operations scenario to convey this message. The real-time operations scenario begins at the initiation of payload operations and runs through post run experiment analysis. In developing this scenario, it is assumed that the ISS payload operations flight and ground capabilities are fully available for use by the payload user community. Emphasis is placed on telescience operations whose main objective is to enable researchers to utilize experiment hardware onboard the International Space Station as if it were located in their terrestrial laboratory. An overview of the Payload Operations Integration Center (POIC) systems and user ground system options is included to provide an understanding of the systems and interfaces users will utilize to perform payload operations. Detailed information regarding POIC capabilities can be found in the POIC Capabilities Document, SSP 50304.
Derived from text
Payloads; Real Time Operation; Payload Integration; Communication Networks; Flight Characteristics

19990041252 Sverdrup Technology, Inc., Edwards AFB, CA USA
[X-33 Launch and Landing Facilities]
X-33 Flight Operations Center; April 1999; 16p; In English; See also 19990041246; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Sverdrup is responsible for the design, construction and activation of the X-33 Flight Operations Center at Edwards Air Force Base and for providing assistance in activating the X-33 Landing Sites. The past year has seen the completion of the construction of the X-33 Flight Operations Center. Construction was completed in December of 1998, with systems checkout and testing continuing into early 1999. Integration of the site with LMCMS and other partner-supplied systems began in December and will continue through rollout of the X-33 vehicle. The construction of the X-33 Launch Complex has been performed within the Edwards AFB and Air Force Research Laboratory (AFRL) systems with no substantial interference to either parties. A high level of cooperation exists between Sverdrup, Edwards AFB, and the Air Force Research Laboratory in the areas of access, training, security, and operations. There have been no conflicts between programs that have not been accommodated. Development of the landing sites is progressing with many of the modifications necessary underway. GSE commitments are in place. The personnel training program developed by Sverdrup for persons entering the launch site construction areas, was modified by Lockheed for use in training and access control to the Center during flight operations to maximize safety and minimize intrusion upon the environment. Close cooperation between Sverdrup, the construction workers, and the environmental biologist permitted construction to proceed in a timely fashion without harm to the wildlife, in particular, the Desert Tortoise. Although the entire X-33 site encompasses approximately 50 acres including a new access road, only the areas directly impacted by the construction were cleared to minimize the impact on the environment. A total of about 30 acres was actually disturbed.
Derived from text
X-33 ReUSAble Launch Vehicle; Launching Sites; Spacecraft Launching; Systems Integration

15
LAUNCH VEHICLES AND SPACE VEHICLES

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

19990041246 Lockheed Martin Corp., Palmdale, CA USA
X-33 Flight Operations Center ***Annual Report, 1 Apr. 1998 - 31 Mar. 1999***
X-33 Flight Operations Center; April 1999; 287p; In English; See also 19990041247 through 19990041252; Original contains color illustrations
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

In response to Clause 17 of the Cooperative Agreement NCC8-115, Lockheed Martin Skunk Works has compiled an Annual Performance Report of the X-33/RLV Program. This report consists of individual reports from all industry team members, as well as NASA team centers. Contract award was announced on July 2, 1996 and the first milestone was hand delivered to NASA MSFC on July 17, 1996. With the dedication of the launch site, and continuing excellence in technological achievement, the third year of the Cooperative Agreement has been one of outstanding accomplishment and excitement.
Author
X-33 ReUSAble Launch Vehicle; Launching Pads; Preflight Operations; Systems Engineering; Systems Integration; Single Stage to Orbit Vehicles

19990041247 Lockheed Martin Corp., Palmdale, CA USA
Lockheed Martin Skunk Works Single Stage to Orbit/ReUSAble Launch Vehicle
X-33 Flight Operations Center; April 1999; 83p; In English; See also 19990041246; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Lockheed Martin Skunk Works has compiled an Annual Performance Report of the X-33/RLV Program. This report consists of individual reports from all industry team members, as well as NASA team centers. This portion of the report is comprised of a status report of Lockheed Martin's contribution to the program. The following is a summary of the Lockheed Martin Centers involved and work reviewed under their portion of the agreement: (1) Lockheed Martin Skunk Works - Vehicle Development, Operations Development, X-33 and RLV Systems Engineering, Manufacturing, Ground Operations, Reliability, Maintainability/ Testability, Supportability, & Special Analysis Team, and X-33 Flight Assurance; (2) Lockheed Martin Technical Operations - Launch Support Systems, Ground Support Equipment, Flight Test Operations, and RLV Operations Development Support; (3) Lockheed Martin Space Operations - TAEM and A/L Guidance and Flight Control Design, Evaluation of Vehicle Configuration, TAEM and A/L Dispersion Analysis, Modeling and Simulations, Frequency Domain Analysis, Verification and Validation Activities, and Ancillary Support; (4) Lockheed Martin Astronautics-Denver - Systems Engineering, X-33 Development; (5) Sanders - A Lockheed Martin Company - Vehicle Health Management Subsystem Progress, GSS Progress; and (6) Lockheed Martin Michoud Space Systems - X-33 Liquid Oxygen (LOX) Tank, Key Challenges, Lessons Learned, X-33/RLV Composite Technology, ReUSAble Cyrogenic Insulation (RCI) and Vehicle Health Monitoring, Main Propulsion Systems (MPS), Structural Testing, X-33 System Integration and Analysis, and Cyrogenic Systems Operations.
Derived from text
X-33 ReUSAble Launch Vehicle; Systems Engineering; Systems Integration; Product Development

19990041248 Allied-Signal Aerospace Co., Kansas City, MO USA
[X-33 Systems]
X-33 Flight Operations Center; April 1999; 11p; In English; See also 19990041246; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Lockheed Martin Skunk Works has compiled an Annual Performance Report of the X-33/RLV Program. This report consists of individual reports from all industry team members, as well as NASA team centers. This portion of the report is comprised of a status report of Allied-Signal Aerospace's contribution to the program. The following is a summary of the work reviewed under their portion of the agreement: (1) Communication Systems; (2) Environmental Control Systems- Active Thermal Control System (ATCS), Purge and Vent System, Hydrogen Detection System (HDS), Avionics Bay Inerting System (ABIS), and Flush Air Data System (FADS); (2) Landing Systems; (3) Power Management and Generation Systems; (4) Flight Control Actuation System (FCAS)- Electric Power Control & Distribution System (EPCDS), and Battery Power System (BPS); and (5) Vehicle Management Systems (VMS)- VMS Hardware, VMS Software Development Activities, and System Integration Laboratory (SIL).
Derived from text
X-33 ReUSAble Launch Vehicle; Systems Engineering; Systems Integration

19990041879 NASA Marshall Space Flight Center, Huntsville, AL USA

ReUSAble Launch Vehicle (RLV) Mission/Market Model

Prince, Frank A., NASA Marshall Space Flight Center, USA; 1999; 23p; In English, 8-11 Jun. 1999, San Antonio, TX, USA; Sponsored by International Society of Parametric Analysts, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this model was to assess the ReUSAble Launch Vehicle's (RLV) capability to support the International Space Station (ISS) servicing, determine the potential to leverage the commercial marketplace to reduce NASA's cost, and to evaluate the RLV's ability to expand the space economy. The presentation is in view-graph format.

CASI

International Space Station; Orbital Servicing; ReUSAble Launch Vehicles; Space Commercialization; Economic Analysis; Defense Program

19990041961 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

East Coast Abort Modeling with RTLS Elimination for the Space Shuttle-Liquid Fly Back Booster Launch System

Miller, Thomas L.; Mar. 1999; 184p; In English

Report No.(s): AD-A361613; AFIT/GSO/ENY/99M-07; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This study investigates the ability of the proposed Liquid Fly Back Booster, a replacement for the Space Shuttle's Solid Rocket Boosters (SRBs), to eliminate the need for the Return to Launch Site (RTLS) abort mode. A FORTRAN model of a nominal launch trajectory was perturbed to simulate a single Space Shuttle Main Engine-out (SSME-out) abort scenario at different times in the launch with the goal being to abort to the southern most landing site possible. The model accounts for vehicle lift, drag, dynamic pressure, throttling times and includes atmospheric effects to enhance fidelity. Results show the RTLS abort mode can be eliminated and successful landings made as far south as Savannah, Georgia. This success is attributed to the throttling capability of the Liquid Fly Back Booster engines.

DTIC

Space Shuttles; Recoverable Spacecraft; Launching Sites

19990042402 NASA Langley Research Center, Hampton, VA USA

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

Powell, Richard W., NASA Langley Research Center, USA; Lockwood, Mary Kae, NASA Langley Research Center, USA; Cook, Stephen A., NASA Marshall Space Flight Center, USA; 1998; 10p; In English; Astronautical Congress, 28 Sep. - 2 Oct. 1998, Melbourne, Australia; Original contains color illustrations

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

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

Author

Low Cost; ReUSAble Launch Vehicles; Single Stage to Orbit Vehicles; Space Commercialization; Commercial Spacecraft; Space Transportation System; X-33 ReUSAble Launch Vehicle

16
SPACE TRANSPORTATION

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

19990041334 NASA Marshall Space Flight Center, Huntsville, AL USA
The X-33/VentureStar Program
Laube, J., NASA Marshall Space Flight Center, USA; Oct. 22, 1998; 11p; In English, 22 Oct. 1998, Canoga Park, CA, USA
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The VentureStar reUSAble launch vehicle is discussed in this viewgraph presentation. The objectives of the VentureStar program are reviewed: (1) expendables cost too much, (2) commercial space market is growing (3) meets NASA's goals, (4) Users want fast ground turnaround, (5) users want quick access to space, (6) the offline payload processing saves time, (7) low cost access to space will enable new markets. Flight tests of the X-33, which was designed to test the technology and is pictured in several slides, built credibility for VentureStar. One slide shows the dimensions, weight, length, LEO payload capacity, and the propulsion, in comparison for the X-33, the VentureStar, the Space Shuttle, the Proton D-1e, and the Ariane V. Yet other slides outline the vehicle's features, the plan for the operation of the vehicle, from the runway, to the pad, to orbit. The planned containerized payload operation will allow for a 7 day turnaround for the system, which will allow for the planned 40 flights per year.
CASI
Flight Tests; Low Cost; Payloads; ReUSAble Launch Vehicles; X-33 ReUSAble Launch Vehicle; Commercial Spacecraft; Space Commercialization; Aerospace Vehicles

19990041739 NASA Johnson Space Center, Houston, TX USA
STS-91 Flight Day 1 Highlights and Crew Activities Report
Jun. 03, 1998; In English; Videotape: 20 min. 45 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1998358182; BRF-1415A; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this first day of the STS-91 mission, the flight crew, Cmdr. Charles J. Precourt, Pilot Dominic L. Pudwill Gorie, and Mission Specialists Franklin R. Chang-Diaz, Janet Lynn Kavandi, Wendy B. Lawrence, Valery Victorovitch Ryumin and Andrew S. W. Thomas, can be 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
Booster Rocket Engines; Space Transportation System Flights; Spacecrews; Launching; Space Flight; Space Missions; Space Shuttles; Countdown

19990041837 NASA Johnson Space Center, Houston, TX USA
STS-96 Crew Training
May 03, 1999; In English; Videotape: 12 min. 33 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999054988; JSC-1788; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The training for the crew members of the STS-96 Discovery Shuttle is presented. Crew members are Kent Rominger, Commander; Rick Husband, Pilot; Mission Specialists, Tamara Jernigan, Ellen Ochoa, and Daniel Barry; Julie Payette, Mission Specialist (CSA); and Valery Ivanovich Tokarev, Mission Specialist (RSA). Scenes show the crew sitting and talking about the Electrical Power System; actively taking part in virtual training in the EVA Training VR (Virtual Reality) Lab; using the Orbit Space Vision Training System; being dropped in water as a part of the Bail-Out Training Program; and taking part in the crew photo session.
CASI
Astronaut Training; Training Simulators; In-Flight Simulation

19990041888 NASA Marshall Space Flight Center, Huntsville, AL USA
General Public Space Travel and Tourism, Volume 2, Workshop Proceedings
ONeil, D., Compiler, NASA Marshall Space Flight Center, USA; Mankins, J., Editor, NASA, USA; Bekey, I., Editor, NASA,

USA; Rogers, T., Editor, Space Transportation Association, USA; Stallmer, E., Editor, Space Transportation Association, USA; Piland, W., Editor, NASA Langley Research Center, USA; February 1999; 76p; In English, 19-21 Feb. 1997, Washington, DC, USA; Sponsored by NASA Marshall Space Flight Center, USA; See also 19990041889 through 19990041894
Report No.(s): NASA/CP-1999-209146/VOL2; NAS 1.55:209146/VOL2; M-913/VOL2; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Space Transportation Association and NASA conducted a General Public Space Travel study between 1996 and 1998. During the study, a workshop was held at Georgetown University. Participants included representatives from the travel, aerospace, and construction industries. This report is the proceedings from that workshop. Sections include infrastructure needs, travel packages, policy related issues, and potential near-term activities.
Author
Space Transportation; Space Tourism; Conferences

19990041889 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Transportation and Destination Facilities
Smitherman, David, NASA Marshall Space Flight Center, USA; McClure, Wallace, Boeing North American, Inc., USA; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 1-21; In English; See also 19990041888; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Space Transportation and Destination Facilities section focused on space transportation vehicles-from use of existing vehicles to development of specialized transports-and on space stations, space business parks, space hotels, and other facilities in space of the kind that eventually would provide services for general public space travel (PST) and tourism. For both transportation and destination facilities, the emphasis was on the identification of various strategies to enable a realistic incremental progression in the development and acquisition of such facilities, and the identification of issues that need resolution to enable formation of viable businesses. The approach was to determine the best: (1) Strategies for general PST and tourism development through the description and analysis of a wide range of possible future scenarios. With these scenarios in mind the section then identified. (2) Key issues to be explored. (3) opportunities to eliminate barriers. (4) Recommendations for future actions. (5) Top-level requirements and characteristics for general PST and tourism systems and services that would guide the development of transportation and destination facilities.
Author
Space Tourism; Space Transportation; Space Commercialization

19990041890 NASA Marshall Space Flight Center, Huntsville, AL USA
Passengers, Crew, Life Support, and Insurance Considerations
ONeil, Daniel A., NASA Marshall Space Flight Center, USA; Young, Lawrence R., Massachusetts Inst. of Tech., USA; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 22-32; In English; See also 19990041888; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This section describes the key issues, barriers, opportunities, and potential trip packages related to the needs and expectations of initial space adventure travelers. A variety of ideas to overcome barriers is presented that address financial, psychological, and sociological problems expected to be encountered in establishing a general PST and tourism business. Tour package descriptions range from near-term surface training facilities to far-term lunar ones. Recommendations include requirements pertaining to human factors in design and needed technology.
Author
Space Tourism; Space Commercialization; Spacecrews; Manned Space Flight; Life Support Systems; Space Transportation

19990041891 Commerce Dept., Office of Air and Space Commercialization, Washington, DC USA
Certification, Regulation, Legislation, Policies, and Environmental Issues
Calhoun-Senghor, Keith, Commerce Dept., USA; Rappaport, Carl S., Department of Transportation, USA; Pace, Scott, RAND Corp., USA; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 33-39; In English; See also 19990041888; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Critical regulatory issues affect general PST and tourism. These regulatory issues concern the nature and extent of regulation to protect public health and safety, safety of property, and U.S. foreign policy, and national security interests. Statutory objectives must be considered in the context of international obligations requiring Governmental authorization, and supervision of commercial space activities. Optimal types and levels of regulation of the emerging business should: (1) Assure Congress, the media, the financial community, and the public that the business is safe; (2) Reduce uncertainty and risk by providing a more stable business environment; (3) Minimize Government burden on industry and commerce; and (4) Promote uniform performance-based industry

standards. This section examines the regulatory and policy issues affecting the viability of public access to space. After a series of presentations, followed by questions and discussions, this issue was divided into three sections: Near-term regulatory issues; Near-term policy issues; and ”Beyond the near term” issues.
Author
Space Tourism; Space Law; Space Commercialization; Policies; Environment Effects; Space Transportation

19990041892 California Inst. of Tech., Pasadena, CA USA
Financial, Economic, Business Planning, and Market Requirements to Start a Viable Space Tourism Business
Marzwell, Neville, California Inst. of Tech., USA; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 40-46; In English; See also 19990041888; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Technology, markets, business, and financial surveys suggest that a general PST and tourism business will be created if a vehicle is developed and demonstrated to be adequately safe for a fast turnaround time at an acceptable price. Various issues are identified that could be ”show stoppers.” The major single requirement for the creation of a solid business is the design from scratch of a very highly reliable system that is uniquely built for general public passenger transport. This vehicle must be designed to be operated like an airline. It should have fully autonomous flight control and navigation systems. It is critical for this vehicle to have onboard health monitoring systems and real-time launch-abort savability. Other issues that could impact business success are space sickness and Government regulations that, if combined, could break the spirit of the public and the entrepreneurs. The major factors affecting the economics of a viable general PST and tourism business are identified. An ultrahigh flight rate and high safety and reliability are crucial. Figures of merit similar to those used to evaluate the economic viability of conventional commercial aircraft are developed. Items, such as payload/ vehicle dry weight, number of passengers, turnaround time, propellant cost per passenger, insurance, and depreciation costs, are discussed in detail, and indications are that an infrastructure can be developed for a viable business. Reference space vehicle designs optimized for general PST and tourism are used to assess the business opportunity. Subsystem allocations for safety and reliability, operability, and cost are discussed, and a route to developing and implementing such capabilities has been judged to be realizable and financially promising.
Author
Space Tourism; Commercial Spacecraft; Space Transportation; Economic Analysis; Space Transportation System; Spacecraft Design

19990041893 Design Finance International
Early Precursors
Spencer, John, Design Finance International; Wolff, Howard, Wimberly, Allison, Tong, and Goo; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 47-54; In English; See also 19990041888; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Throughout history, the great pioneer explorers of the oceans, jungles, polar regions, and deserts have always been followed by homesteaders, vacationers, and entrepreneurs. Once tamed, wild frontiers can quickly become favorite resort destinations. Just as we have become tourists passing over land, above and under the oceans, and through the skies, so shall we eventually ”float away” our leisure time in luxurious vessels orbiting the planet. Thus, there is an emerging need for evolving an infrastructure that will provide the paying tourist with an unforgettable vacation in space. The problem facing private entrepreneurs of general PST and tourism is the current difficulty of access to the space environment. Initially, business developers must look elsewhere for the needed experience and industry growth. Appropriately, initial ground facilities, theme parks, and other Earth-based precursors can provide the evolving infrastructure necessary for the development of a sound business. That is, actual general public orbital space travel and tourism will be preceded by businesses that exploit the demand for surface space-related theme entertainment. Theme parks and flight training facilities developed around space travel launch and recovery sites can both prepare the public for the space experience and provide profit from the enterprise; and such profits could fund the evolution from existing Earth-based travel to actual space travel. Inherent in all of Earth-based space tourism precursors are common parameters applicable to any tourism business. Vehicle and facility design, length of stay, numbers of staff/crew, types of recreational activities, and vacation prices are central to the sustainability of any tourism enterprise. Creating a compelling vacation experience and sound business enterprise in a remote environment requires careful balancing of human factors, economic, and technological/operational issues. These issues range from state-of-the-art Gore-tex(TM) sleeping bags to marble-tiled double staterooms aboard luxurious ocean liners. Much, perhaps even most, of what space entrepreneurs need to know to grow the general PST and tourism business exists today on Earth. Every year millions of people spend at least a billion dollars enjoying space-theme tourist attractions and analogous leisure activities in the U.S. alone.
Author
Space Tourism; Space Transportation; Space Commercialization

19990041894 NASA Langley Research Center, Hampton, VA USA

Research and Development, Technology Requirements, and Use of Existing Space Assets

Grey, Jerry, American Inst. of Aeronautics and Astronautics, USA; Rowell, Larry, NASA Langley Research Center, USA; General Public Space Travel and Tourism; February 1999; Volume 2, pp. 55-60; In English; See also 19990041888; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Technology requirements are addressed in three categories: (1) Passenger-carrying STS(s); (2) orbital facilities (including on-orbit operations such as servicing) and human factors (crew and passenger training and recreation, on-orbit environmental control, etc.); and (3) ground infrastructure. An example tourism trip scenario is used in discussing possible targets for technology development activities. Some general comments are made as are considerations for other working groups.

Author

Space Tourism; Space Transportation System; Space Commercialization; Space Transportation; Technology Utilization

19990041929 NASA Johnson Space Center, Houston, TX USA

STS-86 Post Flight Presentation

Mar. 22, 1999; In English; Videotape: 19 min. 22 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-1999064004; JSC-1685; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The Crew of STS-86 Atlantis Shuttle, Commander James D. Wetherbee, Pilot Michael J. Bloomfield, Mission Specialists Vladimar G. Titov, Scott E. Parazynski, Jean-Loup J. M. Chretien, Wendy Lawrence, and David Wolf, narrate the footage of their mission to the Mir International Space Station. Scenes include crew suit up, walk out to the transfer vehicle, strap-in into the shuttle, start of the main engine, ignition of the rocket boosters, and separation of the solid rocket boosters. The crew of Atlantis participates in an exchange of gifts with the members of Mir, and a space walk to recover experiments outside the Mir Space Station. A beautiful panoramic view of Mir above South America is seen. Scenes also depict the closing of Mir's hatch, Atlantis' separation from Mir, and the reentry of the Atlantis Space Shuttle into the Earth's atmosphere.

CASI

Atlantis (Orbiter); Manned Space Flight; Spacecrews; Mir Space Station; International Space Station

19990041930 NASA Johnson Space Center, Houston, TX USA

Historical Footage of John Glenn Friendship 7

Feb. 20, 1962; In English; Videotape: 16 min. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-1999064003; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The Friendship mission launch on the 20th day of February marked the first time that an American attempts to orbit the Earth. Historical footage of John Glenn's suit up, ride out to the launch pad, countdown, liftoff, booster engine cutoff, and separation of the booster engine escape tower is shown. Views of the Earth, Glenn's manual control of the electrical fly-by wire system, and the recovery of the landing vehicle from the ocean are presented.

CASI

Mercury Ma-6 Flight; Friendship 7; Launch Vehicles; Earth Orbits

19990041931 NASA Johnson Space Center, Houston, TX USA

STS-91 Post Flight Presentation

Jun. 22, 1998; In English; Videotape: 16 min. 45 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-1999064002; JSC-1741; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

Footage of the Crew of STS-91 Discovery Shuttle, Commander Charles J. Precourt, Pilot Dominic L. Pudwill Gorie, Mission Specialists Wendy B. Lawrence, Franklin R. Chang-Diaz, Janet L. Kavandi, and Valery Victorovitch Ryumin, is shown. Scenes include the crew suit up, walk out to the transfer vehicle, and strap-in into the shuttle. Also presented are scenes of the start of the main engine, ignition of the solid rocket boosters, panoramic views of the Earth as the shuttle takes off, and the separation of the solid rocket boosters. The crew of Discovery opens the payload bay doors to the Mir International Space Station, completes SPACEHAB tunnel leak checks, greets crew in Mir Space Station, and transfers materials to Mir. Beautiful panoramic views of the Moon, and Mir above Cape Canaveral are seen. Scenes also include the crew of Discovery sharing meals, and exercising. The film ends with the reentry of the Discovery Space Shuttle into the Earth's atmosphere.

CASI

Discovery (Orbiter); Manned Space Flight; Spacecrews; Mir Space Station; International Space Station

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.

19990041155 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal and Mechanical Performance of a Carbon/Carbon Composite Spacecraft Radiator
Kuhn, Jonathan, NASA Goddard Space Flight Center, USA; Benner, Steve, NASA Goddard Space Flight Center, USA; Butler, Dan, NASA Goddard Space Flight Center, USA; Silk, Eric, NASA Goddard Space Flight Center, USA; 1999; 17p; In English, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Carbon-carbon composite materials offer greater thermal efficiency, stiffness to weight ratio, tailorability, and dimensional stability than aluminum. These lightweight thermal materials could significantly reduce the overall costs associated with satellite thermal control and weight. However, the high cost and long lead-time for carbon-carbon manufacture have limited their widespread USAge. Consequently, an informal partnership between government and industrial personnel called the Carbon-Carbon Spacecraft Radiator Partnership (CSRP) was created to foster carbon-carbon composite use for thermally and structurally demanding space radiator applications. The first CSRP flight opportunity is on the New Millennium Program (NMP) Earth Orbiter-1 (EO-1) spacecraft, scheduled for launch in late 1999. For EO-1, the CSRP designed and fabricated a Carbon-Carbon Radiator (CCR) with carbon-carbon facesheets and aluminum honeycomb core, which will also serve as a structural shear panel. While carbon-carbon is an ideal thermal candidate for spacecraft radiators, in practice there are technical challenges that may compromise performance. In this work, the thermal and mechanical performance of the EO-1 CCR is assessed by analysis and testing. Both then-nal and mechanical analyses were conducted to predict the radiator response to anticipated launch and on-orbit loads. The thermal model developed was based on thermal balance test conditions. The thermal analysis was performed using SINDA version 4.0. Structural finite element modeling and analysis were performed using SDRC/1-DEAS and UAI/NASTRAN, respectively. In addition, the CCR was subjected to flight qualification thermal/vacuum and vibration tests. The panel meets or exceeds the requirements for space flight and demonstrates promise for future satellite missions.
Author
Carbon-Carbon Composites; Spacecraft Radiators; Technology Utilization; Thermal Analysis; Thermodynamic Efficiency; Vibration Tests; Structural Analysis

19990041448 NASA Goddard Space Flight Center, Greenbelt, MD USA
Nanosat Intelligent Power System Development
Johnson, Michael A., NASA Goddard Space Flight Center, USA; Beaman, Robert G., NASA Goddard Space Flight Center, USA; Mica, Joseph A., NASA Goddard Space Flight Center, USA; Truszkowski, Walter F., NASA Goddard Space Flight Center, USA; Rilee, Michael L., Raytheon Co., USA; Simm, David E., Jackson and Tull, Inc., USA; Mar. 31, 1999; 10p; In English; 2nd; Intelligent Micro Nano Technologies for Space Applications, 11-15 Apr. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA Goddard Space Flight Center is developing a class of satellites called nano-satellites. The technologies developed for these satellites will enable a class of constellation missions for the NASA Space Science Sun-Earth Connections theme and will be of great benefit to other NASA enterprises. A major challenge for these missions is meeting significant scientific- objectives with limited onboard and ground-based resources. Total spacecraft power is limited by the small satellite size. Additionally, it is highly desirable to minimize operational costs by limiting the ground support required to manage the constellation. This paper will describe how these challenges are met in the design of the nanosat power system. We will address the factors considered and tradeoffs made in deriving the nanosat power system architecture. We will discuss how incorporating onboard fault detection and correction capability yields a robust spacecraft power bus without the mass and volume penalties incurred from redundant systems and describe how power system efficiency is maximized throughout the mission duration.
Author
Product Development; Fabrication; Technology Assessment; Nanosatellites; Power Conditioning

19990041868 Swedish Inst. of Space Physics, Uppsala, Sweden

Analysis of Freja Charging Events: Modelling of Freja Observations by Spacecraft Charging Codes, 2.0

Eriksson, Anders I., Swedish Inst. of Space Physics, Sweden; Wedin, Lars, Swedish Inst. of Space Physics, Sweden; Wahlund, Jan-Erik, Swedish Inst. of Space Physics, Sweden; Holback, Bengt, Swedish Inst. of Space Physics, Sweden; January 1999; ISSN 0284-1703; 140p; In English

Contract(s)/Grant(s): ESTEC-11974/96/NL/JG(SC)

Report No.(s): IRF-SR-252; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This document presents the results provided by work package WP120 of the spacecraft charging study made at the Uppsala Division of the Swedish Institute of Space Physics. The central part of this work package is the comparison of five Freja charging events, all included in the WP 130 database and presented in WP 110, to charging simulations using the POLAR code. This document was written with the following purposes: (1) Give a brief introduction to spacecraft charging models; (2) Give a materials list of the Freja spacecraft; (3) Present Freja models for POLAR simulations; (4) Present environment models for POLAR simulations; (5) Present results of direct POLAR simulations using the above; (6) List input files for POLAR simulations; (7) Discuss the simulation results; (8) Suggest further investigations; and (9) Suggest code development. The presented input files for POLAR simulations are extensively commented in order to facilitate their future use. These files have also been delivered to ESTEC in digital format. Attachment: A, B, C, D, E, F, G, H, J, and K appendices.

Author

Spacecraft Charging; Simulation; Data Bases; Models

19990041946 GenCorp Aerojet, AzUSA, CA USA

Integrated Advanced Microwave Sounding Unit-A(AMSU-A). Performance Verification Report: METSAT AMSU-A2 Receiver Assembly, (P/N 1356441-1, S.N F04) S/N 107

Kapper, R., GenCorp Aerojet, USA; November 1998; 100p; In English

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

Report No.(s): NASA/CR-1999-209220; NAS 1.26:209220; Rept-11317; CDRL-208; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The AMSU-A receiver subsystem comprises two separated receiver assemblies; AMSU-Al and AMSU-A2(PN1356441-1). The AMSU-A1 receiver contains 13 channels and the AMSU-A2 receiver 2 channels. The AMSU-AL receiver assembly is further divided into two parts; AMSU-A 1-1 (P/N 1356429-1) and AMSU-A 1-2 (P/N 1356409-1), which contain 9 and 4 channels, respectively. The AMSU-A receiver subsystem stands in between the antenna and signal processing subsystems of the AMSU-A instrument and comprises the RF and IF components from RF isolators to IF attenuators. It receives the RF signals from the antenna subsystem, down-converts the RF signals to IF signals, amplifies and defines the IF signals to proper power level and frequency bandwidth as specified for each channel, and inputs the IF signals to the signal processing subsystem. The test reports for the METSAT AMSU-A receiver subsystem are prepared separately for the A1 and A2 receivers so that each receiver stands alone during integration of instruments into the spacecraft. This test report presents the test data of the METSAT AMSU-A2 Flight Model No.4 (FM4) receiver. The tests are performed per the Acceptance Test Procedure for the AMSU-A Receiver Subsystem, AE-26002/6A. The functional performance tests are conducted either at the component or subsystem level. While the component-level tests are performed over the entire operating temperature range predicted by thermal analysis, the subsystem-level tests are conducted at ambient temperature only.

Derived from text

Signal Processing; Microwave Equipment; Performance Tests; Thermal Analysis; Receivers; Advanced Microwave Sounding Unit; Acceptability

19990041973 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

SIMSAT: A Satellite System Simulator and Experimental Test Bed for Air Force Research

Colebank, James E.; Jones, R. Dan; Pollak, Randall D.; Mannebach, Donald M.; Nagy, George R.; Mar. 1999; 495p; In English

Report No.(s): AD-A361635; AFIT/GSE/GSO/ENY/99M-1; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

SIMSAT (the SIMulation SATellite) is an AFIT-sponsored program to develop a laboratory-based physical satellite simulator. SIMSAT supports experimentation in areas of attitude control, precision pointing, and vibration suppression. SIMSAT development began with the purchase of a three-axis gas bearing which simulates a torque-free space environment. SIMSAT subsystems provide power, attitude control, telemetry, and structural support to experimental payloads. Project challenges included integra-

tion of attitude control software/hardware, high-output power storage devices, remote communications, high-frequency data collection, structural design, and computer display outputs.
DTIC
Artificial Satellites; Simulators

19990042065 GenCorp Aerojet, AzUSA, CA USA
Integrated Advanced Microwave Sounding Unit-A(AMSU-A). Performance Verification Report, METSAT Phase Locked Oscillator Assembly, P/N 1348360-1, S/N's F07 and F08
Pines, D., GenCorp Aerojet, USA; December 1998; 290p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209218; NAS 1.26:209218; Rept-11360; CDRL-208; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Two Flight Model AMSU-A Phase Locked Oscillators (PIN 1348360-1, S/N F07 and F08) have been tested per AES Test Procedure AE-26758 Rev. B, which include full functional testing, vibration testing, thermal testing, and AM/FM Noise testing. Both assemblies satisfactorily passed all performance requirements of the AE-26633 Product Specification. During the thermal cycling of both units, spurs developed 1 MHz from the carrier when the units were cold, and TARs were written to document the anomaly. The symptoms observed in both cases were consistent with inadequate tuning. The units were successfully re-tuned. In the case of F08, re-tuning required a design change which allowed a greater range of possible values for tuning resisters. Both units completed thermal cycling without further delay. The results of the required tests are presented in the following section as test data. As indicated on the test data sheets, all measured data passed all requirements.
Derived from text
Advanced Microwave Sounding Unit; Performance Tests; Oscillators; Aircraft Models; Vibration; Thermal Cycling Tests

19990042433 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Maneuver Strategy for Orbital Control of CBERS Satellite *Estudo da Estrategica de Manobra para o Controle de Orbita do Satellite CBERS*
Rocco, Evandro Marconi, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 164p; In Portuguese
Report No.(s): INPE-7035-NTC/336; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This work was developed during the course Topicos Especiais em Dinamica de Orbita e Atitude (CMC-400). Therefore, we only intend to present the study of maneuver strategy for orbital control of China-Brazil Earth Resources Satellites CBERS 1 and CBERS 2. We used as a base the software Ground Tracking Prediction developed by Prasad (1999) which considers the mean elements theory in the ground track prediction model.
Author
Mathematical Models; Ground Tracks; Earth Observations (From Space); Research; Maneuverability

19
SPACECRAFT INSTRUMENTATION

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

19990041197 NASA Glenn Research Center, Cleveland, OH USA
Comparison Tools for Assessing the Microgravity Environment of Orbital Missions, Carriers and Conditions
DeLombard, Richard, NASA Glenn Research Center, USA; Hrovat, Kenneth, Tal-Cut Co., USA; McPherson, Kevin M., NASA Glenn Research Center, USA; March 1999; 10p; In English; 16th; Instrumentation and Measurement Technology, 24-26 May 1999, Venice, Italy; Sponsored by Institute of Electrical and Electronics Engineers, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27254; RTOP 398-95-OA
Report No.(s): NASA/TM-1999-209048; NAS 1.15:209048; E-11580; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Principal Component Spectral Analysis and the Quasi-steady Three-dimensional Histogram techniques provide the means to describe, on a single plot, the microgravity acceleration environment of a long period of time, such as a day, week, or month. This allows a straight forward comparison of the microgravity environment between microgravity increments on the International Space Station, locations within the International Space Station, and/or different operating conditions. Traditional data display methods (e.g. acceleration versus time), while adequate for shorter time periods, would utilize more plots for an extensive period of time, often making interpretation more difficult. These new techniques provide a single page representation of a large

set of microgravity acceleration data. These techniques, in conjunction with other techniques, may be employed to derive useful information from acceleration data to characterize or compare the microgravity environment.
Author
Histograms; Microgravity; Principal Components Analysis; Spectrum Analysis

19990041338 AMPTEk, Inc., Bedford, MA USA
Fabrication, Refurbishment and Flight Support for the SSJ4 Electron and Ion Detectors for the DMSP ***Final Report, Jun. 1988 - Jul. 1997***
Moran, Scott J., AMPTEk, Inc., USA; Huber, Alan C., AMPTEk, Inc., USA; Pantazis, John A., AMPTEk, Inc., USA; Holeman, Ernie, AMPTEk, Inc., USA; McGarity, John O., AMPTEk, Inc., USA; Dec. 31, 1997; 40p; In English
Contract(s)/Grant(s): F19628-88-C-0121; AF Proj. 1924
Report No.(s): AFRL-VS-HA-TR-98-0016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report for work funded under this contract. There were three contracted tasks, each of which has been completed. Task #1 was to fabricate, test and calibrate two SSJ4 sensors, as well as, to design and build the associated ground support equipment (GSE). Task #2 was to refurbish and support the reintegration of sensors for the Defense Meteorology Satellite Program (DMSP) spacecrafts designated F9 through F14. Task #3 provided launch and early-operations support for the SSJ4 sensors on DMSP F9 through F 14. A brief summary of the work performed under each task is presented, and a detailed description of the SSJ4 instrument and its operation is given. Details are also provided on GSE, instrument calibration and refurbishment process, as well as, on the extent of early-operations support after launch. A compilation of instrument data showing instrument performance during the checkout phase of early operations shortly after launch, and operational SSJ4 data as compiled and plotted by AFRL over the extent of the contract, appears at the end. The SSJ4 sensor has proved itself to be a compact, efficient and very reliable instrument over the many years of its operation on DMSP spacecrafts.
Author
Electron Counters; Calibrating; DMSP Satellites; F-14 Aircraft

20
SPACECRAFT PROPULSION AND POWER

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

19990041160 NASA Marshall Space Flight Center, Huntsville, AL USA
Analysis of Linear Aerospike Plume Induced Based-Heating Physics and Fence Effect
Wang, Ten-See, NASA Marshall Space Flight Center, USA; 1999; 10p; In English; 33rd; Thermophysics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 99-3682; Copyright; Avail: Issuing Activity (AIAA, 1801 Alexander Bell Dr., Suite 500, Reston, VA 20191), Hardcopy, Microfiche

Computational analysis is conducted to study the linear aerospike plume induced base-heating physics and fence effect on the X-33 demonstrator during ascent flight. The thermo-flowfield of the entire vehicle at several trajectory points is computed. The computational methodology is based on three-dimensional, finite-difference, viscous flow, chemically reacting, pressure-based computational fluid dynamics formulation, and a three-dimensional, finite-volume, spectral-line based weighted-sum-of-gray-gases absorption, computational radiation heat transfer formulation. The computed base-flow physics is analyzed and compared with those of a sub-scale model hot-flow test. The effects of fence and base-bleed on the linear aerospike plume induced base-heating physics are studied.
Author
Radiative Heat Transfer; Aerospike Engines; Plumes; Viscous Flow; Computational Fluid Dynamics; Finite Difference Theory; Finite Volume Method

19990041161 Boeing North American, Inc., Rocketdyne Div., Canoga Park, CA USA
Prediction of X-33 Engine Dynamic Environments
Shi, John J., Boeing North American, Inc., USA; 1999; 7p; In English; 18th; Aerospace Testing, 16-18 Mar. 1999, Manhattan Beach, CA, USA
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Rocket engines normally have two primary sources of dynamic excitation. The first source is the injector and the combustion chambers that generate wide band random vibration. The second source is the turbopumps, which produce lower levels of wide band random vibration as well as sinusoidal vibration at frequencies related to the rotating speed and multiples thereof. Additionally, the pressure fluctuations due to flow turbulence and acoustics represent secondary sources of excitation. During the development stage, in order to design/size the rocket engine components, the local dynamic environments as well as dynamic interface loads have to be defined.
Author
X-33 ReUSAble Launch Vehicle; Dynamic Loads; Rocket Engines; Engine Parts; Combustion Chambers

19990041172 Los Alamos National Lab., NM USA
Near net shape processing for solar thermal propulsion hardware using directed light fabrication
Milewski, J. O.; Fonseca, J. C.; Lewis, G. K.; Dec. 31, 1998; 5p; In English; Solar energy; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): DE99-000665; LA-UR-98-1800; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Directed light fabrication (DLF) is a direct metal deposition process that fuses gas delivered powder, in the focal zone of a high powered laser beam to form fully fused near net shaped components. The near net shape processing of rhenium, tungsten, iridium and other high temperature materials may offer significant cost savings compared with conventional processing. This paper describes a 3D parametric solid model, integrated with a manufacturing model, and creating a control field which runs on the DLF machine directly depositing a fully dense, solid metal, near net shaped, nozzle component. Examples of DLF deposited rhenium, iridium and tantalum, from previous work, show a continuously solidified microstructure in rod and tube shapes. Entrapped porosity indicates the required direction for continued process development. These combined results demonstrate the potential for a new method to fabricate complex near net shaped components using materials of interest to the space and aerospace industries.
NTIS
Solar Thermal Propulsion; Hardware; Fabrication

19990041442 Auburn Univ., Aerospace Engineering, AL USA
Structural Stiffness Characteristics of the Solid Rocket Booster Field Joint
Bodeker, Dan A., III, Auburn Univ., USA; Foster, Windred A., Jr., Auburn Univ., USA; Nov. 13, 1998; 53p; In English
Contract(s)/Grant(s): NAS8-39131
Report No.(s): NASA/CR-1999-208192; NAS 1.26:208192; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The Space Shuttle Solid Rocket Booster (SRB) is a complex assembly of segments of which the field and factory joints contain an unpredictable amount of freeplay. Freeplay is inherent due to tolerances in being able to assemble the segments and the gaps that occur at each joint. The purpose of this work is to quantify the amount of freeplay for the field joint as well as identify the effects of introducing multiple joints that contain freeplay into a system. To provide a baseline for the above study an additional model was made to quantify the behavior of a field joint that does not have any freeplay in the system.
Author
Booster Rocket Engines; Solid Propellant Rocket Engines; Stiffness; Structural Design; Models

19990041839 NASA Goddard Space Flight Center, Greenbelt, MD USA
Chance Encounter with a Stratospheric Kerosene Rocket Plume from Russia over California
Newman, P. A., NASA Goddard Space Flight Center, USA; Wilson, J. C., NASA Goddard Space Flight Center, USA; Ross, M. N., NASA Goddard Space Flight Center, USA; Brock, C., NASA Goddard Space Flight Center, USA; Sheridan, P., NASA Goddard Space Flight Center, USA; Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Lait, L. R., NASA Goddard Space Flight Center, USA; Bui, T. P., NASA Goddard Space Flight Center, USA; Loewenstein, M., NASA Goddard Space Flight Center, USA; 1999; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
During a routine ER-2 aircraft high-altitude test flight on April 18, 1997, an unusual aerosol cloud was detected at 20 km altitude near the California coast at about 370 degrees N latitude. Not visually observed by the ER-2 pilot, the cloud was characterized bv high concentration of soot and sulfate aerosol in a region over 100 km in horizontal extent indicating that the source of the plume was a large hydrocarbon fueled vehicle, most likely a launch vehicle powered only by rocket motors burning liquid oxygen and kerosene. Two Russian Soyuz rockets could conceivably have produced the plume. The first was launched from the

Baikonur Cosmodrome, Kazakhstan on April 6th; the second was launched from Plesetsk, Russia on April 9. Air parcel trajectory calculations and long-lived tracer gas concentrations in the cloud indicate that the Baikonur rocket launch is the most probable source of the plume. The parcel trajectory calculations do not unambiguously trace the transport of the Soyuz plume from Asia to North America, illustrating serious flaws in the point-to-point trajectory calculations. This chance encounter represents the only measurement of the stratospheric effects of emissions from a rocket powered exclusively with hydrocarbon fuel.
Author
Hydrocarbon Fuels; Kerosene; Ozone Depletion; Trajectory Analysis; Rocket Exhaust; Pollution Transport; Combustion Products

19990041848 Los Alamos National Lab., NM USA
Gas core nuclear rocket feasibility project
Howe, S. D., Los Alamos National Lab., USA; DeVolder, B., Los Alamos National Lab., USA; Thode, L., Los Alamos National Lab., USA; Zerkle, D., Los Alamos National Lab., USA; Sep. 30, 1997; 10p; In English; Space and Defence, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NASA Order H-28025-D
Report No.(s): DE98-001540; LA-UR-97-3786; CONF-9709156; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The next giant leap for mankind will be the human exploration of Mars. Almost certainly within the next thirty years, a human crew will brave the isolation, the radiation, and the lack of gravity to walk on and explore the Red planet. However, because the mission distances and duration will be hundreds of times greater than the lunar missions, a human crew will face much greater obstacles and a higher risk than those experienced during the Apollo program. A single solution to many of these obstacles is to dramatically decrease the mission duration by developing a high performance propulsion system. The gas core nuclear rocket (GCNR) has the potential to be such a system. The gas core concept relies on the use of fluid dynamic forces to create and maintain a vortex. The vortex is composed of a fissile material which will achieve criticality and produce high power levels. by radiatively coupling to the surrounding fluids, extremely high temperatures in the propellant and, thus, high specific impulses can be generated. The ship velocities enabled by such performance may allow a 9 month round trip, manned Mars mission to be considered. Alternatively, one might consider slightly longer missions in ships that are heavily shielded against the intense Galactic Cosmic Ray flux to further reduce the radiation dose to the crew. The current status of the research program at the Los Alamos National Laboratory into the gas core nuclear rocket feasibility will be discussed.
NTIS
Feasibility Analysis; Nuclear Engine For Rocket Vehicles; Gas Jets; Core Flow; Propulsion; Propellants; Aerospace Vehicles

19990041936 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Investigation of Asbestos in TOW Missiles *Final Report Onderzoek Naar het Voorkomen van Asbest in TOW-Raketten*
Arzoni, R. J., Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Netherlands; vanHam, N. H. A., Prins Maurits Lab. TNO, Netherlands; October 1998; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/RIM/442; TNO Proj. 214098327
Report No.(s): TD98-0294; PML-1998-A53; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
TOW missiles contain asbestos as insulator material between the grain and the motor chamber. TNO investigated the possibility that asbestos fibres might be emitted from the rocket motor during functioning. Also possible changes in the structure of the asbestos fibres due to the high temperature of the motor were investigated. During static firing a low concentration of asbestos fibres was measured in the vicinity of the motor. This low concentration is not a health risk. The asbestos in the motor after functioning is partly modified but a major part remains unchanged and potentially dangerous. On impact on the target this asbestos will be distributed over the area. Due to the low concentrations environmental problems are not anticipated. Collecting TOW-missile remnants must be performed with special safety precautions.
Author
Research; Asbestos; Tow Missiles; Safety; Fibers

23
CHEMISTRY AND MATERIALS (GENERAL)

19990041332 Rutherford Appleton Lab., Chilton, UK
Photophysics of Cyanine Dyes on Surfaces: Time Resolved Transient Absorption Spectra and Lifetime Measurements. TMR Large-Scale Facilities Access Programme
Ferreira, L. F. Vieira, Instituto Superior Tecnico, Portugal; Oliveira, A. S., Instituto Superior Tecnico, Portugal; Worrall, D. R., Loughborough Univ. of Technology, UK; Wilkinson, F., Loughborough Univ. of Technology, UK; Matousek, P., Rutherford Appleton Lab., UK; Towrie, M., Rutherford Appleton Lab., UK; Parker, A. W., Rutherford Appleton Lab., UK; Feb. 24, 1999; ISSN 1358-6254; In English
Report No.(s): RAL-TR-1999-007; Copyright; Avail: Issuing Activity (CDRL, Rutherford Appleton Lab., Chiltan, Didcot, Oxfordshire OX11 0QX, UK), Hardcopy, Microfiche

This report describes the experiment entitled ”Photophysics of cyanine dyes on surfaces: Time resolved transient absorption spectra and lifetime measurements”, carried out at the Central Laser Facility (CLF) from the 26th Jan. to the 14th Feb. 1998. The experiment, funded by the Framework IV Large-Scale Facilities Access Scheme, was proposed by Dr L Ferreira, Centro de Quimica-Fisica Molecular, Portugal and carried out by visiting researchers from the Centre. They were supported by researchers from the UK from Loughborough University, Leicestershire and the Central Laser Facility, Rutherford Appleton Laboratory.
Author
Absorption Spectra; Time Functions; Experimentation

19990042282 NASA Marshall Space Flight Center, Huntsville, AL USA
Studies of Protein Solution Properties Using Osmotic Pressure Measurements
Agena, S., London Univ., UK; Bogle, David, NASA Marshall Space Flight Center, USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; Agena, S., London Univ., UK; 1998; 1p; In English; Crystallization of Biological Macromolecules, 3 May 1998, Granada, Spain; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Examination of the protein crystallization process involves investigation of the liquid and solid state and a protein’s properties in these states. Liquid state studies such as protein self association in solution by light scattering methods or other methods have been used to examine a protein Is properties and therefore its crystallization process and conditions. Likewise can osmotic pressure data be used to examine protein properties and various published osmotic pressure studies were examined by us to correlate osmotic pressure to protein solution properties. The solution behavior of serum albumin, alpha - chymotrypsin, beta - lactoglobulin and ovalbumin was examined over a range of temperatures, pH values and different salt types and concentrations. Using virial expansion and a local composition model the non ideal solution behavior in form of the activity coefficients (thermodynamic) was described for the systems. This protein activity coefficient data was related to a protein’s solubility behavior and this process and the results will be presented.
Author
Osmosis; Pressure Measurement; Protein Crystal Growth; Albumins; Crystallization; Proteins

24
COMPOSITE MATERIALS

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

19990041434 NYMA, Inc., Cleveland, OH USA
Design, Fabrication and Characterization of High Temperature Joints in Ceramic Composites
Singh, M., NYMA, Inc., USA; Key Engineering Materials; 1999; Volumes 164-165, pp. 415-420; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Ceramic joining has been recognized as one of the enabling technologies for the successful utilization of ceramic components in a number of demanding, high temperature applications. Various joint design philosophies and design issues have been discussed along with an affordable, robust ceramic joining technology (ARCJoinT). A wide variety of silicon carbide-based composite materials, in different shapes and sizes, have been joined using this technology. This technique is capable of producing joints with tailorable thickness and composition. The room and high temperature mechanical properties and fractography of ceramic joints have been reported. These joints maintain their mechanical strength up to 1200 C in air. This technology is suitable for the joining

of large and complex shaped ceramic composite components and with certain modifications, can be applied to repair of ceramic components damaged in service.
Author
Design Analysis; Fabrication; High Temperature; Joints (Junctions); Ceramic Matrix Composites

19990041477 Lawrence Livermore National Lab., Livermore, CA USA
Structural and electronic properties of clean and defected Si-SiC(001) surfaces
Galli, G.; Jun. 01, 1998; 7p; In English; 1998 semiconducting and insulating materials conference
Report No.(s): DE98-058630; UCRL-JC-131036; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We have studied the reconstructions and electronic properties of both clean and defected Si-terminated (001) surfaces of cubic SiC, by performing -first principles computations within density functional theory. We find that the unstrained bulk exhibits a stable p(2 x l) reconstruction, whereas a bulk under tensile stress shows a c(4 x 2) reconstruction Furthermore our calculations indicate that ad-dimers are common defects on the Si-terminated SIC(001) surface These results permit the interpretation of recent STM and X-ray-photoemission experimental data.
NTIS
Electrical Properties; Silicon Carbides; Silicon; Surface Defects

19990041924 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Progressive Failure Analysis of Composite Panels
Spottswood, Stephen M.; Mar. 1999; 187p; In English
Report No.(s): AD-A361640; AFIT/GAE/ENY/99M-08; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
The objective of this research was to determine the physical response, including material failure, of a curved composite panel designed to resist transverse loading. The cause of the material failure, in the form of delamination, fiber and/or matrix failure, was determined through various criterion based on non-linear movement using a finite element analysis technique. Data generated both with and without the addition of progressive failure criteria, was compared with previously published experimental data, noting where the theory diverges from the experimental results. The inclusion of various failure criterion, to include maximum stress, Lee, and Hashin, provided a more realistic representation of the total physical response of the shell. Once an approximate range of accurate physical representation was realized, progressive failure of composite sandwich shells under transverse loading were examined. Results of the analytic comparison with the published experimental data indicate that the SLR theory overpredicts the stiffness of the various shells for both the cases considering and not considering failure criteria. Furthermore, matrix failure patterns predicted by all three criterion were similar to the experimental results. Core failures predicted in the composite sandwich analysis were similar between the failure criterion.
DTIC
Failure; Composite Structures; Composite Materials; Matrix Materials; Curved Panels; Loads (Forces)

19990041983 NASA Langley Research Center, Hampton, VA USA
Evaluation of a Scaling Approach for Stiffened Composite Flat Panels Loaded in Compression
Rouse, Marshall, NASA Langley Research Center, USA; Assadi, Mahyar, Boeing Commercial Airplane Co., 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 99-1404; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Results of an experimental study of the effects of geometric scaling on a graphite-epoxy flat stiffened-skin panel concept loaded in compression are presented. The scaled models were fabricated using an approach to laminate thickness scaling, referred to as the ”ply-thickness method.” The structural response and failure characteristics of full-, half-, and quarter-scale specimens fabricated with this scaling concept are discussed and compared. The scaled up failure loads of the half- and quarter-scale models agree well with the failure load of the full-scale prototypes tested. The strength scale effects observed in the results were substantially smaller than those in earlier studies that employed other laminate scaling techniques. The experimental results indicate that failure initiated by crippling and delamination in the cap of the longitudinal stiffeners and skin-stiffener separation at the bond-lines, and was followed by failure of the specimen skin. Nonlinear finite element analysis results correlate well with experimental results up to failure.
Author
Composite Structures; Graphite-Epoxy Composites; Scale Effect

19990042339 Los Alamos National Lab., NM USA

High-performance computing of electron microstructures

Bishop, A.; Birnir, B.; Galdrikian, B.; Wang, L.; Dec. 31, 1998; 4p; In English

Report No.(s): DE99-001262; LA-UR-98-2613; 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 project was a collaboration between the Quantum Institute at the University of California-Santa Barbara (UCSB) and the Condensed Matter and Statistical Physics Group at LANL. The project objective, which was successfully accomplished, was to model quantum properties of semiconductor nanostructures that were fabricated and measured at UCSB using dedicated molecular-beam epitaxy and free-electron laser facilities. A nonperturbative dynamic quantum theory was developed for systems driven by time-periodic external fields. For such systems, dynamic energy spectra of electrons and photons and their corresponding wave functions were obtained. The results are in good agreement with experimental investigations. The algorithms developed are ideally suited for massively parallel computing facilities and provide a fundamental advance in the ability to predict quantum-well properties and guide their engineering. This is a definite step forward in the development of nonlinear optical devices.

NTIS

Microstructure; Electrons; Quantum Mechanics; Semiconductors (Materials); Nanostructures (Devices)

19990042394 NASA Langley Research Center, Hampton, VA USA

Induction Bonding of Prepreg Tape and Titanium Foil

Messier, Bernadette C., Old Dominion Univ., USA; Hinkley, Jeffrey A., NASA Langley Research Center, USA; Johnston, Norman J., Old Dominion Univ., USA; 43rd International SAMPE Symposium and Exhibition; 1998; Volume 43, Book 2, pp. 1394-1409; In English, 31 May - 4 Jun. 1998, Anaheim, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Hybrid structural laminates made of titanium foil and carbon fiber reinforced polymer composite offer a potential for improved performance in aircraft structural applications. to obtain information needed for the automated fabrication of hybrid laminates, a series of bench scale tests were conducted of the magnetic induction bonding of titanium foil and thermoplastic prepreg tape. Foil and prepreg specimens were placed in the gap of a toroid magnet mounted in a bench press. Several magnet power supplies were used to study power at levels from 0.5 to 1.75 kW and frequencies from 50 to 120 kHz. Sol-gel surface-treated titanium foil, 0.0125 cm thick, and PIXA/IM7 prepreg tape were used in several lay-up configurations. Data were obtained on wedge peel bond strength, heating rate, and temperature ramp over a range of magnet power levels and frequencies at different ”power-on” times for several magnet gap dimensions. These data will be utilized in assessing the potential for automated processing. Peel strengths of foil-tape bonds depended on the maximum temperature reached during heating and on the applied pressure. Maximum peel strengths were achieved at 1.25kW and 8OkHz. Induction heating of the foil appears to be capable of good bonding up to 10 plies of tape. Heat transfer calculations indicate that a 20-40 C temperature difference exists across the tape thickness during heat-up.

Author

Metal Foils; Bonding; Prepregs; Carbon Fibers; Fiber Composites; Aircraft Structures; Magnetic Induction; Metal Bonding

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.

19990041164 Brookhaven National Lab., Chemistry Dept., Upton, NY USA

Radiation chemical effects of X-rays on liquids

Holroyd, R. A.; Preses, J. M.; Dec. 31, 1998; 35p; In English

Report No.(s): DE99-000579; BNL-65786; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This review describes some of the chemical changes induced by photoelectrons which are released in liquids when X-rays are absorbed. Both experimental studies and theory are discussed. In part 1, the basic processes occurring upon absorption of X-rays are described. Parts 2 and 3 deal with hydrocarbon liquids; in part 2 the ion yields, including effects at K-edges, and in

part 3, the yields of excited states. Part 4 discusses chemical effects of X-rays in aqueous solutions. The authors end with a summary of future needs and directions.
NTIS
Radiation Effects; Chemical Effects; X Rays; Liquids

19990041254 General Motors Research Labs., Warren, MI USA
Numerical Simulation of Turbulent Propane-Air Combustion with Non-Homogeneous Reactants: Initial Results
Haworth, D., General Motors Research Labs., USA; Cuenot, B., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Poinsot, T., Institut de Mecanique des Fluides de Toulouse, France; Blint, R., General Motors Research Labs., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 5-24; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

High-resolution two-dimensional numerical simulations have been initiated for pre-mixed turbulent propane-air flames propagating into regions of non-homogeneous reactant stoichiometry. Simulations include complex chemical kinetics, realistic molecular transport, and fully resolved hydrodynamics (no turbulence model). Aero-thermochemical conditions (pressure, temperature, stoichiometry, and turbulence velocity scale) approach those in an automotive gasoline direct-injection (GDI) engine at a low-speed, light-load operating condition. Initial results suggest that: 1) There is no leakage of the primary fuel (propane) behind an initial thin premixed heat-release zone. This primary premixed flame can be described using a monotonic progress variable and laminar premixed flamelet concepts. 2) Following an initial transient, global heat release with non-homogeneous reactants is lower than with homogeneous reactants for the same overall reactant stoichiometry. Flame area (length) is greater with non-homogeneous reactants. 3) Beyond three-to-four flame thicknesses behind the primary flame, practically all hydrocarbon fuel has broken down into CO and H2. 4) The rate of heat release in the 'secondary reaction zone' behind the primary premixed flame is governed by turbulent mixing and the kinetics of CO2 production. Mixture-fraction-conditioned secondary heat release, CO, and C02 production rates are qualitatively similar to results from a first-order conditional-moment-closure (CMC) model; CMC gives poor results for H2, H2O, and radical species. Description of the secondary heat release using simple laminar diffusion flamelet concepts is problematic. 5) Computational considerations demand modifications to chemical mechanisms involving C3H7 and CH3CO. Specific changes are proposed to strike a satisfactory balance between accuracy and computational efficiency over a broad range of reactant stoichiometry.
Author
Computerized Simulation; Turbulent Combustion; Propane; Air; Reaction Kinetics; Gas Transport; Hydrodynamics; Mathematical Models; Turbulent Heat Transfer

19990041255 Rouen Univ., LMFN, France
Accounting for Spray Vaporization in Turbulent Combustion Modeling
Reveillon, J., Rouen Univ., France; Vervisch, L., Rouen Univ., France; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 25-38; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Three dimensional Direct Numerical Simulations (DNS) of droplet vaporization in the presence of turbulent micromixing have been performed. The transport equations for basic components of non-premixed turbulent combustion modeling, namely the mean of the mixture fraction and its fluctuations, are presented for the case of a dilute spray. The unclosed terms describing vaporization in the equation for the fluctuations of mixture fraction are analyzed via the DNS data, and a One Droplet Model (ODM) is proposed for those terms.
Author
Direct Numerical Simulation; Turbulent Combustion; Vaporizing; Drops (Liquids); Mathematical Models; Turbulent Mixing; Spray Characteristics; Three Dimensional Models

19990041256 Defence Science and Technology Organisation, Aeronautical and Maritime Research lab., Melbourne, Australia
Simulation and Modeling of Reacting Particles in Turbulent Nonpremixed Combustion
Smith, N. S. A., Defence Science and Technology Organisation, Australia; Ruetsch, G. R., Stanford Univ., USA; Oefelein, J., Stanford Univ., USA; Ferziger, J. H., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 39-60; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A conditional moment closure model is proposed for reacting particles in turbulent nonpremixed combustion. The new model for particles differs significantly from the traditional uniform diffusivity gas-phase conditional moment closure model. The new features of the model and its effectiveness are examined against direct numerical simulation data for soot-like and droplet-like

particles in turbulent nonpremixed combustion. The influence of differing particle sizes and types on the effectiveness of the model closure is examined in detail.
Author
Turbulent Combustion; Direct Numerical Simulation; Mathematical Models; Soot; Particle Motion; Reacting Flow; Drops (Liquids)

19990041257 Centre Europeen Recherche et de Formation Advance en Calcul Scientific, Toulouse, France
Large Eddy Simulations of Combustion Instabilities in Premixed Flames
Angelberger, C., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Veynante, D., Ecole Centrale de Paris, France; Egolfopoulos, F., University of Southern California, USA; Poinsot, T., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 61-82; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Our objective is to build a complete tool, based on large eddy simulations, to determine the forced response of a turbulent premixed burner, which is the missing information in models describing combustion instabilities. The developed code includes: (1) a chemistry model based on a new reduction technique (ICC) for propane and methane; (2) a flame thickening approach to handle flame turbulence interactions; and (3) specific boundary conditions to control and measure acoustic wave reflections on inlets and outlets. The chemistry reduction is derived and validated by comparison with full schemes/full transport results obtained from stagnation point flame codes. The flame thickening approach requires subgrid scale parameterization derived from flame/vortex interactions DNS. The code itself is a compressible parallel finite volume solver able to handle hybrid grids. The combustor forced response to acoustic wave excitations and to equivalence ratio modulations is compared in the geometry where experimental data are available.
Author
Large Eddy Simulation; Premixed Flames; Combustion Stability; Turbulent Combustion; Mathematical Models; Finite Volume Method

19990041260 Chicago Univ., Dept. of Astronomy and Astrophysics, Chicago, IL USA
Approaches to Modeling Thermonuclear Flames
Niemeyer, J. C., Chicago Univ., USA; Bushe, W. K., Stanford Univ., USA; Ruetsch, G. R., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 111-117; In English; See also 19990041253
Contract(s)/Grant(s): B341495; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Turbulence-flame interactions of thermonuclear fusion flames occurring in Type Ia Supernovae were studied by means of incompressible DNS with a highly simplified flame description. The flame is treated as a single diffusive scalar field with a nonlinear source term. It is characterized by its Prandtl number, Pr is much less than 1, and laminar flame speed, S(sub L). We find that if S(sub L) is greater than u', where u' is the rms amplitude of turbulent velocity fluctuations, the local flame propagation speed does not significantly deviate from S(sub L) even in the presence of velocity fluctuations on scales below the laminar flame thickness. This result is interpreted in the context of subgrid-scale modeling of supernova explosions.
Author
Thermonuclear Reactions; Turbulent Flames; Direct Numerical Simulation; Supernovae; Flame Propagation; Mathematical Models; Computerized Simulation

19990041265 Institut National des Sciences Appliquees, Routen, France
LES Modeling for Lifted Turbulent Jet Flames
Vervisch, Luc, Institut National des Sciences Appliquees, France; Trouve, Arnaud, Institut Francais du Petrole, France; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 83-100; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The LES method is an attractive approach for the simulation of turbulent jet flames. In this method, the effects of large scale structures controlling the mixing process are resolved while small-scale effects such as the leading-edge flames involved in the flame base dynamics are accounted for by the subgrid-scale models. The LES approach is examined in this study with a particular emphasis on a simple formulation for combustion based on the assumption of infinitely fast chemistry. When applied to the problem of turbulent jet flames, this formulation is limited to the description of a regime where the flame remains attached to the fuel injector. Using DNS and LES databases, a modification of the infinitely fast chemistry formulation is proposed in the present study with the objective of numerically capturing transitions to the lifted flame regime and the flame blowout regime. The DNS database corresponds to leading-edge flames evolving in isotropic turbulent flow and is used to describe the structure of the flame base.

The LES database corresponds to the near-field region of plane turbulent jets and is used to describe the turbulent mixing process. Preliminary results from a priori tests of the new subgrid-scale combustion model are found to be encouraging.
Author
Turbulent Flames; Large Eddy Simulation; Navier-Stokes Equation; Turbulent Combustion; Direct Numerical Simulation; Mathematical Models; Turbulent Mixing; Turbulent Jets; Flame Stability

19990041279 Lawrence Livermore National Lab., Livermore, CA USA
A Subgrid-Scale Model for the Scalar Dissipation Rate in Nonpremixed Combustion
Cook, A. W., Lawrence Livermore National Lab., USA; Bushe, W. K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 101-109; In English; See also 19990041253
Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
A subgrid-scale model is presented for the scalar dissipation rate in nonpremixed turbulent reacting flows. Inputs to the model are the filtered density, the Favre-filtered temperature, and the Favre-filtered mixture-fraction. The model contains a coefficient which is determined by assuming a form for the scalar energy spectrum. Inputs to the presumed spectrum are the integral and dissipation length scales of the scalar field. These quantities are estimated locally from the Favre-filtered velocity field, resulting in a model coefficient which is spatially and temporally dependent. The model is tested a priori using data from a Direct Numerical Simulation (DNS) of a temporal reacting mixing layer. Estimated values of the dissipation rate are found in good agreement with dissipation rates computed directly from the DNS data. Furthermore, the presumed spectrum methodology is found to accurately predict the mean value of the model coefficient as well as its spatial and temporal variations.
Author
Turbulent Combustion; Reacting Flow; Turbulent Flow; Mixing Layers (Fluids); Direct Numerical Simulation; Dissipation; Mathematical Models; Computerized Simulation

19990041385 Department of the Navy, Washington, DC USA
Bulk Cubic Gallium Nitride
Purdy, Andrew P., Inventor, Department of the Navy, USA; Feb. 09, 1999; 23p; In English
Patent Info.: Filed 9 Feb. 1999; US-Patent-Appl-SN-09252592
Report No.(s): AD-D019268; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
Bulk cubic gallium nitride is made by charging into a reaction vessel to a fill of 25-95% having a temperature difference between its ends of at least 1 C a gallium precursor, sufficient amount of an acid mineralizer to form product zinc blende gallium nitride, and sufficient amount of ammonia to at least solubilize the precursor; sealing the reaction vessel; heating contents of the reaction vessel to at least 150 C while autogenously pressurizing contents of the reaction vessel to at least 500 psi for a duration sufficient to form the product zinc blende gallium nitride; cooling contents of the reaction vessel; and removing from the reaction vessel the product zinc blende gallium nitride.
DTIC
Gallium Nitrides; Crystal Structure; Cubic Lattices

19990041464 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Time resolved infrared studies of C-H bond activation by organometallics
Asplund, M. C.; Jun. 30, 1998; 149p; In English
Report No.(s): DE98-058256; LBNL-41912; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This work describes how step-scan Fourier Transform Infrared spectroscopy and visible and near infrared ultrafast lasers have been applied to the study of the photochemical activation of C-H bonds in organometallic systems, which allow for the selective breaking of C-H bonds in alkanes. The author has established the photochemical mechanism of C-H activation by Tp(sup *)Rh(CO)2(Tp(sup *) = HB-Pz(sup *)3, Pz = 3,5-dimethylpyrazolyl) in alkane solution. The initially formed monocarbonyl forms a weak solvent complex, which undergoes a change in Tp(sup *) ligand connectivity. The final C-H bond breaking step occurs at different time scales depending on the structure of the alkane. In linear solvents, the time scale is <50 ns and cyclic alkanes is approximately 200 ps. The reactivity of the Tp(sup *)Rh(CO)2 system has also been studied in aromatic solvents. Here the reaction proceeds through two different pathways, with very different time scales. The first proceeds in a manner analogous to alkanes and takes <50 ns. The second proceeds through a Rh-C-C complex, and takes place on a time scale of 1.8 (micro)s.
NTIS
Organometallic Compounds; Photochemical Reactions; Chemical Bonds

19990041499 Prins Maurits Lab. TNO, Rijswijk Netherlands

Toxicity Testing of Combustion Products of Polyurethane and Polyvinyichioride ***Final Report***

Busker, R. W.; Hammer, A. H.; Kuijpers, W. C.; Poot, C. A.; Bergers, W. W.; Jan. 1999; 33p; In English

Report No.(s): AD-A362007; PML-1998-A97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

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

Toxicity; Combustion Products; Polyurethane Resins

19990041822 Army Construction Engineering Research Lab., Champaign, IL USA

Lead-Based Paint Hazard-Mitigation Technologies: Final Report ***Final Report***

Booth, David; Hollinger, Richard; Stephenson, L. D.; Kumar, Ashok; Apr. 1999; 65p; In English

Report No.(s): AD-A362080; CERL-TR-99/33; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Lead-based paints (LEP) and primers have been used in the past by the Department of Defense (DoD) to protect steel structures from corrosion. DoD owns about 200 million sq it of steel structures with lead-based paint (such as bridges, aircraft hangars, water tanks, etc.). The DoD also owns about 2 billion sq it of pre-1978 buildings with some lead-based paint. Cost-effective procedures for risk assessment, interim controls, and abatement need to be provided to DoD users for a lead hazard free environment. The U.S. Army Construction Engineering Research Laboratory (CERL) has developed and demonstrated cost-effective environmentally compliant technologies for management and safe removal of LBP hazards from steel and wood. These include (1) thermal spray vitrification technology, which can be used safely and effectively for removal and immobilization of paints containing heavy metals; (2) an integrated ”Lead Hazard Mitigation and Management System” (Painter-L); (3) emerging environmentally acceptable technologies for LBP removal; and (4) a microwave-assisted system for removal of LBP from wooden substrates. This report summarizes the results of these four work tasks, which were supported wholly or in part by the multiagency Strategic Environmental Research and Development Program (SERDP).
DTIC

Hazards; Primers; Elastic Properties; Paints

19990041846 NASA Lewis Research Center, Cleveland, OH USA

A Pervasive Mode of Oxidative Degradation in a SiC-SiC Composite

Ogbuji, Linus U. J. T., NASA Lewis Research Center, USA; Journal of the American Ceramic Society; November 1998; Volume 81, No. 11, pp. 2777-2784; In English

Report No.(s): Rept-190680; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The oxidative durability of a SiC-SiC composite with Hi-Nicalon fiber and a BN interphase was investigated at 800 C (where pesting is known to occur in SiC-SiC composites) for exposure durations of up to 500 h and in a variety of oxidant mixes and flow rates, ranging from quasi-stagnant room air, through slow-flowing oxygen that contained 30%-90% H2O, to the high-velocity flame of a burner rig. Degradation of the composite was determined from residual strength and fracture stain in post-exposure mechanical tests and correlated with microstructural evidence of damage to the fiber and interphase. The most-severe degradation of composite behavior occurred in the burner rig and has been shown to be associated with the high oxidant velocity and substantial moisture content, as well as a thin sublayer of carbon that is indicated to form between the fiber and the interphase during composite processing.
Author

Degradation; Damage; Silicon Carbides; Oxidation; Durability

19990041937 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Design and Synthesis of Micron-Conotoxin Analogues with a Possible Antagonistic Effect on Intoxication by Saxitoxin and Tetrodotoxin *Final Report*

Runley-vanGurp, R. A., Prins Maurits Lab. TNO, Netherlands; Noort, D., Prins Maurits Lab. TNO, Netherlands; Gerritse, K., Prins Maurits Lab. TNO, Netherlands; Chau, L. F., Prins Maurits Lab. TNO, Netherlands; November 1998; In English; Original contains color illustrations

Contract(s)/Grant(s): A94/M/445; TNO Proj. 213497109

Report No.(s): TD97-0457; PML-1997-A98; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In a preliminary study on the design of a sodium ion channel antagonist, acyclic residues in the structure of mu-conotoxin GIIIA were substituted by cyclic prolines, and cyclic hydroxyproline residues were substituted by glycines, using molecular modelling techniques. The influence of these substitutions on the tertiary structure of the resulting peptides was monitored using molecular similarity analysis of the 3D structures. From this study, 8 analogues were proposed as potential target compounds. The linear sequences of mu-conotoxin and these analogues were obtained by solid phase peptide synthesis. One of the three disulphide bridges in these peptides was introduced by air oxidation. Subsequently, the two other bridges were formed after deprotection of the cysteines. Two analogues could not be obtained. The other purified products showed the expected masses upon mass spectrometry. However, analysis with capillary electrophoresis revealed that the synthesized native mu-conotoxin contained two main products which did not coincide with a commercially available standard. Alternative methods applied to the formation of the disulphide bridges in mu-conotoxin did not lead to a single product. Although no final proof for the structures of the synthesized analogues was obtained, the products were forwarded to be tested. In addition, three peptides analogous to partial sequences of mu-conotoxin were synthesized containing only one disulphide bridge.

Author

Research; Sodium; Synthesis (Chemistry); Structural Analysis; Cysteine; Metal Ions; Positive Ions

19990041957 Thiokol Chemical Corp., Brigham City, UT USA

Material Safety Data Sheet, MSDS D0211, Revision 5

Aug. 04, 1998; 6p; In English

Report No.(s): AD-A361596; MSDS,DO211-REV.5; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Partial Contents: Chemical Product Identification, Composition and Information on ingredients, First Aid Measures, Fire-Fighting Measures, Accidental Release Measures, Handling and Storage, Exposure Controls, Personal Protection, Physical and Chemical Properties, Stability and Reactivity, Toxicological Information, Ecological Information, Disposal Considerations, Transportation Information.

DTIC

Safety; Chemical Composition; Tables (Data)

19990042226 NASA Goddard Space Flight Center, Greenbelt, MD USA

High Resolution X-Ray Spectroscopy Using Microcalorimeters

Kelley, R. L., NASA Goddard Space Flight Center, USA; The Next Generation of X-Ray Observatories; 1997, pp. 81-87; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

During the past 13 years high resolution X ray spectrometers have been developed that use cryogenically cooled microcalorimeters. These devices have inherently high signal-to-noise by operating at temperatures below 0.1 K and can achieve an energy resolution of is less than 10 eV over the 0.1-10 keV band. Existing devices use doped semiconductor thermometers and typically employ HgTe absorbers. The energy resolution depends on achieving a low heat capacity for the device. For soft X ray applications a relatively thin absorber (approximately 1 micrometer) may be used and an energy resolution of approximately 7 eV has been achieved. For applications up to approximately 10 keV an absorber thickness of approximately 10 micrometer is required and the energy resolution is typically approximately 12 eV. Improvements to the energy resolution in this energy band could be achieved if the problems of thermalizing X rays in low heat capacity superconductors can be overcome. The recent work on transition edge thermometers by Irwin et nl. looks particularly promising because of the higher sensitivity achievable from a sharp superconducting transition. The relatively low impedance of such a device permits the use of a low noise SQUID amplifier for readout. This would also significantly reduce the cryogen heat load compared with JFETs required by higher impedance semiconductor thermometers.

Author

X Ray Astronomy; Calorimeters; High Resolution; X Ray Spectroscopy; X Ray Spectrometers

19990042248 Allied-Signal Aerospace Co., Equipment Systems, Torrance, CA USA

Fabrication and Performance of Zirconia Electrolysis Cells for Carbon Dioxide Reduction for Mars In Situ Resource Utilization Applications

Minh, N. Q., Allied-Signal Aerospace Co., USA; Chung, B. W., Allied-Signal Aerospace Co., USA; Doshi, R., Allied-Signal Aerospace Co., USA; Lear, G. R., Allied-Signal Aerospace Co., USA; Montgomery, K., Allied-Signal Aerospace Co., USA; Ong, E. T., Allied-Signal Aerospace Co., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 5-6; In English; See also 19990042245

Contract(s)/Grant(s): JPL-960970; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The use of the Martian atmosphere (95% CO2) to produce oxygen (for propellant and life support) can significantly lower the required launch mass and dramatically reduce the total cost for Mars missions. Zirconia electrolysis cells are one of the technologies being considered for oxygen generation from carbon dioxide in Mars In Situ Resource Utilization (ISRU) production plants. The attractive features of the zirconia cell for this application include simple operation and lightweight, low volume system.

Derived from text

Zirconium Oxides; Electrolysis; Electrolytes; Mars Atmosphere

19990042249 Los Alamos National Lab., NM USA

Hydrogen Plasma Reduction of Planetary Materials

Currier, R., Los Alamos National Lab., USA; Blacic, J., Los Alamos National Lab., USA; Trkula, M., Los Alamos National Lab., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 7-8; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Large-scale utilization of resources in space exploration and colonization must include the ability to provide oxygen for propulsion and life support. In addition, metals and other structural materials must be produced from locally available planetary resources. We propose to develop a new extractive process for resource utilization in space. This process also has the potential for water extraction from hydrous minerals (water could in turn be used to produce oxygen). Reduction of anhydrous silicate and oxide minerals to produce oxygen and metals will require the importation of hydrogen, which must be recycled with minimal losses. The proposed process uses a microwave or radio frequency produced atomic hydrogen plasma. Electromagnetic energy couples to hydrogen gas to form a non-equilibrium plasma in a reactor configuration that we believe is ideal for low gravity applications. One can form a plasma with high concentrations of atomic hydrogen, at modest bulk temperatures. Thus, we force the system into a standard state where the reductant atomic hydrogen is the key species. We will discuss an integrated approach to process development involving demonstration experiments and initial results and concurrent engineering. In particular, we will discuss key issues related to electromagnetic coupling in particle-laden gas streams, the chemical kinetics of metal extraction, plasma-solid interactions, and chemical process design.

Derived from text

Lunar Resources; Lunar Exploration; Planetary Environments; Lunar Environment; Aerospace Environments

19990042252 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA

A Continued Feasibility Study of Water Vapor Extraction from the Atmosphere of Mars

Grover, M. R., Washington Univ., USA; Hilstad, M. O., Washington Univ., USA; Schneider, M. A., Washington Univ., USA; Bruckner, A. P., Washington Univ., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 13-14; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The key to a successful ongoing Mars exploration program is the identification of an indigenous source of water on Mars, both for propellant production, and in the long term, for support of human explorers. At the University of Washington, a process called WAVAR, or Water Vapor Adsorption Reactor, has been the focus of ongoing studies. A relatively simple process, WAVAR extracts water vapor distributed in the Martian atmosphere by adsorbing it in zeolite 3A, a strongly hydrophilic crystalline alumino-silicate molecular sieve adsorbent commonly used in industrial dehumidifiers.

Derived from text

Aerospace Environments; Mars Atmosphere; Mars Environment; Mars Exploration; Manned Mars Missions; Manned Space Flight; Mars (Planet); Water Resources

19990042260 Old Dominion Univ., Norfolk, VA USA

RF-ICP Discharge for a Hybrid Oxygen Production System

Popovic, S., Old Dominion Univ., USA; Ash, R., Old Dominion Univ., USA; Dinh, T., Old Dominion Univ., USA; Vuskovic, L., Old Dominion Univ., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 29-30;

In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The purpose of this presentation is to demonstrate feasibility of a radio-frequency inductively-coupled discharge (RF-ICP) to be integrated into a hybrid system from two complementary, already demonstrated, technologies for the efficient production of oxygen from Martian atmosphere. The two technologies involved are (a) radiofrequency discharge method for dissociation of carbon dioxide, and (b) oxygen separation using a ceramic honeycomb technology. This approach will ensure the optimal utilization of the advantages of the both subsystems, the RF-ICP reactor and ceramic honeycomb separator. Radio frequency discharge proved efficient in oxygen production by dissociating carbon dioxide. Currently used oxygen separation through silver membrane-electrode is still under development. The honeycomb technology proved efficient in extracting oxygen.

Derived from text

Radio Frequency Discharge; Oxygen Production; Carbon Dioxide; Gas Dissociation

19990042261 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Methane Pyrolysis and Disposing Off Resulting Carbon

Sharma, P. K., Jet Propulsion Lab., California Inst. of Tech., USA; Rapp, D., Jet Propulsion Lab., California Inst. of Tech., USA; Rahotgi, N. K., Jet Propulsion Lab., California Inst. of Tech., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 31-32; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Sabatier/Electrolysis (S/E) is a leading process for producing methane and oxygen for application to Mars ISPP. One significant problem with this process is that it produces an excess of methane for combustion with the amount of oxygen that is produced. Therefore, one must discard roughly half of the methane to obtain the proper stoichiometric methane/oxygen mixture for ascent from Mars. This is a waste of hydrogen, which must be brought from Earth and is difficult to transport to Mars and store on Mars. to reduce the problem of transporting hydrogen to Mars, the S/E process can be augmented by another process which reduces overall hydrogen requirement. Three conceptual approaches for doing this are (i) recover hydrogen from the excess methane produced by the S/E process, (ii) convert the methane to a higher hydrocarbon or other organic with a lower H/C ratio than methane, and (iii) use a separate process (such as zirconia or reverse water gas shift reaction) to produce additional oxygen, thus utilizing all the methane produced by the Sabatier process. We report our results here on recovering hydrogen from the excess methane using pyrolysis of methane. Pyrolysis has the advantage that it produces almost pure hydrogen, and any unreacted methane can pass through the S/E process reactor. It has the disadvantage that disposing of the carbon produced by pyrolysis presents difficulties. The goals of a research program on recovery of hydrogen from methane are (in descending priority order): 1) Study the kinetics of pyrolysis to arrive at a pyrolysis reactor design that produces high yields in a confined volume at the lowest possible operating temperature; 2) Study the kinetics of carbon burnoff to determine whether high yields can be obtained in a confined volume at acceptable operating temperatures; and 3) Investigate catalytic techniques for depositing carbon as a fine soot which can be physically separated from the reactor. In the JPL program, we have made significant measurements in regard to goal 1, cursory measurements in regard to goal 2, and would plan to pursue goal 3 if additional resources are secured.

Derived from text

Pyrolysis; Mars Exploration; Mars Missions; Hydrogen; Space Storage; Carbon; Methane

19990042439 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Asymmetric catalysis in organic synthesis

Reilly, S. D.; Click, D. R.; Grumbine, S. K.; Scott, B. L.; Watkins, J. G.; Dec. 31, 1998; 19p; In English

Report No.(s): DE99-000855; LA-UR-98-1527; 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 goal of the project was to prepare new catalyst systems, which would perform chemical reactions in an enantioselective manner so as to produce only one of the possible optical isomers of the product molecule. The authors have investigated the use of lanthanide metals bearing both dilate and Schiff-base ligands as catalysts for the enantioselective reduction of prochiral ketones to secondary alcohols. The ligands were prepared from cheap, readily available starting materials, and their synthesis was performed in a 'modular' manner such that tailoring of specific groups within the ligand could be carried out without repeating the entire synthetic procedure. In addition, they have developed a new ligand system for Group IV and lanthanide-based olefin polymerization catalysts. The ligand system is easily prepared from readily available starting materials and offers the opportunity to rapidly prepare a wide range of closely related ligands that differ only in their substitution patterns at an aromatic ring. When attached to a metal center, the ligand system has the potential to carry out polymerization reactions in a stereocontrolled manner.

NTIS

Asymmetry; Chemical Reactions; Synthesis (Chemistry); Catalysis

26
METALLIC MATERIALS

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

19990041163 North Dakota Univ., Energy and Environmental Research Center, Grand Forks, ND USA
Support services for ceramic fiber-ceramic matrix composites ***Annual Report***
Hurley, J. P.; Kuehnel, V.; Jun. 22, 1998; 10p; In English
Report No.(s): DE99-000550; ORNL/SUB-94-SS112/03; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The University of North Dakota Energy and Environmental Research Center (EERC) is providing technical assistance and test materials to the US Department of Energy (DOE) Advanced Research and Technology Development (AR and TD) Materials Program investigating ceramic and advanced alloy corrosion in fossil energy systems. The main activity, which is reported here, is to perform thermochemical equilibrium calculations to develop recommendations for test conditions under which to perform corrosion measurements of structural and particle filter materials. The modeling is primarily being performed to determine possible mechanisms of corrosion, especially by species that vaporize in the gasifier then condense on downstream surfaces. For this year, the focus was on the stability of nickel in structural and filter alloys. This work was done in an effort to explain the existence of nickel-containing condensates found downstream of particulate filters in an EERC pilot-scale coal gasifier which operates under conditions similar to the Pinon Pine system, and to determine possible operating conditions that could reduce the wastage of nickel from structural and filter alloys.
NTIS
Ceramic Matrix Composites; Ceramic Fibers; Fiber Composites; Support Systems

19990041168 Los Alamos National Lab., NM USA
Effects of hydrogen absorption in TbNiAl and UNiAl
Bordallo, H. N.; Nakotte, H.; Schultz, A.; Kolomiets, A. V.; Havela, L.; Dec. 31, 1998; 5p; In English; Condensed matter (ENFMc)
Report No.(s): DE99-000645; LA-UR-98-1937; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Although hydrides of intermetallic compounds are used extensively as hydrogen-storage media, little is known about the exact nature of metal-hydrogen interactions. However, this knowledge is of essential importance for the understanding of thermodynamics and other properties. Hydrides (deuterides) of TbNiAl and UNiAl have been widely studied because of drastic increase of magnetic ordering temperature under hydrogenation. Here the authors report neutron-diffraction results of the three deuterides, TbNiAlD(1.28), TbNiAlD(0.8)a nd UNiAlD(2.23).
NTIS
Hydrogen; Terbium Compounds; Nickel Compounds; Uranium Compounds; Intermetallics; Aluminum Compounds; Molecular Absorption

19990041173 Los Alamos National Lab., Materials Science and Technology Div., NM USA
Advances in beryllium powder consolidation simulation
Reardon, B. J.; Dec. 31, 1998; 12p; In English; Powder metallurgy and particulate materials, 1998
Report No.(s): DE99-000676; LA-UR-98-1252; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A fuzzy logic based multiobjective genetic algorithm (GA) is introduced and the algorithm is used to optimize micromechanical densification modeling parameters for warm isopressed beryllium powder, HIPed copper powder and CIPed/sintered and HIPed tantalum powder. In addition to optimizing the main model parameters using the experimental data points as objective functions, the GA provides a quantitative measure of the sensitivity of the model to each parameter, estimates the mean particle size of the powder, and determines the smoothing factors for the transition between stage 1 and stage 2 densification. While the GA does not provide a sensitivity analysis in the strictest sense, and is highly stochastic in nature, this method is reliable and reproducible in optimizing parameters given any size data set and determining the impact on the model of slight variations in each parameter.
NTIS
Beryllium; Consolidation; Metal Powder; Computerized Simulation

19990041174 Los Alamos National Lab., NM USA
Strain hardening of fcc metal surfaces induced by microploughing
Day, R. D.; Dickerson, R. M.; Russell, P. E.; Dec. 31, 1998; 6p; In English; American Society of Precision Engineering conference
Report No.(s): DE99-000702; LA-UR-98-1572; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Microploughing experiments were used as a method for better understanding the ploughing mechanism in gold and iridium single crystals. The plough depths ranged from 20 nm in iridium to 1,600 nm in gold. Yield stress profiles and TEM analyses indicate that both materials strain harden even when very small volumes of material are involved. Strain hardening theory, as applied to bulk material, is useful in analyzing the results.
NTIS
Strain Hardening; Metal Surfaces

19990041178 Los Alamos National Lab., NM USA
Strongly correlated f-electron systems: A PES study
Arko, A. J.; Joyce, J. J.; Sarrao, J.; Thompson, J. D.; Morales, L.; Dec. 31, 1998; 5p; In English; Euroconference on polarons: condensation, pairing, magnetism
Report No.(s): DE99-001226; LA-UR-98-2536; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The term heavy fermions refers to materials (thus far only compounds with elements having an unfilled 4f or 5f shells) whose large specific heat (gamma)-values suggest that the conduction electrons at low temperatures have a very heavy effective mass. Magnetic susceptibility measurements, (chi), generally yield a Curie-Weiss behavior at high temperatures with a well developed moment, which would be consistent with localized behavior of the f-electrons. Thus, the f-electrons appear to behave as non-interacting single impurities at elevated temperature. Below a characteristic Kondo temperature, T(sub K), the susceptibility levels off or even decreases. This is interpreted as a compensation of the f-moment by the ligand conduction electrons that are believed to align anti-parallel to form a singlet state and has led to the widespread use of the Anderson Impurity Hamiltonian and the Single Impurity Model (SIM). Weak hybridization with these conduction electrons yields a narrow, highly temperature dependent, DOS at the Fermi energy, often referred to as the Kondo resonance (KR). At still lower temperatures it is generally agreed that in stoichiometric compounds a lattice of these singlet states finally results in extremely narrow bands at the Fermi energy, whose bandwidth is of the order k(sub B)T(sub K). Clearly coherent bands cannot form above T(sub K) owing to the narrow width. A model for periodic Kondo systems will inevitably have to include the lattice. Preliminary PAM calculations indicate that this inclusion yields results differing qualitatively, rather than just quantitatively, from the SIM predictions. The photoemission data on single crystal heavy fermions are consistent with the following PAM predictions: (1) the temperature dependence of the KR is much slower than expected from the SIM; indeed, it is primarily 7 due to broadening and Fermi function truncation; (2) the spectral weight of the KR relative to the localized 4f feature (not discussed here) is much larger than the SIM expectations (equivalently, n(sub f) values are far too small); (3) the KR and its sidebands does not lose spectral weight with T, but rather only broadens; (4) f-electrons in both Ce and U systems form narrow bands already far above T(sub K) (the jury is still out for Yb systems); (5) the width of these bands is much larger than k(sub B)T(sub K); (6) f-character is obtained in only some regions of the Brillouin zone; i.e., momentum dependence of the KR above T(sub K). While the PAM seems to predict the correct trends, they have no reason yet to rule out other models, such as those of Liu and Sheng and Cooper. Such discrimination may occur when the models develop sufficiently to allow real system calculations.
NTIS
Photoelectron Spectroscopy; Electronic Structure; Conduction Electrons

19990041181 Bettis Atomic Power Lab., West Mifflin, PA USA
Long range migration of hydrogen through Zircaloy in response to tensile and compressive stress gradients
Kammenzind, B. F.; Berquist, B. M.; Bajaj, R.; Kreyns, P. H.; Franklin, D. G.; Dec. 31, 1998; 65p; In English; 12th; Zirconium in the nuclear industry; Sponsored by American Society for Testing and Materials, USA
Report No.(s): DE99-000480; WAPD-T-3197; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Zircaloy-4, which is used widely as a core structural material in pressurized water reactors (PWRs), picks up hydrogen during service. Hydrogen solubility in Zircaloy-4 is low and zirconium hydride phases precipitate after the Zircaloy-4 lattice becomes supersaturated with hydrogen. These hydrides embrittle the Zircaloy-4, degrading its mechanical performance as a structural material. Because hydrogen can move rapidly through the Zircaloy-4 lattice, the potential exists for large concentrations of hydride to accumulate in local regions of a Zircaloy component remote from its point of entry into the component. Much has been reported in the literature regarding the long range migration of hydrogen through Zircaloy under concentration gradients and temperature gradients. Relatively little has been reported, however, regarding the long range migration of hydrogen under stress gradients. This paper presents experimental results regarding the long range migration of hydrogen through Zircaloy in response to both tensile and compressive stress gradients. The importance of this driving force for hydrogen migration relative to concentration and thermal gradients is discussed.
NTIS
Migration; Hydrogen; Zircaloys (Trademark); Tensile Stress; Compression Loads

19990041190 Bettis Atomic Power Lab., West Mifflin, PA USA

Relationship between observed stress corrosion cracking fracture morphology and microstructure in Alloy 600

Symons, D. M.; Burke, M. G.; Foster, J. P.; Dec. 31, 1997; 13p; In English; 8th; Environmental degradation of materials in nuclear power systems-water reactors

Report No.(s): DE99-000483; WAPD-T-3130; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Microstructure is known to influence the stress corrosion cracking (SCC) behavior of Alloy 600 in both hydrogenated water and steam environments. This study evaluated the relative SCC response of a single heat of Alloy 600 as a function of microstructure in a hydrogenated doped-steam environment. The 400 C doped-steam environment was selected for the SCC tests to accelerate cracking. The material was evaluated in three conditions: (1) as-received (2) as-annealed, and (3) as-annealed +26% deformation. Microstructural characterization was performed using analytical electron microscopy (AEM) techniques for the evaluation of carbide type and morphology, and general structure. Constant displacement (bolt-loaded) compact tension specimens were used to induce SCC. The as-annealed and as-annealed plus cold worked samples had two fracture morphologies: a rough intergranular SCC fracture morphology and a smooth intergranular fracture morphology. The SCC fracture in the as-received specimens was characterized by a classic intergranular morphology at low magnification, consistent with the microstructural evaluation of cross-sectional metallographic samples. More detailed examination revealed a pseudo- intergranular fracture morphology. This pseudo-intergranular morphology appears to be comprised of very fine cleavage-like microfacets. These observations may assist in understanding the difference in SCC fracture morphologies as reported in the open literature.

NTIS

Microstructure; Morphology; Stress Corrosion Cracking

19990041353 Los Alamos National Lab., NM USA

Mechanisms responsible for texture development in a 5182 aluminum alloy deformed at elevated temperature

Stout, M. G.; Chen, S. R.; Kocks, U. F.; Schwartz, A. J.; MacEwen, S. R.; Dec. 31, 1998; 12p; In English; International symposium on interstitial and substitutional solute effects in intermetallics

Report No.(s): DE99-001173; LA-UR-98-2646; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The textures that develop in a 5182 aluminum alloy as a result of monotonic high-temperature compression have been investigated. The authors found that the deformation texture was a function of temperature. For compressive deformation at 300 C and below the material formed the classic (101) deformation texture, while the material develops a texture that is a combination of the classical uniaxial compression deformation texture, (101), and static recrystallization texture, (001), as a result of the deformation alone when the deformation temperature was at and above 400 C. The investigation has focused on determining the mechanism responsible for the development of this unusual progression of deformation textures. In addition the authors have performed orientation imaging microscopy (OIM) to identify the shapes of grains with particular orientations and grain-to-grain orientation relationships. The conclusions are summarized as follows: The texture development is not a result of static processes, i.e. static recrystallization at the various hold times altered neither the textures nor the constitutive behavior. Simulation using a crystal plasticity model indicates that the combination of a cube component prevalent in the original texture, slip activity on 011 planes, and increased rate sensitivity leads to a combined (001) and (101) texture. Finally, the microscopic OIM results are consistent with these observations.

NTIS

Textures; Aluminum Alloys; Deformation; High Temperature

19990041354 Los Alamos National Lab., NM USA

Effects of thermomechanical processing on the resulting mechanical properties of 6101 aluminum foam

Margevicius, R. W.; Stanek, P. W.; Jacobson, L. A.; Dec. 31, 1998; 6p; In English; Spring meeting of the Materials Research Society

Report No.(s): DE99-001174; LA-UR-98-2659; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Porous materials represent a tremendous weight savings for light-weight structural applications. The fabrication path can play a critical role in the resulting properties. High porosity aluminum was fabricated in a number of ways. The starting material was a cast 6101 aluminum that had a relative density of 9.8%. The cast aluminum block was compressed by uniaxial, biaxial, and triaxial densification. Uniaxial compression was done at room temperature and 200 C. Biaxial compression was achieved by unidirectional rolling at room temperature and 200 C. Triaxial compression was done by cold isostatic pressing at 3.4, 6.7, and 34 MPa (0.5, 1.0, and 5.0 ksi). Metallography and mechanical test specimens were machines from the processed bars. The mechanical properties showed that the relative yield strength depended both on relative density and processing temperature.

NTIS

Thermomechanical Treatment; Aluminum; Metal Foams

19990041616 NASA Marshall Space Flight Center, Huntsville, AL USA

Time Temperature-Precipitation Behavior in An Al-Cu-Li Alloy 2195

Chen, P. S., NASA Marshall Space Flight Center, USA; Bhat, B. N., NASA Marshall Space Flight Center, USA; 1999; 7p; In English; Light Weight Materials for Aerospace Applications, 1999, San Diego, CA, USA; Sponsored by Metallurgical Society, USA

Contract(s)/Grant(s): NAS8-97105; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Al-Cu-Li alloy 2195, with its combination of good cryogenic properties, low density, and high modulus, has been selected by NASA to be the main structural alloy of the Super Light Weight Tank (SLWT) for the Space Shuttle. Alloy 2195 is strengthened by an aging treatment that precipitates a particular precipitate, labeled as T1(Al2CuLi). Other phases, such as GP zone, (theta)', (theta)", theta, (delta)', S' are also present in this alloy when artificially aged. Cryogenic strength and fracture toughness are critical to the -SLWT application, since the SLWT will house liquid oxygen and hydrogen. Motivation for the Time-Temperature-Precipitation (TTP) study at lower temperature (lower than 350 F) comes in part from a recent study by Chen, The study found that the cryogenic fracture toughness of alloy 2195 is greatly influenced by the phases present in the matrix and subgrain boundaries. Therefore, the understanding of TTP behavior can help develop a guideline to select appropriate heat treatment conditions for the desirable applications. The study of TTP behavior at higher temperature (400 to 1000 F) was prompted by the fact that the SLWT requires a welded construction. Heat conduction from the weld pool affects the microstructure in the heat-affected zone (HAZ), which leads to changes in the mechanical properties. Furthermore, the SLWT may need repair welding for more than one time and any additional thermal cycles will increase precipitate instability and promote phase transformation. As a result considerable changes in HAZ microstructure and mechanical properties are expected during the construction of the SLWT. Therefore, the TTP diagrams can serve to understand the thermal history of the alloy by analyzing the welded microstructure. In the case welding, the effects of thermal cycles on the microstructure and mechanical properties can be predicted with the aid of the TTP diagrams. The 2195 alloy (nominally Al + 4 pct Cu + 1 pct Li + 0.3 pct Ag + 0.3 pct Mg + 0.1 pct Zr) used in this study was received in the form of 1.7 inch thick rolled plates. In brief goal of this study is to develop TTR diagram for the solutiontreated and stretched alloy 2195 from which the precipitation sequence at any service or aging conditions can be preducted.A subgrain boundary TTR diagram is also presented since precipitations at subgrain boundary can control and/or modify a wide veriety of material properties, such as cryogenic fracture toughness.

Author

Lithium Alloys; Cryogenics; Fracture Strength; Mechanical Properties; Time Temperature Parameter

19990041674 Los Alamos National Lab., NM USA

Ion sources for surface treatments of materials ***Final Report***

Dec. 31, 1998; 6p; In English

Report No.(s): DE99-001034; LA-SUB-98-44; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Treatment of materials by accelerated ions causes considerable changes in the microstructure and properties of the surface layer of these materials. Results of numerous laboratory studies show that ion beams are highly efficient in surface modification of materials. However, development and commercial use of ion beam technologies is hampered due to the lack of inexpensive, reliable and efficient ion sources. One of the promising directions in development of commercial ion sources is the use of cold-cathode discharges for producing ion emitting plasma. The main objectives of the contract works were as follows: (1) analyze discharge characteristics in the electrode system of the inverted magnetron type, parameter and emission properties of the discharge plasma, and formation of broad beams in an ion optics system; (2) create a laboratory prototype ion source, deliver the prototype ion source to Los Alamos, and perform joint experiments on ion beam surface modification of materials; (3) use results of the investigations and tests of the laboratory ion source as the basis for development of a commercial ion source with the beam up to 1,000 cm(exp 2) in cross-section area. Results of the research are summarized.

NTIS

Ion Sources; Surface Treatment; Surface Properties

19990041675 Los Alamos National Lab., NM USA

Measurements of the diffusion of iron and carbon in single crystal NiAl using ion implantation and secondary ion mass spectrometry

Hanrahan, R. J.; Withrow, S. P.; Puga-Lambers, M.; Dec. 31, 1998; 7p; In English; Materials Research Society, USA

Report No.(s): DE99-000773; LA-UR-98-2190; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Classical diffusion measurements in intermetallic compounds are often complicated by low diffusivities or low solubilities of the elements of interest. Using secondary ion mass spectrometry for measurements over a relatively shallow spatial range may be used to solve the problem of low diffusivity. In order to simultaneously obtain measurements on important impurity elements

with low solubilities, the authors have used ion implantation to supersaturate a narrow layer near the surface. Single crystal NiAl was implanted with either C-12 or both Fe-56 and C-12 in order to investigate the measurement of substitutional (Fe) versus interstitial (C) tracer diffusion and the cross effect of both substitutional and interstitial diffusion. When C alone was implanted negligible diffusion was observed over the range of times and temperatures investigated. When both Fe and C were implanted together significantly enhanced diffusion of the C was observed, which is apparently associated with the movement of Fe. This supports one theory of dynamic strain aging in Fe alloys NiAl.
NTIS
Diffusion; Iron; Carbon; Single Crystals; Nickel Alloys; Aluminum Alloys

19990041676 Los Alamos National Lab., Materials Science and Technology Div., NM USA
Influence of surface morphology and oxide microstructure on the nucleation and growth of uranium hydride on alpha uranium
Hanrahan, R. J.; Hawley, M. E.; Brown, G. W.; Dec. 31, 1998; 7p; In English; Materials Research Society Meeting, USA
Report No.(s): DE99-000772; LA-UR-98-2193; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
While the bulk kinetics of the uranium-hydrogen reaction are well understood, the mechanisms underlying the initial nucleation of uranium hydride on uranium remain controversial. In this study, the authors have employed environmental cell optical microscopy, Scanning Electron Microscopy (SEM) and Atomic Force Microscopy, (AFM) in an attempt to relate the structure of the surface and the microstructure of the substrate with the susceptibility and site of hydride nucleation. Samples have been investigated with varying grain size, inclusion (carbide) concentration, and thermal history. There is a clear correlation to heat treatment immediately prior to hydrogen exposure. Susceptibility to hydride formation also appears to be related to impurities in the uranium. The oxidized surface is very complex, exhibiting wide variations in thickness and topography between samples, between grains in the same sample, and within individual grains. It is, however, very difficult to relate this fine scale variability to the relatively sparse hydride initiation sites. Therefore, the surface oxide layer itself does not appear to control the sites where hydride attack is initiated, although it must play a role in the induction period prior to hydride initiation.
NTIS
Surface Layers; Morphology; Microstructure; Oxides; Nucleation; Uranium Compounds; Metal Hydrides

19990041714 Los Alamos National Lab., NM USA
Cratering behavior in single- and poly-crystalline copper irradiated by an intense pulsed ion beam
Wood, B. P.; Bitteker, L. J.; Waganaar, W. J.; Perry, A. J.; Dec. 31, 1998; 8p; In English; International conference on metallurgical coatings and thin films
Report No.(s): DE99-000697; LA-UR-98-1794; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
When treated with intense pulsed ion beams (IPIB), many materials exhibit increased wear resistance, fatigue life, and hardness. However, this treatment often results in cratering and roughening of the surface. In this work, high purity single crystal and polycrystalline copper samples were irradiated with pulses from an IPIB to gain insight into the causes of this cratering behavior. Samples were treated with 1,2,5, and 10 shots at 2 J/cm(exp 2) and 5 J/cm(exp 2) average energy fluence per shot. Shots were about 400 ns in duration and consisted of a mixture of carbon, hydrogen, and oxygen ions at 300 keV. It was found that the single crystal copper cratered far less than the polycrystalline copper at the lower energy fluence. At the higher energy fluence, cratering was replaced by other forms of surface damage, and the single crystal copper sustained less damage at all but the largest number of shots. Molten debris from the Lucite anode (the ion source) was removed and redeposited on the samples with each shot.
NTIS
Crystallinity; Copper; Irradiation; Ion Beams; Cratering

19990041715 Los Alamos National Lab., Materials Science and Technology Div., NM USA
Modeling the effects of friction and geometry on deformation path during hot rolling of aluminum
Korzekwa, D. A.; Beaudoin, A. J.; Dec. 31, 1998; 13p; In English; International symposium on interstitial and substitutional solute effects in intermetallics
Report No.(s): DE99-000688; LA-UR-98-1704; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In this work, a parametric study of hot rolling is conducted. The effect of friction model, friction coefficient, roll gap geometry and temperature on the deformation rate field is demonstrated. This parameter space is restricted to a region which is tractable, yet provides considerable variety in the features of non-uniform deformation developed in rolling. The degree and nature of redun-

dant work (shearing) is contrasted for different stream-line locations within the bite. Recommendations for the application of material models in analysis of rolling is made with consideration of the simulation predictions.
NTIS
Friction; Deformation; Aluminum; Hot Working; Geometry; Mathematical Models

19990041730 Alabama A & M Univ., Normal, AL USA
Study of the effects of MeV Ag, Cu, Au, and Sn implantation on the optical properties of LiNbO3
Williams, E. K., Alabama A & M Univ., USA; Ila, D., Alabama A & M Univ., USA; Sarkisov, S., Alabama A & M Univ., USA; Curley, M., Alabama A & M Univ., USA; Poker, D. B., Oak Ridge National Lab., USA; Hensley, D. K., Oak Ridge National Lab., USA; Borel, C., Wien Univ., Austria; Feb. 28, 1998; 9p; In English; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464; NAGw-4078
Report No.(s): DE98-005051; ORNL/CP-96639; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The authors present the results of characterization of linear absorption and nonlinear refractive index of Au, Ag, Cu and Sn ion implantation into LiNbO3. Ag was implanted at 1.5 MeV to fluences of 2 to 17 x 17(exp 16)/sq cm at room temperature. Au and Cu were implanted to fluences of 5 to 20 x 10(exp 16)/sq cm at an energy of 2.0 MeV. Sn was implanted to a fluence of 1.6 x 10(exp 17)/sq cm at 160 kV. Optical absorption spectrometry indicated an absorption peak for the Au implanted samples after heat treatment at 1,000 C at approx. 620 nm. The Ag implanted samples absorption peaks shifted from approx. 450 nm before heat treatment to 550 nm after 500 C for 1h. Heat treatment at 800 C returned the Ag implanted crystals to a clear state. Cu nano-cluster absorption peaks disappears at 500 C. No Sn clusters were observed by optical absorption or XRD. The size of the Ag and Au clusters as a function of heat treatment were determined from the absorption peaks. The Ag clusters did not change appreciably in size with heat treatment. The Au clusters increased from 3 to 9 nm diameter upon heat treatment at 1000 C. TEM analysis performed on a Au implanted crystal indicated the formation of Au nanocrystals with facets normal to the c-axis. Measurements of the nonlinear refractive indices were carried out using the Z-scan method with a tunable dye laser pumped by a frequency doubled mode-locked Nd:YAG laser. The dye laser had a 4.5 ps pulse duration time and 76 MHz pulse repetition rate (575 nm).
NTIS
Research; Ion Implantation; Optical Properties; Lithium Niobates; Crystal Growth; Silver; Copper

19990041736 Los Alamos National Lab., NM USA
Electronic structure and correlation effects in actinides
Albers, R. C.; Dec. 31, 1998; 50p; In English; Electronic structure workshop
Report No.(s): DE99-001218; LA-UR-98-2568; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report consists of the vugraphs given at a conference on electronic structure. Topics discussed are electronic structure, f-bonding, crystal structure, and crystal structure stability of the actinides and how they are inter-related.
NTIS
Electronic Structure; Actinide Series; Correlation

19990041792 Los Alamos National Lab., NM USA
Fundamental and applied studies of helium ingrowth and aging in plutonium
Stevens, M. F.; Zocco, T.; Albers, R.; Becker, J. D.; Walter, K.; Dec. 31, 1998; 21p; In English
Report No.(s): DE99-001276; LA-UR-98-2606; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This is the final report of a two-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The purpose of this project was to develop new capabilities to assess the nucleation and growth of helium-associated defects in aged plutonium metal. This effort involved both fundamental and applied models to assist in predicting the transport and kinetics of helium in the metal lattice as well as ab initio calculations of the disposition of gallium in the n and its resulting effects on phase stability. Experimentally this project aimed to establish experimental capabilities crucial to the prediction of helium effects in metals, such as transmission electron microscopy, thermal helium effusion, and the development of a laser-driven mini-flyer for understanding the role of helium and associated defects on shock response of plutonium surrogates.
NTIS
Defects; Helium; Nucleation; Plutonium; Microstructure; Aging (Materials)

19990041830 Army Armament Research, Development and Engineering Center, Benet Labs., Watervliet, NY USA
Laser-Ultrasonic Characterization of Electrodeposited Chromium Coatings *Final Report*
Knight, Bryon; Braunstein, Jeffrey; Cox, Joseph F.; Frankel, Julius; Mar. 1999; 17p; In English; Presented at the 23rd Conference on Quantitative Non-Destructive Evaluation, Snowbird, UT, 23 July 1998. Published in proceedings of the conference.

Report No.(s): AD-A362120; ARCCB-TR-99004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chromium coatings were electrodeposited onto steel substrates, under controlled conditions. A pulsed laser generated ultrasonic waves in the specimen, and a Michelson interferometer detected the ultrasonic waves at the surface. Signal processing techniques were used to obtain the surface wave velocities, and the various modes are discussed. Conventional piezoelectric techniques were also used for generation and detection of bulk wave velocities to correlate with the surface wave results. A difference technique was used to obtain the bulk measurements: time transit and thickness were measured before and after chromium plating and the velocities evaluated from the respective differences of the data thus obtained.

DTIC

Metal Coatings; Pulsed Lasers; Ultrasonics; Chromium

19990041860 Los Alamos National Lab., NM USA

Structural and magnetic characterization of actinide materials

Cort, B.; Allen, T. H.; Lawson, A. C.; Dec. 31, 1998; 15p; In English

Report No.(s): DE99-001277; LA-UR-98-2608; 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 authors have successfully used neutron scattering techniques to investigate physicochemical properties of elements, compounds, and alloys of the light actinides. The focus of this work is to extend the fundamental research capability and to address questions of practical importance to stockpile integrity and long-term storage of nuclear material. Specific subject areas are developing neutron diffraction techniques for smaller actinide samples; modeling of inelastic scattering data for actinide metal hydrides; characterizing actinide oxide structures; and investigating aging effects in actinides. These studies utilize neutron scattering supported by equilibrium studies, kinetics, and x-ray diffraction. Major accomplishments include (1) development of encapsulation techniques for small actinide samples and neutron diffraction studies of AmD(sub 2.4) and PuO(sub 2.3); (2) refinement of lattice dynamics model to elucidate hydrogen-hydrogen and hydrogen-metal interactions in rare-earth and actinide hydrides; (3) kinetic studies with PuO(sub 2) indicating that the recombination reaction is faster than radiolytic decomposition of adsorbed water but a chemical reaction produces H(sub 2); (4) PVT studies of the reaction between PuO(sub 2) and water demonstrate that PuO(sub 2+x) and H(sub 2) form and that PuO(sub 2) is not the thermodynamically stable form of the oxide in air; and (5) model calculations of helium in growth in aged plutonium predicting bubble formation only at grain boundaries at room temperature. The work performed in this project has application to fundamental properties of actinides, aging, and long-term storage of plutonium.

NTIS

Radioactive Materials; Plutonium; Americium; Radioactive Wastes; Chemical Properties

19990041872 Oak Ridge National Lab., TN USA

Evaluation of the intrinsic and extrinsic fracture behavior of iron aluminides

Cooper, B. R.; Kang, B. S.; Jul. 27, 1998; 35p; In English

Report No.(s): DE99-000311; ORNL/SUB-95-ST547/02; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Iron aluminides have excellent corrosion resistance in high-temperature oxidizing-sulfidizing environments; however, there are problems at room and medium temperatures with hydrogen embrittlement as related to exposure to moisture. In this research, a coordinated computational modeling/experimental study of mechanisms related to environmental-assisted fracture behavior of selected iron aluminides has been undertaken. The modeling and the experimental work connect at the level of coordinated understanding of the mechanisms for hydrogen penetration and for loss of strength and susceptibility to fracture. The focus of the modeling component has been on the challenging question of accurately predicting the iron vacancy formation energy in Fe(sub 3)Al and the subsequent tendency, if present, for vacancy clustering. The authors have successfully performed, on an ab initio basis, the first calculation of the vacancy formation energy in Fe(sub 3)Al. These calculations include lattice sites. This has significant implications for vacancy clustering effects with consequences for hydrogen diffusion. Indeed, the ab-initio-based estimate of the divacancy binding energy indicates a likely tendency toward such clustering for iron vacancies on the sites with large lattice relaxation. The experimental work has focused on the relationship of the choice and concentration of additives to the improvement of resistance to hydrogen embrittlement and hence to the fracture behavior.

NTIS

Aluminides; Fracture Mechanics; Fracturing; High Temperature Environments; Hydrogen Embrittlement; Moisture; Vacancies (Crystal Defects); Iron Alloys; Mathematical Models; Experimentation

19990041873 Oak Ridge National Lab., TN USA

Gallium-cladding compatibility testing plan: Phase 3 -- Test plan for centrally heated surrogate rodlet test. Revision 2

Morris, R. N.; Baldwin, C. A.; Wilson, D. F.; Jul. 31, 1998; 24p; In English

Report No.(s): DE99-000318; ORNL/MD/LTR-146-LEVEL2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Fissile Materials Disposition Program (FMDP) is investigating the use of weapons grade plutonium in mixed oxide (MOX) fuel for light-water reactors (LWR). Commercial MOX fuel has been successfully used in overseas reactors for many years; however, weapons derived fuel may differ from the previous commercial fuels because of small amounts of gallium impurities. A concern presently exists that the gallium may migrate out of the fuel, react with and weaken the clad, and thereby promote loss of fuel pin integrity. Phases 1 and 2 of the gallium task are presently underway to investigate the types of reactions that occur between gallium and clad materials. This is a Level-2 document as defined in the Fissile Materials Disposition Program Light-Water Reactor Mixed-Oxide Fuel Irradiation Test Project Plan. This Plan summarizes the projected Phase 3 Gallium-Cladding compatibility heating test and the follow-on post test examination (PTE). This work will be performed using centrally-heated surrogate pellets, to avoid unnecessary complexities and costs associated with working with plutonium and an irradiation environment. Two sets of rodlets containing pellets prepared by two different methods will be heated. Both sets will have an initial bulk gallium content of approximately 10 ppm. The major emphasis of the PTE task will be to examine the material interactions, particularly indications of gallium transport from the pellets to the clad.

NTIS

Cladding; Gallium; Light Water Reactors; Mixed Oxides; Plutonium Oxides

19990041874 Oak Ridge National Lab., TN USA

Scouting tests to examine potential corrosion of aluminum alloy 2519 during fabrication

Pawel, S. J.; Aug. 31, 1998; 18p; In English

Report No.(s): DE99-000337; ORNL/TM-13676; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Coupons of 2519 aluminum were exposed for three weeks in a variety of environments representative of those expected during fabrication of the advanced amphibious assault vehicle (AAAV). Specimens exposed to tap water developed very minor pitting and staining, while specimens exposed in high humidity air, water chaser, or machine cutting fluid revealed no detectable changes.

NTIS

Aluminum Alloys; Electrochemical Corrosion; Corrosion Tests

19990042146 Los Alamos National Lab., NM USA

Influence of orientation pinning on the Goss-texture in Fe-3%Si electrical steel

Engler, O.; Friedel, F.; Dec. 31, 1998; 7p; In English; International conference on grain growth

Report No.(s): DE99-001249; LA-UR-98-2560; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Despite a large number of investigations on the formation of the Goss-texture in Fe-3%Si electrical steels, the exact mechanisms leading to the preference of this particular orientation are not completely understood so far. As an alternative to the standard explanation of a favored growth of Goss-oriented grains during secondary recrystallization, recently the concept of orientation pinning has been proposed, which considers that the growth of grains with special orientation relationships corresponding to low-angle and twin grain boundaries is disfavored. The present paper present preliminary EBSD-results on the growth of Goss-grains during secondary recrystallization in high-permeability (HiB) transformer steel sheets. A semi-quantitative model to simulate the effect of orientation pinning on the evolution of the Goss-texture is introduced.

NTIS

Pinning; Iron Compounds; Steels; High Strength Steels

19990042171 California Univ., Quantum Inst., Santa Barbara, CA USA

An Investigation of the Effect of Surface Impurities on the Adsorption Kinetics of Hydrogen Chemisorbed onto Iron *Final Report, 1 Apr. 1980 - 30 Sep. 1997*

Shanabarger, R. M., California Univ., USA; 1997; 21p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The original goal of this program was to investigate the effect surface impurities have on the heterogeneous kinetic processes of those molecular species which produce gaseous hydrogen degradation of the mechanical properties of metallic structural mate-

rials. However, shortly after the initiation of the original program, the program's NASA Technical Monitor, Dr. Howard Nelson, requested that the effort supported by this Co-operative Agreement be redirected to study more pressing materials issues associated to the development of the National Aero-Space Plane (NASP). The results of these efforts are outlined in this report. Detailed discussions of specific work, including experimental techniques and procedures, will be found in the publications listed with the subsection discussing that specific work as well and in Section 5. No inventions were generated or disclosed within this Agreement.
Author
Research; Impurities; Surface Defects; Adsorption; Hydrogen; Chemisorption; Iron

19990042342 Los Alamos National Lab., NM USA
Bulk amorphous materials
Schwarz, R. B.; Archuleta, J. I.; Sickafus, K. E.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-001257; LA-UR-98-2368; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This is the final report for a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The objective of this work was to develop the competency for the synthesis of novel bulk amorphous alloys. The authors researched their synthesis methods and alloy properties, including thermal stability, mechanical, and transport properties. The project also addressed the development of vanadium-spinel alloys for structural applications in hostile environments, the measurement of elastic constants and thermal expansion in single-crystal TiAl from 300 to 750 K, the measurement of elastic constants in gallium nitride, and a study of the shock-induced martensitic transformations in NiTi alloys.
NTIS
Amorphous Materials; Synthesis (Chemistry); Semiconductors (Materials)

19990042344 Los Alamos National Lab., NM USA
Stepped-anneal and total helium/hydrogen measurements in high-energy proton-irradiated tungsten
Oliver, B. M.; Hamilton, M. L.; Garner, F. A.; Sommer, W. F.; Maloy, S. A.; Dec. 31, 1998; 12p; In English; American Society for Testing and Materials (ASTM) international symposium on effects of radiation on materials
Report No.(s): DE99-001253; LA-UR-98-2672; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
To provide structural material design data for the Accelerator Production of Tritium (APT) project, a 1 mA, 800 MeV proton beam at the Los Alamos Neutron Science Center (LANSCE) was used to irradiate a large number of metal samples, including a tungsten target similar to that being considered as the neutron source for the tritium production. The maximum proton fluence to the tungsten target was (approximately) 10(exp 21) protons/cm(exp 2). An unavoidable byproduct of spallation reactions is the formation of large amounts of hydrogen and helium. Postulated accident scenarios for APT involving the use of tungsten rods clad with Alloy 718, raise concerns as to the amount and rate of release of these gases due to temperatures increases from afterheat accumulation, with the major concern being pressurizing and possibly failure of the cladding. To address these issues, portions of the LANSCE tungsten rods were subjected to temperature histories calculated as likely to occur, and the time-dependent evolution of helium and hydrogen gases was measured. Stepped-anneal and total helium/hydrogen measurements were conducted on multiple samples of the tungsten material. Helium measurements were conducted at Pacific Northwest National Laboratory (PNNL) using a high-sensitivity magnetic-sector isotope-dilution helium analysis system. Stepped-anneal measurements were conducted at temperatures from (approximately) 25 C to (approximately) 1,600 C in (approximately) 100 C steps. Total helium measurements were conducted by rapid vaporization after completion of the stepped-anneal process, and are compared with Monte Carlo calculations performed at Los Alamos National Laboratory (LANL) using the LAHET code system. Hydrogen measurements were conducted between (approximately) 750 C and (approximately) 1,200 C using a high-temperature furnace that had been extensively modified for the application. Hydrogen detection was accomplished by periodic sampling of the furnace gas using a separate quadrupole analyzer. Hydrogen measurements are also compared with LANL calculations.
NTIS
Annealing; Helium; Hydrogen; Tungsten; Proton Irradiation

27
NONMETALLIC MATERIALS

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

19990041169 Los Alamos National Lab., NM USA
Ceramic-silicide composites
Petrovic, J. J.; Dec. 31, 1998; 13p; In English; World ceramics congress
Report No.(s): DE99-000649; LA-UR-98-1648; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The area of ceramic-silicide composites represents a merging of structural ceramics and structural silicides. Such ceramic-silicide composites can possess the desirable characteristics of both classes of compounds. Important structural ceramics are materials such as Si3N4, SiC, Al2O3, and ZrO2, which possess covalent, ionic, or mixed covalent- ionic atomic bonding. An important structural silicide is MoSi2, which possesses mixed covalent-metallic bonding. The arena of ceramic-silicide composites encompasses both composites where the structural silicide is the matrix and the structural ceramic is the reinforcement, and composites where the structural ceramic is the matrix and the structural silicide is the reinforcement. In the former area, MoSi2-SiC, MoSi2-ZrO2, and MoSi2-Al2O3 composites are discussed. In the latter area, Si3N4-MoSi2 composites are described.
NTIS
Ceramic Matrix Composites; Ceramics; Silicides

19990041591 Argonne National Lab., IL USA
Giant oxygen isotope effect on the metal-insulator transition of RNiO3 perovskites
Medarde, M.; Fauth, F.; Furrer, A.; Lacorre, P.; Conder, K.; Aug. 31, 1998; 3p; In English; Euroconference on polarons: condensation, pairing, magnetism
Report No.(s): DE98-058306; ANL/MSD/CP-97145; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The metal to insulator transition displayed by all the members of the perovskite family RNiO3 (R = 4f rare earth different from La) has attracted a lot of interest since it constitutes one of the few examples of this phenomenon in perfectly stoichiometric compounds. In spite of the great deal of work performed during the last six years, the mechanism responsible for the electronic localization is still a matter of controversy. The observation of unusually large O isotope shifts on the metal-insulator temperature T(sub MI) reported in this study represents an important advance since it clearly proves the dominant role of the electron lattice interaction as driving force for the transition. Moreover, the good agreement between this observation and a simple model based on the existence of Jahn-Teller polarons in the metallic state gives further qualitative and quantitative support to the polaronic picture recently suggested to account for O isotope effects in other 3d transition metal oxides containing Jahn-Teller ions.
NTIS
Isotope Effect; Perovskites; Oxygen Isotopes; Transition Metals; Nickel Oxides; Rare Earth Compounds; Insulators

19990041605 Los Alamos National Lab., NM USA
Processing of YBCO/IBAD YSZ coated conductors on flexible substrates
Arendt, P. N.; Foltyn, S. R.; Dowden, P. C.; Groves, J. R.; DePaula, R.; Dec. 31, 1998; 5p; In English; 1998 superconductivity conference
Report No.(s): DE99-000766; LA-UR-98-2185; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Continuous coaters capable of producing 1.1 m long x 1 cm wide tapes of YBa2Cu3O7(-delta)) (YBCO) on biaxially oriented yttria- stabilized zirconia (YSZ) on flexible Ni-alloy substrates have been developed at this laboratory. Using a 1 (micro)V/cm criterion, the authors have achieved transport critical current (I(sub c)) values of 29 A (75 K, self field) between voltage taps spaced 1 m apart. The corresponding critical current density (J(sub c)) value for this tape is 290 kA/cm(exp 2). For shorter tapes, (12 cm voltage tap separation) they have attained J(sub c) values of 0.67 MA/cm(exp 2) . Individual 1 x 1 cm sections within these shorter tapes have attained J(sub c) values of 1 MA/cm(exp 2).
NTIS
YBCO Superconductors; Substrates

19990041663 Los Alamos National Lab., Materials Science and Technology Div., NM USA
Functionally graded boron carbide
Petrovic, J. J.; McClellan, K. J.; Kise, C. D.; Hoover, R. C.; Scarborough, W. K.; Dec. 31, 1998; 8p; In English; Engineering Ceramics Division conference and exposition on composites, advanced ceramics, materials and structures

Report No.(s): DE99-000615; LA-UR-98-194; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lightweight body armor is important for the protection of US soldiers in the field. Here, fabrication techniques were developed for producing graded porosity B4C, and for producing aluminum-B4C and epoxy-B4C functionally graded materials. The key fabrication aspect was obtaining the graded porosity B4C. The feasibility of producing graded porosity B4C using a grading of carbon densification aid produced from a gradient of promising, but it was not optimized in the present investigation. Graded porosity B4C materials were produced by a layering approach using different size distributions of B4C powders in the green state, and then densifying the layered assembly by hot pressing at 1,900 C. The hardness of uninfiltrated graded B4C, aluminum infiltrated B4C, and epoxy infiltrated B4C was observed to be similar.

NTIS

Boron Carbides; Composite Materials

19990041664 Los Alamos National Lab., NM USA

Mechanical properties of melt-derived erbium oxide

Neuman, A. D.; Blacic, M. J.; Platero, M.; Romero, R. S.; McClellan, K. J.; Dec. 31, 1998; 8p; In English; Engineering Ceramics Division conference and exposition on composites, advanced ceramics, materials and structures

Report No.(s): DE99-000614; LA-UR-98-143; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Erbium oxide (Er2O3) is a rare earth oxide that is chemically and thermally stable and has a melting point of 2,430 C. There is relatively little information available regarding single crystal growth of erbia or the properties of erbia. In this study, erbia single crystals have been grown in a Xenon Optical Floating Zone Unit (XeOFZ) capable of melting materials at temperatures up to 3,000 C. Erbia was melt synthesized in the XeOFZ unit in a container less fashion, proving for little chance of contamination. Crystals were grown in compressed air and in reducing atmospheres. A recurring problem with melt synthesis of erbia is the appearance of flakes at the edges of the melt zone during growth; these flakes disrupt the growth process. The processing details and an initial survey of the physical properties of erbia single crystals is discussed.

NTIS

Mechanical Properties; Melting; Erbium; Oxides

19990041713 Los Alamos National Lab., NM USA

Improvement of luminescent properties of thin-film phosphors by excimer laser processing

McKittrick, J.; Bacalski, C. F.; Hirata, G. A.; Sze, R. C.; Mourant, J.; Dec. 31, 1998; 12p; In English; SPIE's international symposium on high-power laser ablation

Report No.(s): DE99-000698; LA-UR-98-1975; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thin-films of europium doped yttrium oxide, Y(1-x)Eu(x)(2)O3, were deposited on sapphire substrates by metallorganic chemical vapor deposition. The films, approximately 400 nm thick, were weakly luminescent in the as-deposited condition. A KrF laser was pulsed once on the surface of the films at a fluence level between 0.9--2.3 J/cm(exp 2). One pulse was sufficient to melt the film, which increased the photoluminescent emission intensity. Melting of a rough surface resulted in smoothing of the surface. The highest energy pulse resulted in a decrease in luminous intensity, presumably due to material removal. Computational modeling of the laser melting and ablation process predicted that a significant fraction of the film is removed by ablation at the highest fluence levels.

NTIS

Thin Films; Phosphors; Excimer Lasers; Photoluminescence

19990041774 Lawrence Livermore National Lab., Livermore, CA USA

Project progress report

Isakov, A.; Dec. 31, 1997; 43p; In English

Report No.(s): DE98-057723; UCRL-CR-129411; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Works of two variety have been fulfilled: first, research of polystyrene shells formation conditions in drop tower furnace and ballistic furnace; and second, creation of computer codes for simulation of shells formation processes, including numerous nucleation.

NTIS

Computer Programs; Polystyrene

19990041776 Lawrence Livermore National Lab., Livermore, CA USA

Loss of transmittance in fluoropolymer films due to laser-induced damage at 1053 and 351-nm

Whitman, P.; Milam, D.; Norton, M.; Sell, W.; Dec. 01, 1997; 10p; In English; 29th; Annual Boulder damage symposium on optical materials for high power lasers

Report No.(s): DE98-057744; UCRL-JC-128090; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thick fluoropolymer films are being evaluated as a potential 'disposable' debris shield to protect high-peak-power laser optics from x-ray and target debris generated in inertial-confinement fusion-ignition experiments, Two obstacles to implementation are optical uniformity and damage threshold. To understand the damage characteristics, transmittance of single 1053- or 351-nm laser pulses has been measured for commercial fluoropolymer films in vacuum. Samples were tested at fluences up to 105 J/cm(exp 2) at 1053-nm and 13 J/cm(exp 2) at 351- nm. Both the total transmitted energy for a single shot and the temporal energy transmittance profile during the shot were measured as a function of fluence. In addition, the total focUSAble transmitted energy was recorded for 351 -nm pulses. Results show that transmittance decreases slowly during a single-pulse irradiation, allowing much of the energy to be transmitted at fluences which cause noticeable degradation to the film. The film transmits greater than 90% of the 351-nm energy delivered in a beam with spatial average fluence of 8 J/cm(exp 2) with modulation up to 15 J/cm(exp 2). For 1053-nm laser light, the films do not begin to exhibit noticeable transmittance loss until average fluences exceed 40 J/cm(exp 2).

NTIS

Transmittance; Fluoropolymers; Thick Films; Laser Outputs; Laser Damage

19990041818 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Experimental Investigation of Polyurethane Camouflage Coating Using Dynamic Mechanical Analysis ***Progress Report, Jul. 1997 - Sep. 1998***

Crawford, Dawn M.; Escarsega, John A.; Mar. 1999; 28p; In English

Report No.(s): AD-A362010; ARL-TR-1929; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three polyurethane coatings were evaluated using dynamic mechanical analysis (DMA) to investigate the relationship between dynamic mechanical properties and durability properties of coated test panels. The current polyurethane solvent-based (SOL) formulation, used as a chemical-agent-resistant camouflage top coat on all military tactical vehicles, was investigated, along with newly developed water-reducible (WR) polyurethane coatings. The WR coatings offer significantly reduced volatile organic compounds (VOC), compared to the SOL system, and thus represent environmentally compliant coatings. DMA investigations revealed that the two classes of polyurethane coatings exhibit different dynamic mechanical properties, which are attributed to different cross-linking mechanisms involved in film formation. The more uniformly cross-linked SOL coating provides the best chemical-agent resistance (CAR) but the poorest mechanical properties. Properties measured using DMA were sensitive to the degree of isocyanate to hydroxyl indexing in the WR formulations, as well as the drying time of coatings prior to evaluation. DMA investigations indicated that longer cure times at ambient temperature (6 or more months) may adversely affect the mechanical properties of the SOL system and potentially enhance CAR of the WR coating. Further studies involving aged coatings are planned.

DTIC

Coatings; Organic Compounds; Camouflage; Dynamic Characteristics; Elastic Properties

19990041854 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Tribopolymerization: An advanced lubrication concept for automotive engines and systems of the future

Furey, M. J.; Kajdas, C.; Kaltenbach, K. W.; Dec. 31, 1997; 9p; In English; 30th; International symposium on automotive technology and automation: in fusion of technical excellence

Report No.(s): DE99-001493; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Advanced lubrication technologies based on the concept of tribopolymerization as a mechanism of boundary lubrication are described. Advantages of this approach as well as potential applications which could have an impact on the design, manufacture, and performance of existing and future automotive engines are presented and discussed. Tribopolymerization, a novel concept of molecular design developed by Furey and Kajdas, involves the continuous formation of thin polymeric films on rubbing surfaces; the protective films formed are self-replenishing. The antiwear compounds developed from this technology are effective with metals as well as ceramics and in the liquid as well as vapor phases. Furthermore, they are ashless and contain no harmful phosphorus or sulfur; and many are biodegradable. Thus, potential applications of this technology are diverse and include a variety of cost/performance/ energy/environmental advantages. Examples include the following: (a) machining and cutting applications using thin films to reduce friction and ceramic tool wear; (b) the lubrication of ceramic engines (e.g., low heat rejection diesel engines) or ceramic components; (c) the development of ashless lubricants for existing and future automotive engines to reduce

exhaust catalyst poisoning and environmental emissions; (d) ashless antiwear or 'lubricity' additives for fuels, including gasoline, diesel and jet fuel; (e) vapor phase applications of this technology to high temperature gaseous systems or to fuel injector wear problems associated with the use of natural gas engines; and (f) the use of the concept of tribopolymerization as an enabling technology in the development of new engines and new automotive propulsion systems.
NTIS
Automobile Engines; Internal Combustion Engines; Propulsion System Configurations; Propulsion System Performance; Boundary Lubrication

19990042258 Hebrew Univ., JerUSAlem, Israel
Robot Identification and Extraction of Natural Glass
Moskowitz, S. E., Hebrew Univ., Israel; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 25-26; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The quality of natural glass is established by temperature and chemical composition of the original melt, rate of cooling, presence of water and other volatiles, and crystallization kinetics. Glass preservation over millions of years depends on whether the processes of chemical decomposition and devitrification remain secondary. As a resource material, natural glass can be utilized in the construction of extraterrestrial outposts. Possible landing sites containing natural glasses can be identified by means of a global surveyor spacecraft equipped with high resolution imaging sensors.
Derived from text
Glass; Chemical Composition

19990042341 Los Alamos National Lab., NM USA
Local Jahn-Teller effect in (La/SR)(sub n+1)Mn(sub n)O(sub 3n+1)
Louca, D.; Kwei, G. H.; Egami, T.; Dec. 31, 1998; 8p; In English; Euroconference on polarons: condensation, pairing, magnetism
Report No.(s): DE99-001258; LA-UR-98-2537; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lattice polarons form an important constituent in the mechanism of magnetism and transport of the (La/SR)(sub n+1)Mn(sub n)O(sub 3n+1) (for n = 2 and (infinity)) colossal magnetoresistance manganites. The coupling of the polaronic distortions to the local Jahn-Teller (JT) effect has been characterized by the pulsed neutron pair density function (PDF) analysis. Distortions of equal magnitude to the ones found in perovskites arising from a JT effect are found in the 2-dimensional layer crystals. The coupling of the distortions to the lattice is similar in both systems suggesting that lattice polarons are formed independently to the crystal dimensionality.
NTIS
Jahn-Teller Effect; Lanthanum Oxides; Manganese Oxides; Strontium Compounds

19990042392 NASA Lewis Research Center, Cleveland, OH USA
Rotating Pressure and Temperature Measurements on Scale Model Fans Using Luminescent Paints
Bencic, Timothy J., NASA Lewis Research Center, USA; 1998; 10p; In English; Joint Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-26618; RTOP 538-03-11
Report No.(s): AIAA Paper 98-3452; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Pressure and temperature sensitive paint (PSP, TSP) technology is a rapidly developing measurement technique that is widely accepted in external aerodynamic wind tunnel measurements. Almost all quantitative full field measurements have been on stationary surfaces. Rotating pressure and temperature measurements were successfully acquired during scale-model fan tests in the NASA Lewis Research Center 9 foot by 15 foot low speed wind tunnel at speeds as high as 9500 RPM. The use of PSP and TSP on rotating surfaces presents additional challenges to data acquisition. This paper describes in detail the techniques used to acquire global rotating pressure and temperature measurements and overcome the problems associated with this type of measurement. These include illumination and detection problems associated with moving surfaces, temperature dependence of PSP and limited emitted light available from short duration illumination sources. Solutions to these problems as well as pressure and temperature results will be discussed.
Author
Pressure Measurement; Temperature Measurement; Rotation; Luminescence; Paints; Fans; Scale Models

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.

19990041619 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Potential Explosive Hazards from Hydrogen Sulfide Production in Ship Ballast and Sewage Tanks
Fletcher, Lyn E., Defence Science and Technology Organisation, Australia; December 1998; 1p; In English; Sponsored in part by DNPSE
Report No.(s): DSTO-TR-0750; DODA-AR-010-683; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Hydrogen sulfide produced by sulfate-reducing bacteria is a well recognized toxic hazard in storage tanks on HMA Ships, however, it also has the potential to be an explosive hazard. Hydrogen sulfide can cause explosions when its concentration exceeds 4% in air. A number of storage tanks on HMA Ships theoretically have the potential to produce enough hydrogen sulfide to exceed this figure. This report assesses the likelihood of this occurring in ballast and sewage holding tanks. Sewage tanks pose the greatest risk of an explosive hazard occurring and this situation is exacerbated when seawater is used for flushing or a concentrated sewage is produced due to reduced flushing volumes, as is the situation with EVAC systems. Ballast tanks that contain only seawater and Deiso F76 pose minimal risk, but any contamination of the tanks with biodegradable material would increase this risk considerably.
Author
Explosions; Hazards; Hydrogen Sulfide; Tanks (Containers); Ships; Risk; Ballast (Mass)

19990041884 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Antriebstechnik, Cologne, Germany
The Properties of Kerosene Jet A-1 ***Die Stoffeigenschaften von Kerosin Jet A-1***
Rachner, Michael, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 1998; 152p; In German
Report No.(s): DLR-Mitt-98-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents the current knowledge on properties of kerosene Jet A-1, which is at present the primary fuel for aviation gas turbines. After a classification of different kerosenes and some analysis of the composition of kerosene Jet A-1, typical values for all important physical properties of the liquid phase, the vapour phase and the phase equilibrium are reported. Their dependence on relevant parameters is presented in the form of correlations, and is plotted for pressures up to 40 bar. In addition, the complex refractive index, electrical properties as well as the thermal stability of the liquid fuel together with the adiabatic equilibrium temperature of combustion in air are considered. Where literature data were lacking, especially at high pressure, estimation methods for the fuel properties were employed. Real gas behaviour was approximated by the Lee-Kesler equation of state. The given correlations are suitable for CFD use. A comprehensive list of references contains all sources of data on the properties of kerosenes known to the author.
Author
Kerosene; Gas Turbines; Thermal Stability; Liquid Fuels; Liquid Phases; Vapor Phases; Refractivity; Jet Engine Fuels

19990042246 Colorado School of Mines, Div. of Economics and Business, Golden, CO USA
Potential Commercial Uses of Mars ISPP Technology
Blair, B. R., Colorado School of Mines, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 1; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Similarities in components and processes between gas to liquid (GTL) technology and proposed systems for Mars in-situ propellant production (ISPP) may point to a commercial market for spinoffs. Recent advances in the conversion of natural gas - primarily methane - to liquid petroleum products are creating optimism for owners of marginal or remote gas fields worldwide. Many commercial players are entering the field of GTL technology, risking significant capital in a bid to compete for market share with traditional oil refineries. The winners in this new field will be equipped with the lowest-cost GTL process using the most advanced technology available. The potential discovery of innovative solutions to problematic or high-cost steps in GTL methane conversion should be considered by ISPP researchers while trying to find solutions that may significantly lower the cost of future Mars missions. This paper will review the current structure of the GTL industry, with a focus on cost elements and proprietary technologies used by the dominant firms.
Derived from text
Natural Gas; Methane; Petroleum Products

19990042250 NASA Ames Research Center, Moffett Field, CA USA

Low-Power Temperature-Swing Adsorption for Mars Atmosphere Acquisition

Finn, J. E., NASA Ames Research Center, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 9-10; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The promise of ISRU-based mission architectures for Mars surface exploration will begin to be realized during the next decade as robotic spacecraft sent to Mars carry components and whole chemical plants for producing propellants from the planet's atmosphere. These chemical plants will need to perform three primary operations: acquisition of atmospheric carbon dioxide, reactions to transform the gas into oxygen and possibly fuel, and storage of the products. This presentation focuses on development of technologies at NASA Ames Research Center for the first of these operations, carbon dioxide acquisition. The carbon dioxide acquisition component for a propellant production plant has several general, top level requirements. It has a stringent requirement for minimal power consumption; a critical need for long-term reliability over the period of time the chemical plant must operate (say, 500 days); a production rate requirement for carbon dioxide; and a state point requirement (particularly pressure) for the CO2 produced. The first two requirements help determine the best technological approach, while the latter two generally define the characteristics (e.g., size and power consumption) of the device. Mass and volume must be minimized, as usual.

Derived from text

Mars Probes; Mars Exploration; Unmanned Spacecraft; Mars Atmosphere; Mars (Planet); Mars Surface; Carbon Dioxide

19990042251 Southwest Research Inst., San Antonio, TX USA

Trade Study of Five In-Situ Propellant Production Systems for a Mars Sample Return Mission

Green, S. T., Southwest Research Inst., USA; Deffenbaugh, D. M., Southwest Research Inst., USA; Miller, M. A., Southwest Research Inst., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 11-12; In English; See also 19990042245

Contract(s)/Grant(s): NAG9-957; SwRI Proj. 04-1303; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

One of the goals of NASA's HEDS enterprise is to establish a long-term human presence on Mars at a fraction of the cost of employing today's technology. The most direct method of reducing mission cost is to reduce the launch mass of the spacecraft. If the propellants for the return phase of the mission are produced on Mars, the total spacecraft mass could be reduced significantly. An interim goal is a Mars Sample Return (MSR) mission, which is proposed to demonstrate the feasibility of in-situ propellant production (ISPP). Five candidate ISPP systems for producing two fuels and oxygen from the Martian atmosphere are considered in this design trade-off study: 1) Zirconia cell with methanol synthesis, 2) Reverse water gas shift with water electrolysis and methanol synthesis, 3) Sabatier process for methane product ion with water electrolysis, 4) Sabatier process with water electrolysis and partial methane pyrolysis, and 5) Sabatier/RWGS combination with water electrolysis.

Derived from text

Return to Earth Space Flight; Manned Space Flight; Long Duration Space Flight; Manned Mars Missions; Spacecraft Reentry; Mars Atmosphere; Cost Reduction; Launch Vehicles

19990042253 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Development Unit Configuration and Current Status of the MIP/MTERC Experiment

Juanero, K. J., Jet Propulsion Lab., California Inst. of Tech., USA; Johnson, K. R., Jet Propulsion Lab., California Inst. of Tech., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 15; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Mars In-Situ Propellant Production (ISPP) Precursor (MIP) experiment package is planned for inclusion on the Mars 2001 Lander. This experiment package consists of five experiments whose purpose is to demonstrate the performance of various ISPP processes in-situ on Mars. The demonstrated ability to produce propellant for Mars Return Vehicles (MRV) is considered to be a necessary precursor to any future manned mission to Mars. The Mars Thermal Environment/Radiator Characterization (MTERC) experiment is part of the MIP package and is intended to determine the Mars night sky temperature as well as to characterize the performance degradation of radiators caused by environmental exposure on Mars over time. Radiators are needed as part of the ISPP process to remove heat from the Mars Atmosphere Acquisition and Compression (MAAC) CO2 sorption compressor. MTERC will provide the data needed to optimize the design of radiators for ISPP and other processes. A MTERC Development Unit (DU) has been fabricated and tested at JPL. The MTERC DU consists of 1) a radiator subassembly, 2) a motor/cover subassembly, 3) a differential temperature control circuit and motor control electronics circuit board, and 4) a command and data handling electronics circuit board. This paper will describe the operational theory and the configuration of the MTERC DU and

will discuss the current status of the MTERC experiment development including some selected results of performance testing that has been completed prior to the ISRU III meeting.
Author
Physics and Chemistry Experiment In Space; Propellants; Fuel Production; Manned Mars Missions; Return to Earth Space Flight

19990042254 NASA Johnson Space Center, Houston, TX USA
Mars In-Situ Propellant Production Precursor (MIP) Flight Demonstration Project: Overview
Kaplan, D. I., NASA Johnson Space Center, USA; Ratliff, J. E., NASA Johnson Space Center, USA; Sanders, G. B., NASA Johnson Space Center, USA; Johnson, K. R., Jet Propulsion Lab., California Inst. of Tech., USA; Karlmann, P. B., Jet Propulsion Lab., California Inst. of Tech., USA; Juanero, K. J., Jet Propulsion Lab., California Inst. of Tech., USA; Barona, C. R., NASA Lewis Research Center, USA; Landis, G. A., NASA Lewis Research Center, USA; Jenkins, P. P., NASA Lewis Research Center, USA; Scheiman, D. A., NASA Lewis Research Center, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 10-11; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Strategic planning for human missions of exploration to Mars has conclusively identified in-situ propellant production (ISPP) as an enabling technology. A team of scientists and engineers from NASA's Johnson Space Center, Jet Propulsion Laboratory, and Lewis Research Center is preparing the MARS ISPP Precursors (MIP) Flight Demonstration. The objectives of MIP are to characterize the performance of processes and hardware which are important to ISPP concepts and to demonstrate how these processes and hardware interact with the Mars environment. Operating this hardware in the actual Mars environment is extremely important due to both uncertainties in our knowledge of the Mars environment as well as because of conditions that cannot be adequately simulated on Earth. The MIP Flight Demonstration is a payload onboard the MARS SURVEYOR Lander and will be launched in April 2001. MIP will be the first hardware to utilize the indigenous resources of a planet or moon. Its successful operation will pave the way for future robotic and human missions to rely on propellants produced using Martian resources as feedstock. Derived from text
Mars Atmosphere; Flight Tests; Propellants; Mars Exploration; Manned Mars Missions

19990042256 Southwest Research Inst., San Antonio, TX USA
Lunar In-Situ Propellant Production (ISPP) Technology Research
Kuhl, Christopher A., Southwest Research Inst., USA; Johnson, James E., Southwest Research Inst., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 21-22; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Future long duration missions for robotic and human exploration of the solar system will require systems that can utilize in-situ materials during the mission in place of bringing consumable resources from Earth. Oxygen, used as a propellant and required for human habitat, is found abundantly in lunar soil in the form of oxides. Considerable gains in mission performance are possible by utilizing lunar oxygen, alleviating the need for spacecraft to transport it and reducing the mass faction of the vehicle system at lift-off. Four insitu lunar oxygen extraction and production methods are addressed to help significantly reduce the mass faction attributed to the transportation of oxygen during a mission. Production methods addressed are Hydrogen Reduction of Illmenite, Carbothermal Reduction with Methane, Sulfuric Acid Reduction, and Molten Silicate Electrolysis. Near term needs for manned missions to the lunar surface will require oxygen production rates in the range of 10 to 30 mat/yr (metric tons per year). to provide a means for mission planning in terms of required mass and volume for a particular production plant, a software package entitled Lunar Oxygen Plant Sizing (LOPS) was developed to support plant scaling analysis. This Software has been used to show comparative sizing needs for lunar oxygen plants over a production range of 2 to 100 mt/yr. Computed results compare favorably with values found in the literature, in terms of specific energy and mass for given types of lunar oxygen plants. Conclusions from the computations show Hydrogen Reduction of Ilmenite being the most massive and having the largest energy requirement, and Sulfuric Acid Reduction the least in both aspects. For all processes, the photovoltaic power plant comprises over 78% of the total mass of the processing plant, and the liquefaction subsystem contributes negligibly to the overall mass and energy requirements of a production plant. The Hydrogen Reduction process requires a great deal more energy and mass than others, but the process is at a higher level of development or TRL. A determination of which process would be best suited among the other three processes considered will rely heavily on the technological feasibility rather than small differences in mass and energy. The results of these comparisons can aid in identifying areas of each process that need further research involvement, to ultimately determine if the use of a specific process is attainable. Taken on the whole, Hydrogen Reduction appears to be the most developed process, but

it is massive and needs considerable energy. Alternatively, Sulfuric Acid Reduction presents some challenges to bring it to a viable lunar process, but it is potentially the lowest power and mass option.
Derived from text
Reduction (Chemistry); Hydrogen; Oxygen Production; Solar System; Lunar Surface; Lunar Resources

19990042259 Utah State Univ., Space Dynamics Lab., Logan, UT USA
Cryogenic Propellant Production, Liquefaction, and Storage for a Precursor to a Human Mars Mission
Mueller, P. J., Utah State Univ., USA; Durrant, T. C., Lockheed Martin Space Mission Systems and Services, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 27; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The current mission plan for the first human mission to Mars is based on an in-situ resource utilization (ISRU) approach to reduce the amount of propellants needed to be taken to Mars and ultimately to reduce mission cost. The current Mars Robotic Exploration Program does not include ISRU on the early sample return missions. A need exists to demonstrate ISRU technologies on one or more robotic missions prior to the first human mission. This presentation outlines a concept for an ISRU-based precursor mission as a technology demonstration prior to the first human mission. It will also return Martian soil samples to Earth for analysis. The mission will primarily demonstrate cryogenic oxygen and fuel production, liquefaction, and storage for use as propellants for the return trip. The fuel will be hydrocarbon: either methane, methanol, or ethylene. Hydrogen feedstock will be brought from Earth.
Derived from text
Mission Planning; Mars Sample Return Missions; Manned Mars Missions; Return to Earth Space Flight; Long Duration Space Flight; Mars Exploration; Mars Probes; Mars Surface Samples

19990042262 NASA Johnson Space Center, Houston, TX USA
Oxygen Generator System Mars In-Situ Propellant Production Precursor Flight
Sridhar, K. R., Arizona Univ., USA; Gottmann, M., Arizona Univ., USA; Baird, R. S., NASA Johnson Space Center, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 33-34; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The 2001 Lander to Mars will carry the first ever ISRU payload to Mars. This payload, the Mars In-situ Propellant production Precursor (MIP), will demonstrate a variety of technologies that will be required for future ISRU Mars indigenous material processing plant designs. One of those technologies is that of extracting oxygen from the predominantly carbon dioxide atmosphere of Mars, a prerequisite for future sample return and human missions to Mars. The Oxygen Generator Subsystem (OGS) portion of the MIP will demonstrate this and is the focus of this paper. The primary objective of the OGS is to demonstrate the production of oxygen from Mars atmospheric gases. Secondary objectives are to measure the performance and reliability of oxygen generation hardware in actual mission environments over an extended time. Major constraints on the OGS design came from several sources. The Lander provides power to the system from solar power that is harnessed by photovoltaic arrays. This limited OGS to daytime only operations (six to eight hours) and a maximum power of 15W. The reliance on solar power necessitated thermal cycling of the OGS between Mars ambient and OGS operating temperatures. The Lander also limited the total mass of the MIP payload to 7.5 kg with a correspondingly small volume, and the OGS was one of six experiments in the MIP. Mass and volume were to be minimized. Another constraint was cost. Mission funding, as always, was tight. Cost was to be minimized. In short the OGS design had to be low power (is less than 15 Watts), low mass (1 kg), low volume, low cost, and be capable of cyclical operations for an extended stay on Mars. After extensive research, a zirconia based solid oxide electrolyzer design was selected.
Derived from text
Mars Atmosphere; Manned Mars Missions; Payloads; Return to Earth Space Flight; Mars Sample Return Missions; Oxygen Supply Equipment; Life Support Systems

19990042265 Pioneer Astronautics, Lakewood, CO USA
Mars In-Situ Propellant Utilizing the Reverse Water Gas Shift
Zubrin, R., Pioneer Astronautics, USA; Frankie, B., Pioneer Astronautics, USA; Kito, T., Pioneer Astronautics, USA; Muscatello, T., Pioneer Astronautics, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 39-40; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This report describes recent work accomplished on a Mars in situ propellant production project utilizing the reverse water gas shift (RWGS) reaction. This project began with a NASA Phase I SBIR in 1997 and has been continued as a Phase II program in 1998. John Connolly is the JSC program manager and Robert Zubrin is the principal investigator at Pioneer Astronautics. During the project, Pioneer has successfully built and operated two chemical synthesis units representing the cores of machines capable of manufacturing oxidizer and a variety of fuels out of primarily indigenous Martian material. The units include a Reverse Water Gas Shift (RWGS) unit and a Methanol Synthesis (MEOH) or Fischer Tropsch (FT) unit.
Derived from text
Mars Missions; Liquid Hydrogen; Transport Theory; Carbon Dioxide; Mars Atmosphere

29
MATERIALS PROCESSING

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

19990041435 NASA Lewis Research Center, Cleveland, OH USA
Melt Convection Effects in the Bridgman Crystal Growth of an Alloy Under Microgravity Conditions
Simpson James E., Wisconsin Univ., USA; Garimella, Suresh V., Wisconsin Univ., USA; deGroh, Henry C., III, NASA Lewis Research Center, USA; Abbaschian, Reza, Florida Univ., USA; 1998; In English; 7th; Thermophysics and Heat Transfer, 15 Jun. 1998, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC3-557; RTOP 963-35-0F; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The solidification of a dilute bismuth-tin alloy under Bridgman crystal growth conditions is investigated in support of NASA's MEPHISTO space shuttle flight experiment. Computations are performed in two-dimensions with a uniform grid. The simulation includes the species-concentration, temperature and flow fields, as well as conduction in the ampoule. Fully transient simulations have been performed; no simplifying steady state approximations are used. Results are obtained under microgravity conditions for pure bismuth, and Bismuth-0.1 at.% Sn and Bi-1.0 at.% Sn alloys. The concentration dependence of the melting temperature is neglected; the solid/liquid interface temperature is assumed to be the melting temperature of pure bismuth for all cases studied. For the Bi-1.0 at.% Sn case the results indicate that a secondary convective cell, driven by solutal gradients, forms near the interface. The magnitude of the velocities in this cell increases with time; this causes increasing solute segregation at the liquid/solid interface.
Author
Bridgman Method; Crystal Growth; Melts (Crystal Growth); Microgravity; Simulation; Gravitational Effects; Convection; Mathematical Models

19990041731 European Space Agency. European Space Research and Technology Center, ESTEC, Publications Div., Noordwijk, Netherlands
Microgravity News, Volume 11
Kaldeich-Schuermann, Brigitte, Editor, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; August 1998; ISSN 1015-1648; 24p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A space station with large technical and operational resources will provide the space user community with permanent access to space for the first time. In order to maintain the momentum of this community, and to foster concrete applications, ESA's Member States decided to participate in the ISS and approved a 'Utilization Preparation' programme element. About 50% of its resources are earmarked for Utilisation Promotion.
Author
Microgravity; Space Stations

31
ENGINEERING (GENERAL)

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

19990041146 NASA Goddard Space Flight Center, Greenbelt, MD USA
Modular Wideband Active Vibration Absorber
Zewari, Wahid, NASA Goddard Space Flight Center, USA; Lee, Kenneth Y., NASA Goddard Space Flight Center, USA; Smith, David R., Massachusetts Univ., USA; 1999; 7p; In English; 6th; International Congress on Sound and Vibration, 5-8 Jul. 1999, Copenhagen, Denmark; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A comparison of space experiments with previous missions shows a common theme. Some of the recent experiments are based on the scientific fundamentals of instruments of prior years. However, the main distinguishing characteristic is the embodiment of advances in engineering and manufacturing in order to extract clearer and sharper images and extend the limits of measurement. One area of importance to future missions is providing vibration free observation platforms at acceptable costs. It has been shown by researchers that vibration problems cannot be eliminated by passive isolation techniques alone. Therefore, various organizations have conducted research in the area of combining active and passive vibration control techniques. The essence of this paper is to present progress in what is believed to be a new concept in this arena. It is based on the notion that if one active element in a vibration transmission path can provide a reasonable vibration attenuation, two active elements in series may provide more control options and better results. The paper presents the functions of a modular split shaft linear actuator developed by NASA's Goddard Space Flight Center and University of Massachusetts Lowell. It discusses some of the control possibilities facilitated by the device. Some preliminary findings and problems are also discussed.
Author
Vibration Damping; Spaceborne Experiments; Control Systems Design; Actuators

19990041156 NASA Marshall Space Flight Center, Huntsville, AL USA
Dynamic Testing of an Inflatable Structure Under Thermal Vacuum Conditions
Engberg, Robert, NASA Marshall Space Flight Center, USA; Lassiter, John, NASA Marshall Space Flight Center, USA; 1999; In English; Structures, Structural Dyanmics and Materials, 12-15 Apr. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 99-1519; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Marshall Space Flight Center's Space Transportation Programs Office is responsible for the development and demonstration of advanced launch vehicle and propulsion technologies. One of these advanced propulsion concepts being pursued is solar thermal propulsion. This concept employs a concentrated beam of sunlight to heat a working fluid within a solar thermal engine. Expansion of the fluid would provide thrust at an increased specific impulse. One way to concentrate the sun's light to a specific point in the engine cavity is to use a fresnel lens that is supported by an inflatable structure. Such propulsion systems could provide an inexpensive way of transferring and maintaining satellites to upper stage orbit trajectories. This paper describes the test hardware, procedures, and non-contacting measurement methodologies used to determine the modal characteristics of an inflatable concentrator under the thermal-vacuum conditions of space. These characteristics were necessary to identify for validation of a finite element model to be used for developing the spacecraft's pointing and control system.
Author
Inflatable Structures; Solar Thermal Propulsion; Fresnel Lenses; Space Erectable Structures; Thermal Vacuum Tests

19990041712 Los Alamos National Lab., NM USA
Suppression of acoustic streaming in tapered pulse tubes
Olson, J. R.; Swift, G. W.; Dec. 31, 1998; 8p; In English; 10th; International cryocooler conference
Report No.(s): DE99-000745; LA-UR-98-2013; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In a pulse tube cryocooler, the gas in the pulse tube can be thought of as an insulating piston, transmitting pressure and velocity from the cold heat exchanger to the hot end of the pulse tube. Unfortunately, convective heat transfer can carry heat from the hot end to the cold end and reduce the net cooling power. Here, the authors discuss one driver of such convection: steady acoustic streaming as generated by interactions between the boundary and the oscillating pressure, velocity, and temperature. Using a perturbation method, they have derived an analytical expression for the streaming in a tapered pulse tube with axially varying mean temperature in the acoustic boundary layer limit. The calculations showed that the streaming depends strongly on the taper angle, the ratio of velocity and pressure amplitudes, and the phase between the velocity and pressure, but it depends only weakly on the mean temperature profile and is independent of the overall oscillatory amplitude. With the appropriate tapering of the tube, streaming can be eliminated for a particular operating condition. Experimentally, the authors have demonstrated that an orifice pulse tube

cryocooler with the calculated zero-streaming taper has more cooling power than one with either a cylindrical tube or a tapered pulse tube with twice the optimum taper angle.
NTIS
Acoustic Streaming; Tapering; Tubes; Retarding

19990041788 Lawrence Livermore National Lab., Livermore, CA USA
Rapid mapping of volumetric machine errors using distance measurements
Krulewich, D. A.; Apr. 01, 1998; 13p; In English; International seminar on improving machine tool performance, USA
Report No.(s): DE98-058341; UCRL-JC-130154; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a relatively inexpensive, fast, and easy to execute approach to maping the volumetric errors of a machine tool, coordinate measuring machine, or robot. An error map is used to characterize a machine or to improve its accuracy by compensating for the systematic errors. The method consists of three steps: (1) models the relationship between volumetric error and the current state of the machine, (2) acquiring error data based on distance measurements throughout the work volume; and (3) fitting the error model using the nonlinear equation for the distance. The error model is formulated from the kinematic relationship among the six degrees of freedom of error an each moving axis. Expressing each parametric error as function of position each is combined to predict the error between the functional point and workpiece, also as a function of position. A series of distances between several fixed base locations and various functional points in the work volume is measured using a Laser Ball Bar (LBB). Each measured distance is a non-linear function dependent on the commanded location of the machine, the machine error, and the location of the base locations. Using the error model, the non- linear equation is solved producing a fit for the error model Also note that, given approximate distances between each pair of base locations, the exact base locations in the machine coordinate system determined during the non-linear filling procedure. Furthermore, with the use of 2048 more than three base locations, bias error in the measuring instrument can be removed The volumetric errors of three-axis commercial machining center have been mapped using this procedure. In this study, only errors associated with the nominal position of the machine were considered Other errors such as thermally induced and load induced errors were not considered although the mathematical model has the ability to account for these errors. Due to the proprietary nature of the projects we are not able to report actual error measurements. instead, we have scaled the work volume to 500 x 500 x 500 mm and proportionally scaled the errors. The fitted model was able to predict independently measured laser body diagonals to within 3 (mu)m peak-to-valley throughout scaled 500 x 500 x 500 mm' volume. or approximately 88% of the total error. Furthermore, this approach performed as well as, if not better than the parametric methods, but required only four hours to collect data for calibration.
NTIS
Mapping; Machine Tools; Error Analysis; Measuring Instruments

19990042083 NASA Goddard Space Flight Center, Greenbelt, MD USA
Modular Wideband Active Vibration Absorber
Smith, David R., Massachusetts Univ., USA; Zewari, Wahid, NASA Goddard Space Flight Center, USA; Lee, Kenneth Y., NASA Goddard Space Flight Center, USA; 1999; 4p; In English; Sound and Vibration, 5 Jul. - Aug. 1999, Copenhagen, Denmark; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A comparison of space experiments with previous missions shows a common theme. Some of the recent experiments are based on the scientific fundamentals of instruments of prior years. However, the main distinguishing characteristic is the embodiment of advances in engineering and manufacturing in order to extract clearer and sharper images and extend the limits of measurement. One area of importance to future missions is providing vibration free observation platforms at acceptable costs. It has been shown by researchers that vibration problems cannot be eliminated by passive isolation techniques alone. Therefore, various organizations have conducted research in the area of combining active and passive vibration control techniques. The essence of this paper is to present progress in what is believed to be a new concept in this arena. It is based on the notion that if one active element in a vibration transmission path can provide a reasonable vibration attenuation, two active elements in series may provide more control options and better results. The paper presents the functions of a modular split shaft linear actuator developed by NASA's Goddard Space Flight Center and University of Massachusetts Lowell. It discusses some of the control possibilities facilitated by the device. Some preliminary findings and problems are also discussed.
Author
Active Control; Vibration; Vibration Damping; Attenuation; Broadband

19990042255 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Development Unit Configuration and Current Status of the MIP/MAAC Experiment
Karlmann, P. B., Jet Propulsion Lab., California Inst. of Tech., USA; Johnson, K. R., Jet Propulsion Lab., California Inst. of Tech.,

USA; Rapp, D., Jet Propulsion Lab., California Inst. of Tech., USA; Wu, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 19; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Mars In-Situ Propellant Production (ISPP) Precursor (MIP) experiment package is planned for inclusion on the Mars 2001 Lander. This experiment package consists of five experiments whose purpose is to demonstrate the performance of various ISPP processes in-situ on Mars. The demonstrated ability to produce propellant for Mars Return Vehicles (MRV) is considered to be a necessary precursor to any future manned mission to Mars. The Mars Atmosphere Acquisition and Compression (MAAC) experiment is part of the MIP package and is intended to demonstrate that, by using a sorption compressor, CO2 can be preferentially adsorbed at about 6 torr from the Mars atmosphere during the night when the bed is cold then subsequently compressed to about 800 torr by heating the bed and desorbing CO2 during the day. The compressed CO2 produced by MAAC is to be fed to the Oxygen Generator Subsystem (OGS) where pure oxygen is to be produced. Pure oxygen is considered to be one of the primary constituents of a future manned MRV propellant system. A MAAC Development Unit (DU) has been fabricated and tested at JPL. The MAAC DU consists of 1) a sorption bed filled with a CO2 selective sorbent material, 2) a purge system to be used to periodically backflush non-CO2 gases from the sorbent bed during adsorption, 3) a JPL-developed gas-gap heat switch that allows heat transfer to a radiator for heat removal from the bed during the night time adsorption period and that impedes heat transfer during the day time desorption period, 4) a radiator to radiate heat to the night sky during the adsorption period, 5) a set of three isolation valves and connecting tubing. 6) two pressure transducers and several thermocouples for monitoring the MAAC operating conditions, and command and data handling electronics. This paper will describe the operational theory and the configuration of the MAAC DU and will discuss the current status of the MAAC experiment development including some selected results of performance testing that has been completed prior to the ISRU III meeting.

Author

Mars Atmosphere; Physics and Chemistry Experiment In Space; Research and Development; Propellants; Fuel Production; Return to Earth Space Flight

19990042257 NASA Johnson Space Center, Houston, TX USA

Low-Cost, High-Performance Cryocoolers for In-Situ Propellant Production

Martin, J. L., Mesoscopic Devices, LLC, USA; Corey, J. A., CFIC, Inc., USA; Peters, T. A., NASA Johnson Space Center, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 23-24; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A key feature of many In-Situ Resource Utilization (ISRU) schemes is the production of rocket fuel and oxidizer from the Martian atmosphere. Many of the fuels under consideration will require cryogenic cooling for efficient long-term storage. Although significant research has been focused on the techniques for producing the fuels from Martian resources, little effort has been expended on the development of cryocoolers to efficiently liquefy these fuels. This paper describes the design of a pulse tube liquefier optimized for liquefying oxygen produced by an In-Situ Propellant Production (ISPP) plant on Mars.

Derived from text

Fuel Production; Liquid Rocket Propellants; Oxidizers; Mars Atmosphere; Mars (Planet)

19990042263 NASA Johnson Space Center, Houston, TX USA

Microchemical and Thermal Systems for In-Situ Resource Utilization

Wegeng, Robert S., Pacific Northwest National Lab., USA; Sanders, Gerald B., NASA Johnson Space Center, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 35-36; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Process Intensification and Process Miniaturization can simultaneously be achieved through the application of microfabricated chemical process systems, based on the rapid heat and mass transport in engineered microchannels. Researchers at NASA's Johnson Space Center (JSC) and the Department of Energy's Pacific Northwest National Laboratory (PNNL) are collaboratively developing micro thermal and chemical systems for NASA's Mission to Mars program. Preliminary results show that many standard chemical process components (e.g., heat exchangers, chemical reactors and chemical separations units) can be reduced in hardware volume without a corresponding reduction in chemical production rates. Low pressure drops and improved thermal integration are also accomplished when appropriate scaling rules are applied and when individual microchemical components are packaged together into integral systems.

Derived from text

Chemical Reactions; Mars Sample Return Missions; Manned Mars Missions; Mars Probes; Microchannels; Heat Exchangers; Chemical Reactors; Mission Planning

19990042264 Adroit Systems, Inc., Bellevue, WA USA

Atmospheric Water Vapor Adsorption for Mars In-Situ Resource Utilization

Williams, J. D., Adroit Systems, Inc., USA; Bratkovich, T. E., Adroit Systems, Inc., USA; Bussing, T. R. A., Adroit Systems, Inc., USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 37-38; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

ASI has successfully completed a Phase I SBIR contract to develop a method for extracting water vapor from the atmosphere of Mars in an efficient, lightweight, and reliable manner. Through the use of molecular sieve technology, the Water Vapor Adsorption Reactor (WAVAR) would provide a dependable source of water to future exploration missions from sources indigenous to the red planet. This water can be used as feedstock for propellant production, for direct human consumption, or as the basis for a multitude of industrial, agricultural and biological processes. Using locally available materials at the site of an interplanetary mission is known as in situ resource utilization (ISRU). Missions employing ISRU techniques can attain dramatic cost savings, while improving mission robustness, by reducing the amount of raw materials transported from Earth. The most important of these materials is water. WAVAR would meet this need, providing a crucial technology for future missions.
Derived from text

Mars Atmosphere; Atmospheric Moisture; Water Vapor; Adsorption; Reactors; Mars Exploration; Mars (Planet); Mars Sample Return Missions; Manned Mars Missions; Mars Probes

32
COMMUNICATIONS AND RADAR

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

19990041157 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

High Speed A/D DSP Interface for Carrier Doppler Tracking

Baggett, Timothy, New Mexico State Univ., USA; November 1998; 72p; In English
Contract(s)/Grant(s): NAG5-1491
Report No.(s): NMSU-ECE-98-010; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As on-board satellite systems continue to increase in ability to perform self diagnostic checks, it will become more important for satellites to initiate ground communications contact. Currently, the NASA Space Network requires users to pre-arranged times for satellite communications links through the Tracking and Data Relay Satellite (TDRS). One of the challenges in implementing an on-demand access protocol into the Space Network, is the fact that a low Earth orbiting (LEO) satellite's communications will be subject to a doppler shift which is outside the capability of the NASA ground station to lock onto. In a prearranged system, the satellite's doppler is known a priori, and the ground station is able to lock onto the satellite's signal. This paper describes the development of a high speed analog to digital interface into a Digital Signal Processor (DSP). This system will be used for identifying the doppler shift of a LEO satellite through the Space Network, and aiding the ground station equipment in locking onto the signal. Although this interface is specific to one application, it can be used as a basis for interfacing other devices with a DSP.
Author

Doppler Effect; Satellite Communication; Signal Processing; Analog to Digital Converters; Digital Systems; Carrier Frequencies; Telecommunication

19990041744 Naval Postgraduate School, Monterey, CA USA

Investigation of Near-Field Electromagnetic Source Imaging Using Inverse Green's Function Integrations

Steenman, Daryl G.; Mar. 1999; 115p; In English
Report No.(s): AD-A361988; NPS-EC-99-004; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

As continued efforts are made to reduce the radar cross sections of aircraft and ships, designs are first modeled with computers and then tested in the lab. In the far-field of these tested objects, actual sources of high reflectivity or "Hot Spots" on the tested objects can be isolated to within only one half the wavelength of the electromagnetic wave used for testing. Ideally, a probe could measure fields on the surface of the object being tested to completely isolate the source of the hot spot. Unfortunately, the presence of the probe on the surface of the object will disturb the very fields it is attempting to measure. Probe measurements made in the near field, close to but not on the object, can be designed to reduce the influence of the probe while providing accurate field data. The data thus measured, while not able to determine the source location perfectly, can be used to localize a source to less than one half wavelength, the far-field diffraction limit .This thesis tests a technique for back propagating computer generated near field

measurements of an axisymmetric field source to determine the fields closer to the source. Several cases are examined that test the accuracy and resolving capability of the technique.
DTIC
Imaging Techniques; Near Fields; Radar Targets; Electromagnetic Radiation

19990041806 Helsinki Univ. of Technology, Radio Lab., Espoo, Finland
Quasioptical Methods for Antenna Measurements
Hirvonen, Taavi M., Helsinki Univ. of Technology, Finland; Sep. 1997; ISSN 1239-7350; 70p; In English
Report No.(s): Rept-S-228; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis deals with the quasioptical methods for antenna and material measurements. The work in this thesis may be divided into three parts: (1) a lens type of compact antenna test range (CATR) and a near-field analysis of a thick lens and horn combination, (2) a hologram type of CATR, and (3) measurement of low-loss dielectric materials for quasioptical components with an open resonator. A CATR has a great potential for testing electrically large antennas of remote sensing and radio astronomical satellites. However, the application of conventional reflector type CATRs becomes increasingly difficult, thought not impossible, above 100 GHz due to the tight surface accuracy requirements for the reflectors. In this thesis, the use of a shaped dielectric lens and a planar computer-generated hologram have been studied to overcome the problems incurred by the use of reflectors with insufficient surface accuracy. The required field-quality of the quiet-zone is driven by the required measurement accuracy of the antenna under test (ALTT). Typical requirements at millimeter wavelengths are a peak- to-peak amplitude ripple less than 1 dB and phase ripple less than 10 deg. With a hologram CATR a peak-to-peak amplitude and phase ripple under 1 dB and 10 deg., respectively, have been achieved both theoretically and experimentally at 119 GHz. Whenever dielectric components are used for collimating electromagnetic fields, a precise knowledge of the dielectric properties of the material is essential. Thus, precise material measurements with an open resonator are included in this work. The aim of this work was to build a facility for precise measurement of the dielectric properties of low-loss materials. The uncertainty of the measurement is 0.02-0.04% for (epsilon')(sub r) (epsilon greater than 2) and 6 - 40 x 10(exp -6) for tan(delta)(10(exp -4) less than or equal to tan(delta) less than or equal to 10(exp -3). The contents of the thesis is divided into two parts: (1) a general overview of antenna and material measurements main emphasis being on the millimeter wave antenna measurement techniques and on the theoretical background of this thesis work, and (2) the published reports on the theoretical and experimental work.
Author
Procedures; Remote Sensing; Microwave Antennas; Lens Antennas; Holography; Electromagnetic Fields; Dielectric Properties

19990041824 Naval Postgraduate School, Monterey, CA USA
Development a High Assurance Multilevel Mail Server
Eads, Bradley R.; Mar. 1999; 126p; In English
Report No.(s): AD-A361947; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Electronic mail (email) often contains sensitive information, which requires special handling to prevent accidental disclosure to unauthorized personnel. Using multiple systems operating at different classifications has caused a number of inefficiencies in the way email is managed and distributed. Attachments in emails have increased the likelihood that a "Trojan Horse" could be inserted in the system to obtain unauthorized access to information. To address this problem Commercial Off-The-Shelf (COTS) software for Internet Message Access Protocol (IMAP), a mail server protocol, has been adapted to a high assurance multilevel base, the Wang Federal XTS-300. The XTS-300 constrains information flow permitting information at different sensitivity levels to be stored securely. Controlled access to mail is provided to client workstations. Enhanced with a trusted computing base extension, these COTS IBM PC compatibles run a standard office productivity suite. This architecture eliminates the risk that a "Trojan horse" will pass higher sensitivity information to a lower sensitivity level.
DTIC
Security; Electronic Mail; Information Flow; Handling Equipment

19990041827 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Transient Electromagnetic Fields Produced by Pulsed Moving Conductors ***Final Report, Aug. 1997 - Oct. 1998***
Kohlberg, Ira; Zielinski, Alexander; Le, Calvin D.; Apr. 1999; 67p; In English
Report No.(s): AD-A361995; ARL-TR-1931; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A model was developed for determining the space and time behavior of the magnetic field external to a system of moving pulsed finite conductivity conductors. The moving conductor is in relative close proximity to a stationary conductor. The external magnetic field content has a space and time periodicity that is related to the parameters of the system. A numerical example pre-

dicts the magnitude and frequency of the magnetic field as a flmction of distance from the stationary conductor. Potential applications of this study are discussed.
DTIC
Magnetic Fields; Pulses; Electric Conductors; Periodic Variations; Conductors

19990041971 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Multi-Discipline Network Vulnerability Assessment
Wallace, Karilynne; Mar. 1999; 172p; In English
Report No.(s): AD-A361630; AFIT/GSO/ENS/99M-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

”Air Force Space Command has a mission to provide real-time, survivable, and enduring communications, surveillance, environmental monitoring, navigation, and warning....according to Air Force Space Handbook - A War Fighters Guide to Space. In order to prevent disruption of the critical networks in Space Command, a vulnerability assessment must be performed. The set of components called a vulnerability set, which could cause network disruption, must be identified and prioritized. In order to move beyond subjective prioritization, implementation of a quantitative methodology that measures the value of each vulnerability set is needed. This thesis proposes a technique for vulnerability assessment of a multi-disciplined network consisting of components that satisfy primary functions and secondary supporting functions. A Network Vulnerability Assessment Tool was developed and used to analyze the network. The tool models the network as nodes and links. A cut-set algorithm generates potential vulnerability sets. The overall objective is to find sets that cause critical network disruptions. Value-focused thinking and decision analysis techniques are used to rank the vulnerability sets according to decision maker preferences. The network vulnerability sets are ranked to provide an overall vulnerability assessment. Sensitivity analysis provides insight into the driving factors of the vulnerability set prioritization.
DTIC
Vulnerability; Decision Making

19990042033 Office National d’Etudes et de Recherches Aerospatiales, Paris, France
A Temporal/Frequential Finite Volume Method for Solving Maxwell Equations. Application to ElectroMagnetic Compatibility ***Resolution des Equations de Maxwell Instationnaires et Harmoniques par une Technique de Volumes Finis. Application a des Problemes de Compatibilite Electromagnetique***
Bonnet, Pierre, Office National d’Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 224p; In French
Report No.(s): ONERA-NT-1998-8; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Nowadays, in Electromagnetic compatibility (EMC), numerical simulations are commonly used. For complex applications we must rely on some accurate and efficient numerical methods. In the present work, we propose a time/frequency-domain finite volume method in order to solve Maxwell equations. First, the conservative form of Maxwell equations and the hyperbolic character of Maxwell system used in the numerical scheme is particularly emphasized. Numerous validations and comparisons point out the advantages of this method such as the conformal meshing and the natural treatment of discontinuities. To be able to treat some EMC problems, a thin wire formalism is also introduced and validated. Finally, a hybridization with finite difference and an application to a decomposition domain method are suggested.
Author
Electromagnetic Compatibility; Finite Volume Method; Maxwell Equation

19990042095 NASA Lewis Research Center, Cleveland, OH USA
HTTP Page Transfer Rates Over Geo-Stationary Satellite Links
Kruse, Hans, Ohio Univ., USA; Allman, Mark, Sterling Software, Inc., USA; Griner, Jim, NASA Lewis Research Center, USA; 1998; In English; Telecommunication Systems, 1998, Nashville, TN, USA
Contract(s)/Grant(s): NCC3-430; RTOP 632-60-5A; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The explosive growth of the Internet is being fueled by the popularity of the World Wide Web. A large amount of multimedia data is readily available on the web, making the physical distance between the information provider and the information user irrelevant. This development also produces pressure to extend the Internet, and with it the web, into geographic areas that have traditionally been far away from information sources. Rural areas, temporary installations, and developing nations all need Internet access. Geostationary satellites offer one possible avenue for providing this access. Any Internet application operating over a geostationary satellite link must contend with round trip times (RTTs) in excess of 500ms. Protocol design decisions with minimal performance impact on low-delay links can have profound effects on satellite links [Kru95]. We present in this paper a comprehensive experimental performance study of the current HTTP protocol (HTTP 1.0) using the geostationary NASA Advanced Communications Technology Satellite (ACTS) system. We examine the time required for the retrieval of a number of different test web pages.

In the experiment we evaluate the effect of using multiple TCP connections in the web browser (many browsers permit the user to control this setting). We also look at the impact of using persistent TCP connections, which most web servers allow, and the use of various TCP window sizes. We begin the paper with a description of the network used for this experiment. We then detail the TCP protocol stack used for this study. to correctly evaluate the performance of HTTP, we felt that a TCP implementation close to the documented standard should be used. Therefore, while we start with the NetBSD UNIX implementation, we apply a number of fixes to the TCP stack. We also implement, for part of this study, the ”4K” slow start modification that has been suggested for improved performance of web page transfers.
Author
Internets; UNIX (Operating System); Protocol (Computers); Hypertext; Multimedia

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.

19990041330 Rutherford Appleton Lab., Chilton, UK
The Operation of Vacuum Phototriodes in Non-Axial Magnetic Field: A Monte-Carlo Study
Bateman, J. E., Rutherford Appleton Lab., UK; Dec. 21, 1998; ISSN 1358-6254; 25p; In English
Report No.(s): RAL-TR-1998-089; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

The predictions of a simple monte-carlo model of the operation of vacuum photo-triodes in a non-axial magnetic field are presented and compared to some available experimental measurements.
Author
Monte Carlo Method; Models; Vacuum

19990041331 Rutherford Appleton Lab., Chilton, UK
Some Noise Calculations for Time Invariant Filters
Seller, P., Rutherford Appleton Lab., UK; Jan. 18, 1999; In English
Report No.(s): RAL-TR-1998-086; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

This paper presents the noise calculations for some detector readout circuits. The circuits considered are a charge amplifier combined with the following filters: RC, RC-CR, CR-RC(sup 2), CR-RC(sup n), CR(sup 2)-RC (bipolar), Indefinite Cusp, Trapezoidal, CR followed by Correlated Double Sampling, and Triple Sampled Deconvolution. The voltage-to-voltage transfer functions for the filters and the calculations of the thermal, shot and flicker noise for each filter are given. The calculations are performed in the time domain and then repeated in the frequency domain. The calculation of flicker noise is not done in the time domain.
Derived from text
Shot Noise; Circuits; Thermal Noise; Electric Potential; Computation

19990041585 Sandia National Labs., Electronics Quality/Reliability Center, Albuquerque, NM USA
1998 technology roadmap for integrated circuits used in critical applications
Dellin, T. A.; Sep. 30, 1998; 49p; In English
Report No.(s): DE99-000586; SAND-98-1914; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Integrated Circuits (ICs) are being extensively used in commercial and government applications that have extreme consequences of failure. The rapid evolution of the commercial microelectronics industry presents serious technical and supplier challenges to this niche critical IC marketplace. This Roadmap was developed in conjunction with the Using ICs in Critical Applications Workshop which was held in Albuquerque, NM, November 11--12, 1997.
NTIS
Integrated Circuits; Technology Assessment

19990041771 Lawrence Livermore National Lab., Livermore, CA USA

High-performance RF coil inductors on silicon

Malba, V.; Young, D.; Ou, J. J.; Bernhardt, A. F.; Boser, B. E.; Mar. 01, 1998; 8p; In English; 48th; Electronic component and technology (ECTC) conference

Report No.(s): DE98-057705; UCRL-JC-129936; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Strong demand for wireless communication devices has motivated research directed toward monolithic integration of transceivers. The fundamental electronic component least compatible with silicon integrated circuits (IC) is the inductor, although a number of inductors are required to implement oscillators, filters and matching networks in cellular devices. Spiral inductors have been integrated into the silicon IC metallization sequence but have not performed adequately due to coupling to the silicon which results in parasitic capacitance and loss. We have, for the first time, fabricated three dimensional coil inductors on silicon which have significantly lower capacitive coupling and loss and which now exceed the requirements of potential applications. Quality factors of 30 at 1 GHz have been measured in single turn devices and Q is greater than 16 in 2 and 4 turn devices. The reduced Q for multiturn devices appears to be related to eddy currents in outer turns generated by magnetic fields from current in neighboring turns. Higher Q values significantly in excess of 30 are anticipated using modified coil designs.

NTIS

Radio Frequencies; Inductors; Silicon; Coils

19990041780 Lawrence Livermore National Lab., Livermore, CA USA

Waveguide fabrication in Nd(3+) and Yb(3+) doped phosphate glasses

Patel, F. D.; Honea, E. C.; Krol, D.; Payne, S. A.; Hayden, J. S.; Mar. 02, 1998; 7p; In English; 13th; Topical meeting on advanced solid-state lasers and radiative processes and dephasing in semiconductors topical meeting

Report No.(s): DE98-057758; UCRL-JC-128624; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report on planar waveguides formed by field assisted ion exchange in Nd(3+) and Yb(3+) doped phosphate glasses. Losses of 0.71 dB/cm are measured. Electron probe measurements confirm Ag(+) diffusion.

NTIS

Waveguides; Fabrication; Phosphates; Glass; Neodymium Isotopes; Ytterbium Isotopes

19990041802 Norwegian Defence Research Establishment, Kjeller, Norway

Miniaturization of Electronics ***Mimiatyrisering av Elektronikk***

Snorre, Prytz, Norwegian Defence Research Establishment, Norway; Oct. 12, 1998; 44p; In Portuguese; Original contains color illustrations

Contract(s)/Grant(s): Proj. FFIE/299001/110

Report No.(s): FFI/RAPPORT-98/05172; ISBN 82-464-0307-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The possibilities for miniaturization of electronics available today are examined and a roadmap for the evolution is given in this report made as part of a miniaturization study for Lett FlerbruksRadio, LFR.

Author

Miniaturization; Miniature Electronic Equipment; Integrated Circuits

19990041820 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Stability of Aluminum in Low-Temperature Lithium-Ion Battery Electrolytes ***Progress Report, Oct. 1997 - Sep. 1998***

Behl, Wishvender K.; Plichta, Edward J.; Mar. 1999; 17p; In English

Report No.(s): AD-A362036; ARL-TR-1879; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We investigated the stability of aluminum at the high positive potentials encountered during the charging of lithium-ion cells. The electrolyte in these cells consists of solutions of lithium hexafluorophosphate and lithium methide in binary- and ternary-solvent mixtures of ethylene carbonate, dimethyl carbonate, and ethyl methyl carbonate. We performed the investigations with the controlled potential coulometry technique. We found that a protective surface film was formed on aluminum electrodes in these solutions and that this film protected the electrodes from further corrosion. The protective surface film was found to break down in lithium methide solutions at 4.25 V versus a lithium reference electrode, and this resulted in increased corrosion of the aluminum electrodes at higher potentials. In contrast to lithium methide solutions, the protective surface film formed on aluminum electrodes in lithium hexafluorophosphate solutions was found to be quite stable and did not break down at potentials up to 5 V.

DTIC

Low Temperature; Stability; Aluminum Alloys; Electrolytes; Electric Batteries

19990041821 Quest Integrated, Inc., Kent, WA USA
Nonintrusive System for Replication of interlayer Printed Circuit Patterns ***Final Report, 5 May 1997 - 31 Jan. 1998***
Chai, M.; Chau, A.; Feb. 1998; 45p; In English
Contract(s)/Grant(s): F42650-97-C-0038
Report No.(s): AD-A362070; QUEST-TR-779-PHASE-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Report developed under SBIR contract. The overall objective of this Phase I research program was to develop a nonintrusive method to image the art work of interlayer printed circuit board. Using forward Compton scattering and innovative design of a high-efficiency and high-resolution ring-slit Compton scattering camera, we have both theoretically demonstrated and experimentally verified the feasibility of reverse engineering the circuit board. An algorithm using 2-D projection and Compton scattering data was proposed for image reconstruction of the layout of the printed circuit board, layer by layer. This algorithm is highly efficient, less computational, straightforward, and easy to implement.
DTIC
Compton Effect; Forward Scattering; Image Reconstruction; High Resolution

19990042103 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Chelating Agents as Electrolyte Additives for Lithium-Ion Batteries ***Progress Report, Oct. 1997 - Sep. 1998***
Foster, Donald L.; Wolfenstine, Jeff; Behl, Wishvender K.; Mar. 1999; 18p; In English
Report No.(s): AD-A361949; ARL-TR-1878; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pentamethyldiethylenetriamine (PMDT), tetraglyme, and the crown ether 12-Crown-4 (12-Cr-4) were investigated as electrolyte additives for lithium-ion cells using graphite anodes. Cyclic voltammetry at glassy carbon electrodes in 1 mol/L LiPF6/propylene carbonate (PC) solutions containing PMDT, 12-Cr-4, or tetraglyme additives showed that the PMDT additive was electrochemically oxidized at 3.5 V versus lithium reference. The electrolytes with 12-Cr-4 and tetraglyme, on the other hand, were found to be stable up to 4.5 V, where the control electrolyte without any additive was oxidized. Ionic conductivity measurements of the same solutions showed that all three additives enhanced the conductivity of 1 mol/L LiPF6/PC solution at 25 deg C. Lithium cycling studies in PC solutions using graphite electrodes showed that the 12-Cr-4 and tetraglyme additives allowed reversible lithium intercalation into graphite; whereas, the PMDT additive did not have any effect. However, the PMDT additive was found to reduce the irreversible capacity loss on the first cycle in ethylene carbonate-propylene carbonate electrolyte solutions.
DTIC
Chelation; Electrolytes; Additives; Ion Currents; Lithium Sulfur Batteries

19990042149 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Development of Lightweight Electronics Enclosures for Space Applications
Fenske, Matthew T., NASA Goddard Space Flight Center, USA; Barth, Jane L., NASA Goddard Space Flight Center, USA; Didion, Jeffrey R., NASA Goddard Space Flight Center, USA; Mule, Peter, NASA Goddard Space Flight Center, USA; 1999; 13p; In English, May 1999, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper outlines the end to end effort to produce lightweight electronics enclosures for NASA GSFC electronics applications with the end goal of presenting an array of lightweight box options for a flight opportunity. Topics including the development of requirements, design of three different boxes, utilization of advanced materials and processes, and analysis and test will be discussed. Three different boxes were developed independently and in parallel. A lightweight machined Aluminum box, a cast Aluminum box and a composite box were designed, fabricated, and tested both mechanically and thermally. There were many challenges encountered in meeting the requirements with a non-metallic enclosure and the development of the composite box employed several innovative techniques.
Author
Fabrication; Enclosure; Spacecraft Construction Materials; Weight (Mass)

19990042172 NASA Glenn Research Center, Cleveland, OH USA
New Materials for EMI Shielding
Gaier, James R., NASA Glenn Research Center, USA; April 1999; 14p; In English; Electromagnetic Compatibility, 2-6 Aug. 1999, Seattle, WA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 632-1A-1E
Report No.(s): NASA/TM-1999-209054; NAS 1.15:209054; E-11590; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Graphite fibers intercalated with bromine or similar mixed halogen compounds have substantially lower resistivity than their pristine counterparts, and thus should exhibit higher shielding effectiveness against electromagnetic interference. The mechanical and thermal properties are nearly unaffected, and the shielding of high energy x-rays and gamma rays is substantially increased. Characterization of the resistivity of the composite materials is subtle, but it is clear that the composite resistivity is substantially lowered. Shielding effectiveness calculations utilizing a simple rule of mixtures model yields results that are consistent with available data on these materials.
Author
Graphite; Fiber Composites; Electromagnetic Interference; Thermodynamic Properties; Shielding

19990042312 Building and Construction Research TNO, Center for Mechanical Engineering, Delft, Netherlands
Shock Testing of an Electric Actuator, Type ELQ-200, Manufacturer El-o-matic
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 25, 1998; 56p; In English
Contract(s)/Grant(s): A96/KM/151; TNO Proj. 82376198
Report No.(s): TD98-0106; TNO-98-CMC-R0374; Copyright; Avail: Issuing Activity (TNO Building and Construction Research, Centre for Mech. Engineering, Schoemakerstraat, P.O. Box 49, 2600 AA Delft, The Netherlands), Hardcopy, Microfiche

An electric actuator, type ELQ-200, make El-o-matic, has been exposed to shock tests. The shock tests have been carried out in accordance with the shock specification B(F) for the LCF. Damage has been ascertained in the vertical negative test direction, however the functioning of the electric actuator was still in good order.
Author
Shock Tests; Actuators; Damage

19990042354 Lawrence Livermore National Lab., Livermore, CA USA
Fabrication and Testing of Optics for EUV Projection Lithography
Taylor, J.; Mar. 18, 1998; 14p; In English; SPIE annual international symposium on microlithography conference
Report No.(s): DE98-058865; UCRL-JC-128290-REV.1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

EUV Lithography (EUVL) is a leading candidate as a stepper technology for fabricating the ”0.1 (micro)m generation” of microelectronic circuits. EUVL is an optical printing technique qualitatively similar to DUV Lithography (DUVL), except that 11-13nm wavelength light is used instead of 193-248nm. The feasibility of creating 0.1(micro)m features has been well-established using small-field EUVL printing tools and development efforts are currently underway to demonstrate that cost-effective production equipment can be engineered to perform full-width ring-field imaging consistent with high wafer throughput rates. Ensuring that an industrial supplier base will be available for key components and subsystems is crucial to the success of EUVL. In particular, the projection optics are the heart of the EUVL imaging system, yet they have figure and finish specifications that are beyond the state-of-the-art in optics manufacturing. Thus it is important to demonstrate that industry will be able to fabricate and certify these optics commensurate with EUVL requirements. Indeed, the goal of this paper is to demonstrate that procuring EUVL projection optical substrates is feasible. This conclusion is based on measurements of both commercially-available and developmental substrates. The paper discusses EUVL figure and finish specifications, followed by examples of ultrasmooth and accurate surfaces, and concludes with a discussion of how substrates are measured and evaluated.
NTIS
Extreme Ultraviolet Radiation; Beams (Radiation); Lithography; Optical Equipment

19990042401 NASA Lewis Research Center, Cleveland, OH USA
Effect of Helical Slow-Wave Circuit Variations on TWT Cold-Test Characteristics
Kory, Carol L., Analex Corp., USA; Dayton, James A., Jr., NASA Lewis Research Center, USA; IEEE Transactions on Electron Devices; April 1998; ISSN 0018-9383; Volume 45, No. 4, pp. 972-976; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Recent advances in the state of the art of computer modeling offer the possibility for the first time to evaluate the effect that slow-wave structure parameter variations, such’as manufacturing tolerances, have on the cold-test characteristics of helical traveling-wave tubes (TWT’s). This will enable manufacturers to determine the cost effectiveness of controlling the dimensions of the component parts of the TWT, which is almost impossible to do experimentally without building a large number of tubes and controlling several parameters simultaneously. The computer code MAxwell’s equations by the Finite Integration Algorithm (MAFIA) is used in this analysis to determine the effect on dispersion and on-axis interaction impedance of several helical slow-wave circuit parameter variations, including thickness and relative dielectric constant of the support rods, tape width, and height

of the metallized films deposited on the dielectric rods. Previous computer analyzes required so many approximations that accurate determinations of the effect of many relevant dimensions on tube performance were practically impossible.
Author
Circuits; Traveling Wave Tubes; Computerized Simulation; Helical Flow

19990042403 NASA Lewis Research Center, Cleveland, OH USA
Accurate Cold-Test Model of Helical TWT Slow-Wave Circuits
Kory, Carol L., Analex Corp., USA; Dayton, James A., Jr., NASA Lewis Research Center, USA; IEEE Transactions on Electron Devices; April 1998; ISSN 0018-9383; Volume 45, No. 4, pp. 966-971; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Recently, a method has been established to accurately calculate cold-test data for helical slow-wave structures using the three-dimensional (3-D) electromagnetic computer code, MAxwell's equations by the Finite Integration Algorithm (MAFIA). Cold-test parameters have been calculated for several helical traveLing-wave tube (TWT) slow-wave circuits possessing various support rod configurations, and results are presented here showing excellent agreement with experiment. The helical models include tape thickness, dielectric support shapes and material properties consistent with the actual circuits. The cold-test data from this helical model can be used as input into large-signal helical TWT interaction codes making It possible, for the first time, to design complete TWT via computer simulation.
Author
Circuits; Computerized Simulation; Traveling Wave Tubes; Wave Propagation; Attenuation; Wave Attenuation; Impedance

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.

19990041149 NASA Goddard Space Flight Center, Greenbelt, MD USA
Investigation of the Temperature Hysteresis Phenomenon of a Loop Heat Pipe
Kaya, Tarik, National Academy of Sciences - National Research Council, USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Hoang, Triem, TTH Research, Inc., USA; Cheung, Mark K., Naval Research Lab., USA; 1999; 14p; In English; 33rd; National Heat Transfer, 15-17 Aug. 1999, Albuquerque, NM, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The temperature hysteresis phenomenon of a Loop Heat Pipe (LHP) was experimentally investigated. The temperature hysteresis was identified by the fact that the operating temperature depends upon not only the imposed power but also the previous history of the power variation. The temperature hysteresis could impose limitations on the LHP applications since the LHP may exhibit different steady-state operating temperatures at a given power input even when the condenser sink temperature remains unchanged. In order to obtain insight to this phenomenon, a LHP was tested at different elevations and tilts by using an elaborated power profile. A hypothesis was suggested to explain the temperature hysteresis. This hypothesis explains well the experimental observations. Results of this study provide a better understanding of the performance characteristics of the LHPS.
Author
Hysteresis; Operating Temperature; Heat Pipes; Experimentation

19990041158 Boeing Co., Canoga Park, CA USA
Laser Velocimeter Measurements of the Flow Within a Vane-Island Diffuser
Ferguson, Thomas V., Boeing Co., USA; Guinzburg, Adiel, Boeing Co., USA; McGlynn, Robert D., Boeing Co., USA; Brozowski, Laura A., Boeing Co., USA; 1999; In English; 3rd; Joint Fluids Engineering, 18-23 Jul. 1999, San Francisco, CA, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): NAS8-40000
Report No.(s): FEDM99-6985; Copyright; Avail: Issuing Activity (ASME), Hardcopy, Microfiche

A series of detailed non-intrusive laser velocimeter flow field surveys were performed to validate computational fluid dynamic (CFD) codes for rotating pump components. Three component laser-2-focus (L2F) laser velocimetry was used to acquire data within a flow passage of a diffuser at design flow conditions. The thirteen vane-island type diffuser was designed to allow diffusion in the axial direction. Multiple laser velocimeter surveys were performed throughout several diffuser passages and at multiple diffuser depths (hub to shroud). The axial (3D) component of the velocity at all locations was small. The radial and meridional velocity components nearest the diffuser hub increased in magnitude relative to the flow nearest the shroud as the flow prog-

ressed through the diffuser. A continuity check across the diffuser throat and based on the meridional velocity component yielded a match with a facility flow meter of 98.0%.
Author
Nonintrusive Measurement; Laser Doppler Velocimeters; Computational Fluid Dynamics; Radial Velocity

19990041179 Bettis Atomic Power Lab., West Mifflin, PA USA
Development of a scattering probability method for accurate vapor fraction measurements by neutron radiography, Revision 1
Joo, H.; Glickstein, S. S.; Dec. 31, 1998; 13p; In English; 3rd; Neutron radiography
Report No.(s): DE99-000482; WAPD-T-3142-REV.1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent test results indicated drawbacks associated with the simple exponential attenuation method (SEAM) as currently applied to neutron radiography measurements to determine vapor fractions in a hydrogenous two- phase flow in a metallic conduit. The scattering component of the neutron beam intensity exiting the flow system is not adequately accounted for by SEAM, and this leads to inaccurate results. to properly account for the scattering effect, a neutron scattering probability method (SPM) is developed. The method applies a neutron-hydrogen scattering kernel to scattered thermal neutrons that leave the incident beam in narrow conduits but eventually show up elsewhere in the measurements. The SPM has been tested with known vapor (void) distributions within an acrylic disk and a water/vapor channel. The vapor (void) fractions deduced by SPM are in good agreement with the known exact values. Details of the scattering correction method and the test results are discussed.
NTIS
Probability Theory; Neutron Scattering; Neutron Radiography; Water Vapor

19990041253 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Studying Turbulence Using Numerical Simulation Databases, No. 7, Proceedings of the Summer Program
Studying Turbulence Using Numerical Simulation Databases; November 1998; 422p; In English; 7th; Studying Turbulence Using Numerical Simulation Databases, 5-31 Jul. 1998, Stanford, CA, USA; Sponsored by NASA Ames Research Center, USA; See also 19990041254 through 19990041279
Contract(s)/Grant(s): NCC2-460; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The Seventh Summer Program of the Center for Turbulence Research took place in the four-week period, July 5 to July 31, 1998. This was the largest CTR Summer Program to date, involving thirty-six participants from the U. S. and nine other countries. Thirty-one Stanford and NASA-Ames staff members facilitated and contributed to most of the Summer projects. A new feature, and perhaps a preview of the future programs, was that many of the projects were executed on non-NASA computers. These included supercomputers located in Europe as well as those operated by the Departments of Defense and Energy in the United States. In addition, several simulation programs developed by the visiting participants at their home institutions were used. Another new feature was the prevalence of lap-top personal computers which were used by several participants to carry out some of the work that in the past were performed on desk-top workstations. We expect these trends to continue as computing power is enhanced and as more researchers (many of whom CTR alumni) use numerical simulations to study turbulent flows. CTR's main role continues to be in providing a forum for the study of turbulence for engineering analysis and in facilitating intellectual exchange among the leading researchers in the field. Once again the combustion group was the largest. Turbulent combustion has enjoyed remarkable progress in using simulations to address increasingly complex and practically more relevant questions. The combustion group's studies included such challenging topics as fuel evaporation, soot chemistry, and thermonuclear reactions. The latter study was one of three projects related to the Department of Energy's ASCI Program (www.llnl.gov/asci); the other two (rocket propulsion and fire safety) were carried out in the turbulence modeling group. The flow control and acoustics group demonstrated a successful application of the so-called evolution algorithms which actually led to a previously unknown forcing strategy for jets yielding increased spreading rate. A very efficient algorithm for flow in complex geometries with moving boundaries based on the immersed boundary forcing technique was tested with very encouraging results. Also a new strategy for the destruction of aircraft trailing vortices was introduced and tested. The Reynolds Averaged Modeling (RANS) group demonstrated that the elliptic relaxation concept for RANS calculations is also applicable to transonic flows with shocks; however, prediction of laminar/turbulent transition remains an important pacing item. A large fraction of the LES effort was devoted to the development and testing of a new algorithmic procedure (as opposed to phenomenological model) for subgrid scale modeling based on regularized de-filtering of the flow variables. This appears to be a very promising approach, and a significant effort is currently underway to assess its robustness in high Reynolds number flows and in conjunction with numerical methods for complex flows. As part of the Summer Program two review tutorials were given on Turbulent structures in hydrocarbon pool fires (Sheldon Tieszen), and Turbulent combustion modeling: from RANS to LES via DNS (Luc Vervisch); and two seminars entitled Assessment

of turbulence models for engineering applications (Paul Durbin) and Subgrid-scale modeling for non-premixed, turbulent reacting flows (James Riley) were presented. A number of colleagues from universities, government agencies, and industry attended the final presentations of the participants on July 31 and participated in the discussions. There are twenty-six papers in this volume grouped in five areas. Each group is preceded with an overview by its coordinator.
Derived from text
Direct Numerical Simulation; Large Eddy Simulation; Turbulent Flow; Turbulent Combustion; Mathematical Models; Computerized Simulation; Conferences; Navier-Stokes Equation; Reacting Flow; Turbulent Flames; Turbulence Models; Scaling Laws

19990041258 La Sapienza Univ., Dept. of Mechanics and Aeronautics, Rome, Italy
LES in Complex Geometries using Boundary Body Forces
Verzicco, R., La Sapienza Univ., Italy; Mohd-Yusof, J., Stanford Univ., USA; Orlandi, P., La Sapienza Univ., Italy; Haworth, D., General Motors Technical Center, USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 171-186; In English; See also 19990041253
Contract(s)/Grant(s): N68171-98-M-5645; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A numerical method is presented which can simulate flows in complex geometries with moving boundaries while still retaining all the advantages and the efficiency of solving the Navier-Stokes equations on cylindrical grids. The boundary conditions are applied independently of the grid by assigning body forces over surfaces that need not coincide with coordinate lines. The method has been validated by a large-eddy simulation of the flow in a motored axisymmetric piston-cylinder assembly for which experimental measurements are available. The comparison of the results has shown a very good agreement for mean and rms velocity profiles, thus confirming the accuracy of the present approach. This numerical method, in addition, runs on a small PC-like workstation ten times faster than corresponding simulations on supercomputers. In large-eddy simulations the dynamic subgrid-scale model is very efficient in combination with the body force procedure because it automatically accounts for the walls without requiring ad hoc damping functions. This feature is very useful in the present approach since the body surface in general does not coincide with a coordinate line and the computation of the wall distance is time consuming.
Author
Large Eddy Simulation; Dynamic Models; Boundary Conditions; Computerized Simulation; Navier-Stokes Equation; Axisymmetric Flow

19990041259 University of Southern California, Los Angeles, CA USA
A Subgrid-Scale Estimation Model Applied to Large Eddy Simulations of Compressible Turbulence
Domaradzki, J. A., University of Southern California, USA; Dubois, T., Stanford Univ., USA; Honein, A., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 351-366; In English; See also 19990041253
Contract(s)/Grant(s): NSF CTS-97-04728; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A subgrid-scale estimation procedure investigated previously for incompressible turbulence is extended to compressible flows. The procedure provides an estimate of the unfiltered velocity field and temperature appearing in the expressions for the subgrid-scale stress tensor and heat flux. The procedure in the physical space representation is applied to the compressible equations, which are written in a conservative form using sixth-order finite difference compact schemes for the approximation of the spatial derivatives. Two compressible flows are considered in this investigation: spatially decaying turbulence and shock/turbulence interaction. A priori analysis and actual large eddy simulations for both flows have been performed and a good agreement with filtered direct numerical simulations results has been obtained.
Author
Compressible Flow; Turbulent Flow; Large Eddy Simulation; Shock Wave Interaction; Turbulent Diffusion; Mathematical Models

19990041261 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Evolution Strategies for Parameter Optimization in Jet Flow Control
Koumoutsakos, P., Stanford Univ., USA; Freund, J., California Univ., USA; Parekh, D., Georgia Inst. of Tech., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 121-132; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present results from the application of evolution strategies for parameter optimization in direct numerical simulations and vortex models of controlled jet flows. It is shown that evolution strategies are a portable, highly parallel method that can complement our physical intuition in the parameter optimization of such flows.
Author
Jet Control; Jet Mixing Flow; Optimization; Stochastic Processes; Mathematical Models; Direct Numerical Simulation; Algorithms; Parameterization

19990041262 Boeing Co., Saint Louis, MO USA
An Approach to Systems Modeling for Real-Time Control of Jet Flows
Cain, A. B., Boeing Co., USA; Bewley, T., California Univ., USA; Freund, J. B., California Univ., USA; Colonius, T., California Inst. of Tech., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 133-139; In English; See also 19990041253; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The past 25 years have seen many examples of open-loop control of jet flows with significant practical importance. During the same time, there have been tremendous developments in the area of closed-loop feedback control strategies for linear and nonlinear systems. It has been seen in many applications that coordination of control application with state measurements in the closed-loop setting is essential for optimum system performance. Thus, the possibility of feedback control of flow systems such as turbulent jets should be carefully examined. However, such control problems also pose technical difficulties as turbulent flow systems are multi-scale and difficult to compute with a high degree of fidelity. Thus, the present work explores the development of low-order system models for use in the feedback control framework for the jet control problem. The present work is part of a collaboration involving Georgia Tech, Stanford University, UCLA, UCSD, and The Boeing Company under the support of the Air Force Office of Scientific Research. to design feedback control algorithms, it is very useful to have a simple model that accurately captures the relevant physics of the phenomena under consideration. Such a model, which should have sufficient simplicity to enable real-time state estimation, is developed in the present work using linear stability theory to model the initial development of the instabilities leading to the turbulent breakdown of a jet. Direct numerical simulations of turbulent jets carried out by Freund et al. (1998) will be used as validation for these models; when performed properly, such simulations can capture the relevant flow physics ”exactly”, albeit at a very large computational expense. System identification techniques may also be used (instead of linear stability theory) to develop input-output system models of jets for use in the feedback control setting, as explored by Ikeda (1998). Such models may be constructed without any reference to the equations which govern or approximate the flow physics. The present work is an intermediate-level approach that uses inviscid linear stability theory to approximate the jet system. A key feature of the present work is a piecewise quadratic approximation of the mean flow that permits rapid solution of the equations. The authors acknowledge the careful work of Pal (1998) in deriving the stability equations used.
Derived from text
Jet Control; Systems Stability; Feedback Control; State Estimation; Turbulent Jets; Turbulent Flow; Inviscid Flow; Shear Layers; Mathematical Models

19990041263 Institut de Recherche sur les Phenomenes Hors d’Equilibre, Marseille, France
Mode Interaction in a Forced Homogeneous Jet at Low Reynolds Numbers
Danaila, I., Institut de Recherche sur les Phenomenes Hors d’Equilibre, France; Boersma, B. J., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 141-158; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The near-field evolution of a forced axisymmetric jet was investigated by means of Direct Numerical Simulation (DNS). The numerical configuration simulated a low Reynolds number jet (Re(sub D) = 1500) issuing from a circular orifice in a solid wall. Periodic streamwise velocity disturbances were applied at the nozzle. Four modal distributions of forcing were studied. The first and the second type of perturbation contained only one of the two fundamental instability modes of the round jet: the axisymmetric m = 0 mode and the helical m = 1 mode. A ’classical’ evolution of the jet flow was obtained for these cases. This provided a reference to the third case, which consisted of forcing simultaneously the counter-rotating helical modes m = +/- 1 with the same amplitude and the same frequency (flapping mode). The jet split into two branches, taking a distinct ’Y’ shape characteristic of the bifurcating jets. A different evolution of the bifurcating jet is observed when superposing the axisymmetric mode, at the most amplified unstable frequency, with the flapping mode, with the same amplitude but with subharmonic frequency. This combination led to resonant growth of the jet with a spectacular increase of the spreading angle up to 90 deg.
Author
Jet Flow; Turbulent Jets; Coupled Modes; Perturbation; Flow Distribution; Direct Numerical Simulation; Flow Stability; Velocity Distribution

19990041267 Arizona Univ., Tucson, AZ USA

Evaluation of the Statistical Rayleigh-Ritz Method in Isotropic Turbulence Decay

Eyink, G. L., Arizona Univ., USA; Wray, A., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 209-220; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A Rayleigh-Ritz method for calculating the statistics of nonlinear dynamical systems is tested against LES data for homogeneous and isotropic decay of turbulence. The comparisons in this work are of 2-point, 2-time Eulerian velocity correlators. At this level, the Rayleigh-Ritz predictions are formally realized by a linear Langevin model for the fluctuation variables. We study how well standard K-epsilon models that are adequate to describe the decay of ensemble means can also predict the decay of fluctuations. In addition to such standard RANS closures, we also consider some spatially nonlocal and temporally non-Markovian models, which include scale-dependent eddy viscosities and convective sweeping in Fourier space.

Author

Rayleigh-Ritz Method; Dynamical Systems; Isotropic Turbulence; K-Epsilon Turbulence Model; Langevin Formula; Turbulent Diffusion; Large Eddy Simulation; Mathematical Models

19990041268 Technische Hochschule, Inst. fuer Technische Mechanik, Aachen, Germany

Group Analysis, DNS and Modeling of a Turbulent Channel Flow with Streamwise Rotation

Oberlack, M., Technische Hochschule, Germany; Cabot, W., Stanford Univ., USA; Rogers, M. M., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 221-242; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The turbulent channel flow with streamwise rotation has been investigated by means of several different analytical, numerical, and modeling approaches. Lie group analysis of the two-point correlation equations led to linear scaling laws for the streamwise mean velocity. In addition it was found that a cross flow in spanwise direction is induced, which may also exhibit a linear region. By further analysis of the two-point correlation equation, it is shown that all six components of the Reynolds stress tensor are non-zero. In addition, certain symmetries and skew-symmetries about the centerline have been established for all flow quantities. All the latter findings of the analysis have been very well verified by means of direct numerical calculations. The flow has also been tackled by LES and second-moment closure models. The dynamic LES captured most of the theoretical and DNS findings quantitatively. The second-moment closure model was able to capture most of the basic trends, but any quantitative agreement could not be achieved.

Author

Lie Groups; Direct Numerical Simulation; Large Eddy Simulation; Turbulent Flow; Channel Flow; Mathematical Models

19990041269 Universite Catholique de Louvain, Center for Systems Engineering and Applied Mechanics, Belgium

Testing of a New Mixed Model for LES: The Leonard Model Supplemented by a Dynamic Smagorinsky Term

Winckelmans, G. S., Universite Catholique de Louvain, Belgium; Wray, A. A., Stanford Univ., USA; Vasilyev, O. V., Missouri Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 367-388; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new mixed model which uses the Leonard expansion (truncated to one term) supplemented by a purely dissipative term (dynamic Smagorinsky) has been developed and tested in actual Large Eddy Simulations (LES) of decaying homogeneous turbulence and of channel flow. This model assumes that the LES filter is smooth in wave space, which is the case of most filters defined in physical space (e.g., top hat, Gaussian, discrete filters). The dynamic procedure has been extended for the mixed model. It is used to determine the model coefficient, C, for the added Smagorinsky term. The one-term Leonard model provides significant local backscatter while remaining globally dissipative. In a priori testing, its correlation with DNS is greater than 0.9. However, when used on its own in actual LES, this model is found to provide too little dissipation. Hence the need for added dissipation, here provided by the dynamic Smagorinsky term. In 64(exp 3) LES of decaying homogeneous turbulence started from Gaussian filtered 256(exp 3) DNS at Re(sub lambda) is approx. = 90, the new mixed dynamic model performs significantly better than the dynamic Smagorinsky model with same Gaussian filtering; it also outperforms the dynamic Smagorinsky model with sharp cutoff filtering: much better energy spectra, much better energy and enstrophy decay. For the preliminary 48(exp 3) LES runs on the channel flow at Re(sub tau) = 395 done with smooth LES filtering (Gaussian in the homogeneous directions, top hat in the non-homogeneous direction), the mixed dynamic model is also superior to the dynamic Smagorinsky model. However, the dynamic Sma-

gorinsky model with sharp cutoff test filtering in the homogeneous directions still produces a better mean velocity profile. This result calls for further investigations.
Author
Channel Flow; Dynamic Models; Energy Spectra; Homogeneous Turbulence; Large Eddy Simulation; Velocity Distribution; Mathematical Models; Dissipation

19990041270 Universite Joseph Fourier, LMC-IMAG, Grenoble, France
Comparison of Dynamic Smagorinsky and Anisotropic Subgrid-Scale Models
Cottet, Georges-Henri, Universite Joseph Fourier, France; Vasilyev, Oleg V ., Missouri Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 389-397; In English; See also 19990041253; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

LES models using dynamically computed coefficient values have been extensively used since the pioneering work of Germano. Starting from the Smagorinsky subgrid-scale model, the common idea to all these models is to extrapolate the information on the resolved fields at two scale levels to compute optimal coefficient values. A simple solution to the integral equations which follow from this approach can be obtained by restricting the test filter action to certain directions and assuming that the model coefficient only varies along the orthogonal directions. The coefficient values are then derived from simple least-square formulas. The resulting global dynamic model has been successfully used for a number of flows having at least one direction of homogeneity. For more general flows, the brute force solution of the integral equations may lead to persistent local negative values, which have a destabilizing effect on the numerical solver. Clipping these values lead to discard up to 50% of the coefficients. Moreover, local large values of the coefficient require an implicit treatment of the eddy viscosity term to avoid prohibitively small time-steps. Ghosal et al. have proposed two models to address this issue. In the first one the positivity of the coefficient is rigorously constrained in the integral equation. In the second one, negative coefficient values are allowed, but the model is supplemented by a transport equation for the subgrid-scale kinetic energy. These techniques do alleviate the restrictions of the global dynamic model, but at the expense of a significant computational overhead. Our work here has been motivated by practical considerations. It seems clear that the difficulties associated with the solution of integral equations in the dynamic Smagorinsky model would be avoided if the variations of the coefficient over a scale of the order of the grid-size could be assumed to be small. This, in turn, requires that the underlying subgrid-scale model is well-conditioned for the dynamic procedure, or, in other words, has good correlation properties. It is well known that this is not the case for the Smagorinsky model. Leonard's expansion of the subgrid-scale residual stress, by contrast, is known to have very good correlation properties. Its drawback in actual implementations is that it contains backscatter as well as dissipation. The backscatter control strategies which have been proposed so far do not allow it to retain its anisotropic features and thus are inefficient. This explains why this model is in general complemented by Smagorinsky model in so-called mixed models. In 1997 we proposed a simple grid-implementation of Leonard's expansion which enables a truly anisotropic backscatter control. Tests with constant coefficients for homogeneous isotropic turbulence as well as in channel flow geometry showed that this model performs better than the Smagorinsky model. In particular, unlike the Smagorinsky model, it has the property of vanishing in laminar regimes and solid boundaries. Moreover, the specific backscatter control enabled by the grid formulas overcomes the lack of dissipation in general observed in the implementation of Leonard's expansion. In view of these results, we believe that this model is a good candidate for simple local dynamic implementations. In the following section we summarize the key properties of the anisotropic subgrid scale formulas and present our approach for dynamic coefficient calculations. In Section 3 we then discuss results obtained for channel flows and draw some preliminary conclusions.
Derived from text
Dynamic Models; Channel Flow; Anisotropy; Large Eddy Simulation; Backscattering; Scaling Laws; Similarity Theorem

19990041271 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Approximate Lateral Boundary Conditions for Turbulent Simulations
Jiminez, J., Stanford Univ., USA; Vasco, C., Universidad Politecnica de Madrid, Spain; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 399-412; In English; See also 19990041253
Contract(s)/Grant(s): F49620-97-0210; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Several synthetic lateral boundary conditions are tested on a direct numerical simulation in which only half of a turbulent channel is computed, with the boundary conditions being imposed at the central plane. This is motivated by the problem of matching large-eddy simulations to wall models. When the boundary contains no turbulent structure, a thin layer is created which decorrelates it from the flow, and the mean and fluctuating velocities are poorly represented. Introducing more structure, obtained by modifying velocity planes copied from the interior of the flow, improves the fluctuations, but the mean velocity profiles are still poor. This is traced to spurious pressure fluctuations which induce artificial energy fluxes, and can be partially avoided by approximately taking into account continuity in the generation of the boundary conditions. This third boundary condition gives good

results for the velocity fluctuations, but some pressure and the mean velocity errors persist. It is argued that the problem is related to that of imposing boundary conditions along characteristics in a hyperbolic system, and possible avenues for improvement are suggested.
Author
Direct Numerical Simulation; Boundary Conditions; Large Eddy Simulation; Channel Flow; Mathematical Models; Turbulent Flow

19990041272 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Boundary Conditions for LES Away from the Wall
Nicoud, F., Stanford Univ., USA; Winckelmans, G., Universite Catholique de Louvain, Belgium; Carati, D., Brussels Univ., Belgium; Baggett, J., Stanford Univ., USA; Cabot, W., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 413-422; In English; See also 19990041253; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Artificial boundary conditions for LES away from the wall have been developed with the hope of avoiding the problem of grid refinement in the wall region of the LES. In the particular example of channel flow, the main idea is to replace the natural no-slip boundary conditions (at y = 0) by artificial boundary conditions at y = y(sub 1) is greater than 0. The one-point statistics (mean velocity and turbulence intensities) of the flow at y(sub 1) are supposed to be provided externally. In practice, this information could be obtained from a RANS for the same flow. However, it is known that supplying only the one-point statistics of the velocity field is not sufficient for obtaining a reasonable core flow. The method developed here consists of building two-point statistics at the artificial boundary by using information from the core flow at y = y(sub 2) is greater than y(sub 1). In particular, the time evolution of the velocity fields at y = y(sub 1) and y = y(sub 2) are assumed to be self-similar with a time scale ratio determined dynamically during the simulation. Encouraging results for the channel flow at Re(sub tau) = 1000 have been obtained when the domain removed from the simulation (O is less than y is less than y(sub 1)) contains half of the grid points used in ”full domain” LES of the channel flow.
Author
Boundary Conditions; Channel Flow; Core Flow; Large Eddy Simulation; Computational Grids; Grid Generation (Mathematics)

19990041273 Italian Aerospace Research Center, Capua, Italy
Simulation of Rocket Motor Internal Flows with Turbulent Mass Injection
Ciucci, A., Italian Aerospace Research Center, Italy; Iaccarino, G., Stanford Univ., USA; Moser, R., Illinois Univ. at Urbana-Champaign, USA; Najjar, F., Illinois Univ. at Urbana-Champaign, USA; Durbin, P., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 245-266; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A study of flows subject to strong, turbulent fluid injection has been conducted in this work. The study included both RANS simulations of a nozzleless rocket motor to investigate the applicability of closure models to this type of flows and a DNS analysis aiming at gaining a better understanding of the flow structure near a wall with strong blowing. For the nozzleless motor simulations, both a k-E and the v(exp 2) - f turbulence models were adopted. Results indicated a strong dependence on turbulent transition; large overpredictions were obtained with free transition, but a much better agreement with the experimental data was achieved when transition was fixed. Also, a parametric study indicated only a weak dependence of the solution, in particular of the turbulent kinetic energy profiles, on the turbulent fluctuations at the wall. The DNS analysis of a ”periodic” motor with injection from two opposite walls has revealed that the streaks dominant in the conventional near-wall turbulence are not visible. Also, simulations of a channel flow with injection from one wall and suction from the other wall have been performed using the v(exp 2) - f turbulence model; comparison with available DNS data is very good.
Author
Nozzleless Rocket Engines; Internal Flow; Turbulent Flow; Fuel Injection; Turbulence Models; Direct Numerical Simulation; Applications Programs (Computers); Transition Flow

19990041274 Waterloo Univ., Ontario Canada
RANS Modeling for Compressible and Transitional Flows
Lien, F. S., Waterloo Univ., Canada; Kalitzin, G., Stanford Univ., USA; Durbin, P. A., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 267-286; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Recent LES suggested that the turbulence fluctuation in the wall-normal direction v' plays an important role in the evolution of transition. This motivates the use of v(exp 2) - f model for turbomachinery flows, in which different types of transition co-exist. An 'ad hoc' Reynolds-number-dependent term is added to C(sub epsilon 1) in the epsilon-equation in order to reduce the level of near-wall dissipation rate. As a result, the onset and length of transition are greatly improved for a moderate level of free-stream turbulence intensity. However, the peak of streamwise turbulence intensity within the transition zone is underestimated. The implication of this is that the intermittency effect needs to be incorporated into the model - for example, based on the 'conditioned Navier-Stokes equation' which splits the equation into turbulent and nonturbulent parts - in order to capture the correct physical mechanism of transition. Another objective of this study is to resolve the issue of whether the 'elliptic relaxation' model can be used for supersonic flows. The results for the RAE2822 transonic airfoil will demonstrate that a good agreement with experimental data has been achieved. This is because the pressure-strain term (f), though elliptic in nature, acts simply as a source term in the v(exp 2)(bar)-equation, which is not associated with the convection process.
Author
Applications Programs (Computers); Mathematical Models; Transition Flow; Turbulent Flow; Intermittency; Free Flow; Turbulence Models; Navier-Stokes Equation; Reynolds Averaging

19990041275 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Modeling of Natural Convection Heat Transfer
Tieszen, S., Stanford Univ., USA; Ooi, A., Stanford Univ., USA; Durbin, P., Stanford Univ., USA; Behnia, M., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 287-301; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Results from two-dimensional calculations using the v(exp 2) - f and a k - epsilon model are compared with data for two geometries, the vertical flat plate and the 5:1 height:width box with a constant temperature hot and cold side wall. The results show that the v(exp 2) - f model is at least as good as a k - epsilon model with a two-layer wall treatment. The nature of buoyancy/turbulence coupling is discussed, and three different treatments of it are compared. Preliminary results show that all three treatments have little effect on the heat transfer in fully turbulent conditions but that the generalized gradient diffusion hypothesis can make a large difference in the location of transition with the v(exp 2) - f model.
Author
Turbulence Models; Two Dimensional Models; Convective Heat Transfer; Flat Plates; Boundary Layer Flow; Transition Flow

19990041276 Electricite de France, Lab. National d'Hydraulique, Chatou, France
Assessment of Non-Local Effect on Pressure Term in RANS Modeling using a DNS Database
Manceau, R., Electricite de France, France; Wang, M., Stanford Univ., USA; Durbin, P., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 303-322; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A DNS database for the channel flow at Re(sub tau) = 590 is used to investigate the validity of the hypotheses used to model the pressure term in the Reynolds stress transport equations by elliptic relaxation. It is shown that the correlation function involving the fluctuating velocity and the Laplacian of the pressure gradient, which is modeled by an exponential function, is actually not isotropic. It is not only elongated in the streamwise direction but also asymmetric in the direction normal to the wall. This feature is the main cause for the slight amplification of the redistribution between the Reynolds stress components in the log layer as predicted by the elliptic relaxation operator. The expected reduction in redistribution is predicted by a new formulation of the model, which can be derived by accounting for the asymmetry in the correlation function, without using any wall echo correction terms. The belief that this reduction is due to the wall echo effect is called into question through the present DNS analysis.
Author
Direct Numerical Simulation; Reynolds Averaging; Navier-Stokes Equation; Mathematical Models; Reynolds Stress; Channel Flow; Pressure Effects; Turbulence Models

19990041277 Brussels Univ., Belgium
Ensemble-Averaged LES of a Time-Evolving Plane Wake
Carati, D., Brussels Univ., Belgium; Rogers, M. M., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 325-336; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The ensemble-averaged dynamic procedure (EADP) introduced during the 1996 CTR Summer Program is tested on a time-evolving plane wake, an inhomogeneous flow that is statistically non-stationary. Convergence of the results with respect to the LES ensemble size is investigated, and it is found that an ensemble of as few as 16 realizations yields accurate converged results.

New modeling concepts are tested in which quantities that explicitly require the knowledge of several realizations of the same flow are included.
Author
Large Eddy Simulation; Direct Numerical Simulation; Navier-Stokes Equation; Turbulent Wakes; Turbulence Models

19990041278 Eidgenoessische Technische Hochschule, Zurich, Switzerland
Analysis and Subgrid Modeling of Shock-Wave/Boundary-Layer Interaction
Adams, N. A., Eidgenoessische Technische Hochschule, Switzerland; Stolz, S., Eidgenoessische Technische Hochschule, Switzerland; Honein, A., Stanford Univ., USA; Mahesh, K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 337-349; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper considers two different issues that arise in LES of supersonic wall bounded flows. First, an a priori analysis of subgrid-scale models in a highly compressible environment is conducted. DNS data from a Mach 3 compression-corner are used for this purpose. Models of the scale-similarity type correlate best with filtered DNS data. Lower correlations are obtained with the dynamic mixed model, the dynamic Smagorinsky model, and the fixed-coefficient Smagorinsky model. Second, the possibility of treating the shock as a subgrid scale is investigated. It is found that a straightforward application of dynamic eddy-viscosity models is unsuccessful. A direct deconvolution is found to give a proper agreement between a 6th order spectral-like finite-difference scheme and a 5th order ENO shock-capturing scheme for the simple case of a 1D convected M = 3 shock.
Author
Shock Wave Interaction; Boundary Layer Flow; Wall Flow; Supersonic Flow; Large Eddy Simulation; Direct Numerical Simulation; Dynamic Models; Finite Difference Theory; Mathematical Models; Corner Flow

19990041450 Stanford Univ., Stanford, CA USA
Summary of Work for Joint Research Interchanges with DARWIN Integrated Product Team 1998
Hesselink, Lambertus, Stanford Univ., USA; March 1999; 13p; In English
Contract(s)/Grant(s): NCC2-5211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The intent of Stanford University's SciVis group is to develop technologies that enabled comparative analysis and visualization techniques for simulated and experimental flow fields. These techniques would then be made available under the Joint Research Interchange for potential injection into the DARWIN Workspace Environment (DWE). In the past, we have focused on techniques that exploited feature based comparisons such as shock and vortex extractions. Our current research effort focuses on finding a quantitative comparison of general vector fields based on topological features. Since the method relies on topological information, grid matching and vector alignment is not needed in the comparison. This is often a problem with many data comparison techniques. In addition, since only topology based information is stored and compared for each field, there is a significant compression of information that enables large databases to be quickly searched. This report will briefly (1) describe current technologies in the area of comparison techniques, (2) will describe the theory of our new method and finally (3) summarize a few of the results.
Author
Data Bases; Topology; Flow Distribution; Comparison; Vector Analysis

19990041882 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Stroemungsmechanik, Goettingen, Germany
Flow Field Investigations in a Turbulent Round Free Jet by Means of 3D-Laser-Doppler Anemometry ***Stroemungsfelduntersuchungen in Einem Runden Freistrahl Mittels der 3D-Laser-Doppler-Anemometrie***
Weiland, Mattias, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 1997; 104p; In German
Report No.(s): DLR-FB-97-39; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The velocity field of a turbulent round free jet ejecting in still air has been investigated by means of 3D-laser-Doppler anemometry. by conditional seeding of the jet fluid or the ambient fluid alone or both at the same time the influence of the seeding particle distribution on the measurement of the three components of velocity and the Reynolds stresses has been measured. As for all optical measurement techniques using particles as a tracer, different particle-number densities cause a biasing of the statistical weights towards the higher particle-number density components. Due to the large cross flow velocity gradients the greatest discrepancies have been found near the beginning of the shear laser. The mixing process leads to an increasing similarity of the velocity distributions of the fluid components farther downstream so that weighing with the particle-number density loses its importance. The

investigation of the different components of the flow field leads to both an insight into the mixing process and an approximation of the reliability of the measurements.
Derived from text
Flow Distribution; Turbulent Jets; Lasers; Cross Flow; Flow Velocity

19990041958 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Tip Vortex and Crenulation Effects in a Compressor Cascade with Moving Endwall
Germain, Barry W.; Mar. 1999; 122p; In English
Report No.(s): AD-A361607; AFIT/GAE/ENY/99M-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The effects of changing Reynolds number and flow coefficients on the velocity and pressure flow fields within a linear cascade with moving endwall were investigated in this experimental thesis. All flow field measurements were taken at a constant compressor blade tip gap clearance of 1.0 % chord and endwall speed of 318.6 ft/s (97.1 m/s), with flow coefficients of 0.40, 0.52, 0.62 and 0.72. All data acquisition occurred in a plane 23 % chord downstream of the trailing edge plane of the linear cascade. Hotwire probes determined the complete passage, three-dimensional flowfield behind both crenulated and regular blade geometries. Vector plots showed that the mid-span crenulations aligned the flow axially, increasing the wake mixing and reducing the spanwise flow evident in the regular blade's wake region. A total pressure rake measured the pressure flowfield behind the blades, showing that the crenulated blade geometry produced larger, less intense areas of total pressure loss than for the regular blades. Overall, the crenulated blade tested showed equal passage total pressure losses, increased wake mixing, reduced wake deficit and a reduced flow turning angle compared to a regular blade of similar overall dimensions.
DTIC
Axial Flow; Compressor Blades; Flow Distribution; Velocity Distribution; Vortices; Wakes

19990041959 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Heat Transfer to the Inclined Trailing Wall of an Open Cavity
Powell, Orval A.; Mar. 1998; 106p; In English
Report No.(s): AD-A361609; AFIT/GAE/ENY/99M-07; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Experimental and computational heat transfer investigations were performed on a cavity with an inclined trailing wall (20-degrees to the horizontal), simulating one under investigation for use in a scramjet engine. Heat transfer data are reported in the form of Stanton number obtained using a curve fit to the recorded transient surface temperature history under cold flow conditions. Ascending from the reattachment point, the Stanton number increased by nearly 50% due to flow compression. This effect of flow compression was also evident at the junction of the cavity floor and inclined trailing wall, where the Stanton number also increased by 50%. Descending from the reattachment point, the Stanton number increased by 30% due to flow recirculation. Downstream of the inclined trailing wall, the Stanton number increased by 90% due to the boundary layer-shock interaction when compared to that at the same axial location on a flat plate. A schlieren flow visualization technique was employed, showing the formation of the oblique shock from coalescing weak compression waves. For comparison, a 2-D Navier-Stokes CFD analysis was performed using a realizable k-epsilon turbulence model. In the cavity, the CFD Stanton number results were an order of magnitude lower than the experimental values, while downstream of the cavity, the CFD Stanton number results were 40% lower than the experimental results. Similar differences are noted within the open literature with application of various turbulence models, suggesting that the flow in the cavity is quite complex and the use of two equation turbulence models requires closer investigation.
DTIC
Supersonic Combustion Ramjet Engines; Computational Fluid Dynamics; Convection; Heat Transfer; Shock Wave Interaction

19990041979 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Incompressible Flows of an Ideal Fluid with Unbounded Vorticity
Vishik, M.; Nov. 1998; 44p; In English; Sponsored in part by Technical Assistance Research Programs, Inc.
Report No.(s): PB99-129595; IHES/M/98/75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
No abstract available.
NTIS
Euler-Lagrange Equation; Fluid Flow

19990042429 Department of Energy, Office of Energy Research, Washington, DC USA
Development of an electrical impedance computed tomographic two-phase flows analyzer ***Final Report***
Ovacik, L.; Jones, O. C.; Aug. 31, 1998; 514p; In English
Report No.(s): DE99-001023; DOE/ER/13032-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report summarizes the work on the research project on this cooperative program between DOE and Hitachi, Ltd. Major advances were made in the computational reconstruction of images from electrical excitation and response data with respect to existing capabilities reported in the literature. A demonstration is provided of the imaging of one or more circular objects within the measurement plane with demonstrated linear resolution of six parts in two hundred. At this point it can be said that accurate excitation and measurement of boundary voltages and currents appears adequate to obtain reasonable images of the real conductivity distribution within a body and the outlines of insulating targets suspended within a homogeneous conducting medium. The quality of images is heavily dependent on the theoretical and numerical implementation of imaging algorithms. The overall imaging system described has the potential of being both fast and cost effective in comparison with alternative methods. The methods developed use multiple plate-electrode excitation in conjunction with finite element block decomposition, preconditioned voltage conversion, layer approximation of the third dimension and post processing of boundary measurements to obtain optimal boundary excitations. Reasonably accurate imaging of single and multiple targets of differing size, location and separation is demonstrated and the resulting images are better than any others found in the literature. Recommendations for future effort include the improvement in computational algorithms with emphasis on internal conductivity shape functions and the use of adaptive development of quadrilateral (2-D) or tetrahedral or hexahedral (3-D) elements to coincide with large discrete zone boundaries in the fields, development of a truly binary model and completion of a fast imaging system. Further, the rudimentary methods shown herein for three-dimensional imaging need improving.
NTIS
Electrical Impedance; Two Phase Flow; Computer Aided Tomography; Flow Visualization

35
INSTRUMENTATION AND PHOTOGRAPHY

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

19990041515 NASA Langley Research Center, Hampton, VA USA
First International Symposium on Strain Gauge Balances, Pt. 1
Tripp, John S., Editor, NASA Langley Research Center, USA; Tcheng, Ping, Editor, NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999; 443p; In English; 1st, 22-25 Oct. 1996, Hampton, VA, USA; Sponsored by NASA, USA; See also 19990041516 through 19990041541
Contract(s)/Grant(s): RTOP 992-35-12-18
Report No.(s): NASA/CP-1999-209101/PT1; L-17809A; NAS 1.55:209101/PT1; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

The first International Symposium on Strain Gauge Balances was sponsored and held at NASA Langley Research Center during October 22-25, 1996. The symposium provided an open international forum for presentation, discussion, and exchange of technical information among wind tunnel test technique specialists and strain gauge balance designers. The Symposium also served to initiate organized professional activities among the participating and relevant international technical communities. Over 130 delegates from 15 countries were in attendance. The program opened with a panel discussion, followed by technical paper sessions, and guided tours of the National Transonic Facility (NTF) wind tunnel, a local commercial balance fabrication facility, and the LaRC balance calibration laboratory. The opening panel discussion addressed ”Future Trends in Balance Development and Applications.” Forty-six technical papers were presented in 11 technical sessions covering the following areas: calibration, automatic calibration, data reduction, facility reports, design, accuracy and uncertainty analysis, strain gauges, instrumentation, balance design, thermal effects, finite element analysis, applications, and special balances. At the conclusion of the Symposium, a steering committee representing most of the nations and several U.S. organizations attending the Symposium was established to initiate planning for a second international balance symposium, to be held in 1999 in the UK.
Author
Conferences; Strain Gage Balances; Wind Tunnel Tests; Wind Tunnel Apparatus; Weight Indicators

19990041516 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Calibration of Multicomponent Strain Gauge Balances Using Method of Optimum Experiment Planning
Krivoruchenko, Vladimir S., Tsentralni Aerogidrodinamicheskii Inst., Russia; Panchenko, Ivan N., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 1-5; In English; See also 19990041515; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Let's consider under the term, calibration of aerodynamic balances, the experiment aimed to search for a functional relation between loads applied to balances and readings of measuring equipment. The goal of this experiment is an attainment of operational calibration formulas of balances having a nominated precision at a maximum reduction of a total time for calibration, i.e. reduction of a total number of loading combinations. The totality of all loading combinations. applied within one calibration, we will name the plan of an experiment. The traditional methodology of multicomponent aerodynamic balances calibration conduction comprises doubled conduction of single calibrations for each component. Readings are taken during direct and inverse loading processes in differently located points. Using results of single calibrations main coefficients and terms describing influence of separate components are determined. For the determination of corrections from twin interactions additional calibrations with additional loadings are conducted. As its disadvantage may be considered long duration and difficulty of calibrations since as a result the main part of experimental data does not include considerable information for getting coefficients in operation formulas. Besides that, during calibration using traditional methodology there is not envisaged calculation of coefficients reflecting interactions of more higher orders. There are existing methodologies of calibrations conduction based on application of arbitrary combinations of loads with consequent results procession using least square method.
Derived from text
Aerodynamic Balance; Calibrating; Experiment Design; Strain Gage Balances; Least Squares Method; Matrices (Mathematics)

19990041517 Technische Hochschule, Dept. of Aerodynamics and Measuring Techniques, Darmstadt, Germany
The Development of a Modern Manual Calibration and Measuring System for Internal Balances
Quade, Matthias, Technische Hochschule, Germany; Hufnagel, Klaus, Technische Hochschule, Germany; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 7-17; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Calibration of internal wind tunnel balances is a time consuming task. Therefore several approaches have been made to automate the process. Nevertheless there are facilities with few balances that do not need (or cannot afford) an automatic calibration machine. Those facilities do still have a need for manual calibration procedures. Many have purchased calibration software from the balance manufacturer, others have written their own procedures and some will work forever with the matrices that came along with the balance and never recalibrate the instrument. This paper presents a manual calibration and measuring software that was developed with the following goals in mind: (1) All routines necessary for a calibration should be in one program; (2) User friendly interface (GUI); (3) Extensive on-line help; (4) Extensive error checking and mistake avoiding; (5) Quick look for calibration results; (6) Exchangeable data format; (7) Interface to an existing matrix calculation program; (8) Reuse data acquisition software for wind tunnel measurements; (9) Software should run on a widespread hardware and software platform.
Author
Calibrating; Software Engineering; Weight Indicators; Wind Tunnel Apparatus; Computer Programs

19990041518 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Transformation of Aerodynamic Balances Formulas to the Resolved Respecting to Loading Form
Panchenko, Ivan N., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 19-28; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents a method of invention of formulas of multi-component strain gauge balances which permits one to obtain formulas of strain gauge balances with invention error, which does not exceed (1...3) * 10(exp -2)% for the range of components. For balances which have mean square errors of (0.1...0.3)%, invention error practically does not influence summary error of strain gauge balances' formulas.
Derived from text
Aerodynamic Balance; Mean Square Values; Strain Gage Balances; Least Squares Method; Instrument Errors

19990041519 Micro Craft, Inc., San Diego, CA USA
Limitations of Internal Balance Calibration Math Models for Simulating Multicomponent Interactions
Crooks, Richard S., Micro Craft, Inc., USA; Zwan, Allen, Micro Craft, Inc., USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 29-40; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Multi-component internal force and moment balances have been utilized in wind tunnels for over 50 years as the primary measurement instrument for defining aerodynamic performance. Designs for these instruments have evolved to meet increasing accuracy requirements. However, much less has been done to improve the processes used to calibrate these important instruments. Conventional wind tunnel test applications require that the balance perform in a 6 degree of freedom environment; yet standard calibration processes characterize the balance using primarily single, two or in very limited cases, three combined loads. Addition-

ally, the common practice is to use matrix based math models representing only two combined load terms. Data acquired from a number of different balances and from both manual and automatic calibration processes will be presented. The data suggests that second order combined load characterizations described by standard error of the curve fit statistics are not indicative when used to predict performance under combined load conditions outside the calibration envelope. There is substantial opportunity to reduce uncertainty (improve the quality and robustness of the calibration) by tailoring the loading combinations and including higher order combined load terms in the math model when interactions and non-linearity's are present.
Author
Calibrating; Mathematical Models; Robustness (Mathematics); Wind Tunnel Apparatus; Weight Indicators; Statistical Analysis

19990041520 Daimler-Benz Aerospace A.G., Bremen, Germany
Design and Construction of Internal Balances for the German/Netherlands Wind Tunnel (DNW)
Graewe, Eberhard, Daimler-Benz Aerospace A.G., Germany; Ewald, Bernd, Technische Hochschule, Germany; Eckert, D., German-Dutch Wind Tunnel, Netherlands; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 41-52; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The German-Netherlands Wind Tunnel (DNW) is a modern large atmospheric Low Speed Wind Tunnel. The tunnel is equipped with a six component external balance and with a tail sting mounting. During the construction period of this tunnel in 1978 a request for proposal for an Internal Balance was published and in 1984 and 1989 two additional balances were purchased. For all three balances VFW in Bremen (now Daimler Benz Aerospace, Deutsche Airbus GmbH) was awarded the contract. These balances were a large step forward with respect to size, ranges and required accuracy. The technology of the electron beam welded balance, invented at VFW, was used in the design and fabrication of the balances. The first balance (designated W 605) had conventional cone joints for sting and model attachment. The two other balances (designated W 608 and W 616) were designed with flange joints. The large size of these balances allowed the application of rather large strain gages. This resulted in excellent stability of measurements. Combined with the excellent stability and accuracy of the signal acquisition electronics of the DNW thermal effects were observed. The influence of spatial thermal gradients reduced the accuracy. So as a combined effort of VFW and DNW some research on correction of thermal effects was performed. The result, finally, was a force measuring technology for the DNW with outstanding accuracy and reliability.
Author
Strain Gages; Wind Tunnel Apparatus; Weight Indicators; Calibrating; Temperature Effects

19990041521 China Aerodynamics Research and Development Center, Mianyang, China
Recent Advances of Wind Tunnel Balance Techniques in CARDC
He, De-Xin, China Aerodynamics Research and Development Center, China; Gu, Xing-Ruo, China Aerodynamics Research and Development Center, China; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 53-81; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper gives a brief introduction to the different kinds of wind tunnel balances, and calibration machines in use at the China Aerodynamics Research and Development Center (CARDC). The applications of these machines is also reviewed.
Derived from text
Calibrating; Weight Indicators; Wind Tunnel Apparatus

19990041522 Sverdrup Technology, Inc., Arnold Engineering Development Center Group, Arnold AFS, TN USA
The AIAA/GTTC Internal Balance Technology Working Group
Cahill, David M., Sverdrup Technology, Inc., USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 83-92; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A working group on internal balance technology has been formed under the auspices of the Ground Testing Technical Committee (GTTC) of the American Institute of Aeronautics and Astronautics (AIAA) to share information on and experiences with all facets of internal balances and develop standards that could be used to allow the facilities to work together to advance the state-of-the-art. The working group's membership consists primarily of individuals from organizations that calibrate and use internal balances. The working group has made excellent progress in three areas: the exchange of information, which requires developing open communications and trust among the member organizations, is flourishing and has had a major impact on the achievements made by the working group; documentation of the balance technology in use at the member organizations; and the establishment of standards for balance nomenclature, axis system, reporting, and an interim standard for a calibration matrix. These efforts will benefit the wind tunnel testing community as a whole through the standardization of balance calibration, USAge, terminology,

and uncertainty estimation. The standards will improve understanding and communication between facilities as well as the quality of the test data.
Author
Organizations; Standardization; Wind Tunnel Apparatus; Technology Transfer; Strain Gage Balances

19990041523 National Aerospace Lab., Emmeloord, Netherlands
Strain Gauge Balance Development at NLR
Vos, H. B., National Aerospace Lab., Netherlands; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 93-104; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The National Aerospace Laboratory (NLR) has developed and manufactured strain gauge balances for more than thirty years. All types of balances were developed, not only for NLR tunnels and models but also for many customers and other research institutes. Through the years new techniques and new materials became available. In order to raise the overall accuracy of balance measurements the total process of balance design, manufacture and calibration has been reviewed. Based on extensive investigations many design criteria for the various parts of the balances have been modified and brought in to practice. This paper summarizes the state of the art of balance technology at NLR.
Author
Accuracy; Design Analysis; Strain Gage Balances; Measuring Instruments

19990041524 NASA Langley Research Center, Hampton, VA USA
NASA Langley Research Center Force and Strain Measurement Capabilities
Roberts, Paul W., NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 105-114; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Direct measurements of forces and moments are some of the most important data acquired during aerodynamic testing. This paper deals with the force and strain measurement capabilities at the Langley Research Center (LaRC). It begins with a progressive history of LaRC force measurement developments beginning in the 1940's and ends with the center's current capabilities. Various types of force and moment transducers used at LaRC are discussed including six-component sting mounted balances, semi-span balances, hinge moment balances, flow-through balances, rotor balances, and many other unique transducers. Also discussed are some unique strain-gage applications, such as those used in extreme environments. The final topics deal with the LaRC's ability to perform custom calibrations and our current levels of effort in the area of force and strain measurement.
Author
Strain Gages; Strain Measurement; Strain Gage Balances; Wind Tunnel Apparatus; Aerodynamic Forces; Stability Derivatives

19990041525 Technische Hochschule, Darmstadt, Germany
The Half Model Balance for the Cologne Cryogenic Tunnel (KKK)
Ewald, Bernd, Technische Hochschule, Germany; Viehweger, G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Rebstock, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 115-126; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Cologne Cryogenic Tunnel, better known as KKK, is a Low Speed Atmospheric Wind Tunnel working at temperatures from ambient down to 100 K. The test section size is 2.4 by 2.4 meters. The tunnel has the Reynolds number capability of a highly pressurized tunnel of the same size. The tunnel allows Reynolds number excursions at constant Mach number without change in dynamic pressure, so there are no model deformation effects. With this simulation capability the tunnel will be highly useful for Reynolds Number testing during the high lift system development of transport airlines. This capability may be improved even more by the use of half models. In conventional tunnels the half model technique is successfully and routinely used in the Airbus development wind tunnel test programs. The typical design of compact half model balances leads to a high sensitivity against temperature effects, so a very careful design of the half model mounting system is necessary to get the required high accuracy and repeatability with half models. In co-operation of the DLR and the Technical University of Darmstadt a half model mounting and measuring system was developed and constructed. The Technical University of Darmstadt was responsible for the balance design and manufacture; on the other hand the DLR designed and constructed the difficult balance installation. to avoid any accuracy degradation due to temperature effects, the complete balance including the angle of attack drive is isolated and conditioned to ambient temperature. The connections to the cold model at the model side of the balance and to the cold tunnel structure at the earth side created serious design problems. Large forces must be transferred by these connections and heat flow through the connections must be avoided as perfectly as possible. A combination of isolation and local heating was developed to fulfill these requirements. The half model balance is designed by an interactive computer program, which analyses the stress distribution in

the balance and allows an optimized design for signal strength and stiffness. The half model balance is fabricated from one piece of high strength maraging steel by milling and EDM. Regardless of the fact that the balance will be conditioned to ambient temperature in the cryogenic environment, gaging and wiring will be done with materials and methods fully qualified for cryogenic conditions. The balance was to be calibrated using a third order algorithm. to allow engine interference testing, in the design of the balance, provisions have been made for installation of a compressed air bridge for the engine simulation drive air (resp. nitrogen).
Author
Wind Tunnel Apparatus; Design Analysis; Strain Gage Balances; Aircraft Models; Wind Tunnel Models

19990041526 Aktiebolaget Rollab, Solna, Sweden
On Internal Bending-Beam Strain-Gauge Wind-Tunnel Balances
Fristedt, Knut, Aktiebolaget Rollab, Sweden; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 127-176; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A design study of an internal strain-gauge wind-tunnel balance with a force system valid for an airplane model in a transonic 1.5 x 1.5 sq m wind-tunnel with a stagnation pressure of 400 kPa is presented. It concerns a ”flow-through” model, and the permitted diameter of a balance of type bending-beam is 30 mm. It is shown, that a balance can be designed, if a maximum nominal stress of 600 N/sq mm is permitted. The 30 mm diameter part of the sting may however be to short from an aerodynamic point of view. As a background, a comparison of the relative load carrying capacity of three types of balances is made by use of information found in the literature. This study shows, that the bending-beam balance is superior, when D is less than 35 mm. The capacity of ’Task’ balances is equal at larger diameters and the ”Two-Shell” balance is a competitor, when D is greater than 50 mm. A discussion of the influence of the numerical value of the diameter on the load carrying capacity at constant stress of the present type of balance is made together with a limited comparison with Task and Two-Shell balances. A mathematical model of 2:nd degree, which combines the force system loading the balance with the balance signals is finally commented. This model can be used both for calibration and wind-tunnel testing.
Author
Strain Gage Balances; Wind Tunnel Apparatus; Mathematical Models; Bending; Design Analysis

19990041527 Beijing Inst. of Aerodynamics, Beijing, China
Hinge Moment Balance for Complete Model
Guo, Kaike, Beijing Inst. of Aerodynamics, China; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 177-192; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The structure, reference center, measurement range, bridges, static and dynamic calibration of hinge moment balance for complete models are discussed in this paper.
Author
Calibrating; Wind Tunnel Apparatus; Wind Tunnel Models; Strain Gage Balances; Torque

19990041528 Aircraft Research Association Ltd., Bedford, UK
Developments to Improve the Accuracy of Half-Model Balance Measurements in the ARA 2.74 m x 2.44 m (9 ft x 8 ft) Transonic Wind Tunnel
Day, Adrian J., Aircraft Research Association Ltd., UK; Corby, Nigel, Aircraft Research Association Ltd., UK; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 193-212; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Tests on half span models provide a significant contribution to the programme of work performed in the Aircraft Research Association (ARA) Transonic Wind Tunnel. The half model concept is considered mainly as a means of obtaining high quality incremental aerodynamic data. to achieve this objective, balance performance has to be maximized. Details of an evolutionary program of work undertaken at ARA to improve balance quality is presented.
Author
Transonic Wind Tunnels; Semispan Models; Wind Tunnel Models; Weight Indicators; Wind Tunnel Apparatus; Aerodynamic Characteristics

19990041529 National Aerospace Lab., Amsterdam, Netherlands
Looking for the Last Dragcount: Model Vibrations Versus Drag Accuracy
Fuijkschot, Pieter Herman, National Aerospace Lab., Netherlands; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 213-219; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper investigates the influence by which vibrations of a wind tunnel model have on the reading of the axial force as measured by an internal strain-gage balance. When the model vibration modes exhibit a finite bending radius - as they usually do - centrifugal accelerations are generated. These will act on the model mass and thus cause a bias on the axial force or drag reading of the balance. Though this effect is not spectacular, it is certainly not always negligible: errors can be up to five dragcounts. The paper is an extension of an earlier study on the compensation of comparable effects in gravity sensing angle-of-attack inclinometers. It presents a theoretical analysis and some typical quantitative results. Based on this analysis a simple but effective compensation scheme is proposed: it uses only four signals from the inclinometer signal conditioning and some model data such as mass and center of gravity location.
Author
Strain Gage Balances; Wind Tunnel Models; Wind Tunnel Apparatus; Axial Stress; Aerodynamic Drag; Vibration Effects

19990041530 Naval Surface Weapons Center, Hypervelocity Wind Tunnel 9, Silver Spring, MD USA
Uncertainty Analysis for Force Testing in Production Wind Tunnels
Kammeyer, Mark E., Naval Surface Weapons Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 221-242; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper documents the implementation of measurement uncertainty analysis for aerodynamic force testing at the Naval Surface Warfare Center (NSWC) Hypervelocity Wind Tunnel 9. The general uncertainty methodology as presented in several published standards is reviewed, highlighting the general approach in use at Tunnel 9. A detailed application to static stability and drag testing is presented. The emphasis is not on estimating precision and bias errors for force balances. Rather, the focus is on the automation of procedures and the propagation of errors to provide the maximum understanding of the data flow. The techniques and approach discussed should have application to other wind tunnel facilities.
Author
Aerodynamic Forces; Error Analysis; Estimating; Hypervelocity Wind Tunnels; Stability Tests; Data Processing; Vibration Effects

19990041531 Boeing Commercial Airplane Co., Seattle, WA USA
Experiences Relative to the Interaction Between the Balance Engineer and the Project Engineer With Regard to Measurement Uncertainty
Wright, Frank L., Boeing Commercial Airplane Co., USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 243-277; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

When conducting ground based testing, to measure forces and moments on a model, the balance is a key, but not the only component of the measurement system. The data acquisition system is also an important part of the overall measurement system. In the case of a balance which rotates with the model as it is pitched, the measurement of the pitch angle of the balance relative to the freestream velocity vector (angle of attack) is critical in resolving the balance force components into the model stability axes. Many balance engineers tend to view test measurement uncertainty requirements in terms of the forces and moments of the balance. On the other hand, the project engineer who uses the test results views the measurement uncertainty requirements in terms of corrected force and moment coefficients. The uncertainty of these coefficients is not only a function of balance uncertainty, but also of the data acquisition system uncertainty, the angle of attack uncertainty, the dynamic pressure uncertainty, and the uncertainty of any corrections applied to obtain the final results. This paper gives some experiences relative to the measurement uncertainty interaction between balance and project engineers. In addition, statistical analysis techniques and uncertainty analysis methodology are described which can be used to facilitate a productive interchange between balance and project engineers regarding measurement uncertainty requirements.
Author
Statistical Analysis; Error Analysis; Data Acquisition; Strain Gage Balances; Aerodynamic Forces; Stability Derivatives; Measurement; Accuracy; Confidence Limits; Wind Tunnel Apparatus

19990041532 NASA Langley Research Center, Hampton, VA USA
Strain Gauge Balance Uncertainty Analysis at NASA Langley: A Technical Review
Tripp, John S., NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 279-306; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a method to determine the uncertainties of measured forces and moments from multi-component force balances used in wind tunnel tests. A multivariate regression technique is first employed to estimate the uncertainties of the six balance sensitivities and 156 interaction coefficients derived from established balance calibration procedures. These uncertainties are then employed to calculate the uncertainties of force-moment values computed from observed balance output readings

obtained during tests. Confidence and prediction intervals are obtained for each computed force and moment as functions of the actual measurands. Techniques are discussed for separate estimation of balance bias and precision uncertainties.
Author
Multivariate Statistical Analysis; Strain Gage Balances; Wind Tunnel Apparatus; Instrument Errors; Mathematical Models; Error Analysis

19990041533 Technische Hochschule, Darmstadt, Germany
Development and Construction of Fully Automatic Calibration Machines for Internal Balances
Ewald, Bernd, Technische Hochschule, Germany; Hufnagel, Klaus, Technische Hochschule, Germany; Polansky, Lubomir, Schenck (Carl) A.G., Germany; Graewe, Eberhard, Daimler-Benz Aerospace A.G., Germany; Badet, Laurent, European Transonic Wind Tunnel, Germany; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 307-320; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The accuracy of force testing requirements of airplane development in wind tunnels is extremely high. Besides the design and construction of the strain gage balance, the balance calibration technique is the most important contribution for the improvement of accuracy. Balance calibration has been a more or less traditional procedure with more or less standard calibration rig designs. Recently, balance calibration became a subject of research again. One motivation is the large amount of man power absorbed by the conventional balance calibration technique. The additional parameter temperature in the calibration of cryogenic balances multiplies the man power and resulted in the search for automatic calibration procedures. Another motivation for balance research is the finding, that calibration is an important key item to improve accuracy of balances. Several automatic calibration rigs have been constructed in recent years. Some of them follow the idea of applying pure single loads or pairs of pure loads. These designs have complicated realignment mechanisms and were not fully successful. Other machines were designed without realignment. In this case, the misalignment must be measured. For the automatic balance calibration requirements of the European Transonic Wind Tunnel, we developed the principle of the Inverse Calibration Machine. The loads are applied to the earth end of the balance. The loading condition is measured with a device called ”External Balance” to which the balance is clamped. In the case of the Inverse Calibration Machine the desired loads normally are also single loads or pairs of two single loads. The balance elasticity results in a misalignment of the loading system and so small loads in the other components occur. The loads are precisely known, since they are measured at the other end of the balance. Nevertheless the conventional evaluation methods can not handle such ”Mixed Loading Cases”. So a new algorithm was developed. Following these principles an Automatic Calibration Machine was constructed for the European Transonic Tunnel (ETW) as a joint effort of the Carl Schenck Company, the Technical University of Darmstadt and the Deutsche Airbus GmbH at Bremen. The loads are generated by pneumatic push-pull actuators. The external balance follows the well known technology of the Carl Schenck AG External Wind Tunnel Balances. The machine is fully automatic and is controlled by a network of PC computers. A climate chamber allows the precise temperature conditioning of the examination, which is most important for a reliable calibration of cryogenic balances. The successful operation of this machine encouraged the design of a second generation calibration machine. A prototype of this advanced machine is constructed at the Technical University of Darmstadt.
Author
Algorithms; Calibrating; Prototypes; Strain Gage Balances; Transonic Wind Tunnels; Wind Tunnel Apparatus; Cryogenic Wind Tunnels

19990041534 Defence Research Agency, High Speed and Weapon Aero. Dept., Bedford, UK
The Application of an Automatic Precision Balance Calibration Machine to the Calibration of Wind Tunnel Strain-Gauged Balances
Law, Ron D., Defence Research Agency, UK; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 321-336; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Tests are described in which a precision automatic balance calibration machine is used to calibrate a half model balance and assess the influence of a high pressure air-feed system passing through the balance to simulate aircraft engine loads. The recently developed calibration machine is described which is used both as a research tool and as a means of providing routine balance calibrations for wind tunnel model testing. The machine is installed at the 8ft x 8ft Wind Tunnel at DRA Bedford and uses computer controlled pneumatic force generators to apply precisely controlled loads to strain gauged balances. Theses loads are measured using a precision system of weighbeams. All six components can be represented in a light or heavy load range and normal force extends to a maximum of +/- 33 kN. The specification of the machine is 0.02 % on all ranges. All the loads can be applied sequentially in positive and negative directions or simultaneously as required, and represented without reorienting the balance. The pro-

cedure for calibrating both sting mounted and half model balances is described. The balance sensitivities and interactions are represented in a 6 x 27 matrix together with a graphical presentation of residuals.
Author
Calibrating; Wind Tunnel Apparatus; Strain Gage Balances; Aerodynamic Loads

19990041535 China Aerodynamics Research and Development Center, Mianyang, China
A Fully Automatic Calibration System for Six Component Internal Strain Gauge Balances for High Speed Wind Tunnels
Zhang, Ying-Pei, China Aerodynamics Research and Development Center, China; Yan, Jun-Ren, China Aerodynamics Research and Development Center, China; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 337-352; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The paper outlines the design principles, structure, technical specifications, precision and accuracy tracebility and quality guarantee system, as well as application advantages of the fully automatic calibration system developed and manufactured by China Aerodynamics Research and Development Center (CARDC), for conventional six component internal strain gauge balances for high speed wind tunnels.
Author
Accuracy; Calibrating; Strain Gage Balances; Automatic Control; Supersonic Wind Tunnels; Wind Tunnel Apparatus

19990041536 NASA Langley Research Center, Hampton, VA USA
Preliminary Statistical Analysis of the 1995 Evaluation by NASA LaRC of the IAI Automatic Balance Calibration Machine
Tcheng, Ping, NASA Langley Research Center, USA; Tripp, John S., NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 353-371; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The NASA Langley Research Center (LARC) participated in a national cooperative evaluation of the Israel Aircraft Industries (IAI) automatic balance calibration machine at Microcraft, San Diego in September 1995. A LaRC-designed six-component strain gauge balance was selected for test and calibration during LaRC's scheduled evaluation period. Eight calibrations were conducted using three selected experimental designs. Raw data were exported to LaRC facilities for reduction and statistical analysis using the techniques outlined in Tripp and Tcheng (1994). This report presents preliminary assessments of the results, and compares IAI calibration results with manual calibration results obtained at the Modern Machine and Tool Co., Inc. (MM & T). Newport News, VA. A more comprehensive report is forthcoming.
Author
Calibrating; Strain Gage Balances; Mathematical Models; Computer Programs; Multivariate Statistical Analysis

19990041537 Micro Craft, Inc., Force Measurement Systems, San Diego, CA USA
Development of a Six Component Unitized Flexured Force Balance
Booth, Dennis, Micro Craft, Inc., USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 373-383; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Present day aircraft configurations and flight envelope requirements demand higher loads per unit diameter from wind tunnel balances. The constant drive to improve aircraft and to operate at very high angles of attack and potentially high sideslip angles. Additionally, these aircraft have exterior lines which limit the ability to provide large diameter balances or balances with higher deflections to meet these high load requirements. to test at these conditions, a wind tunnel balance must be capable of providing accurate model loads data under high combined loading conditions while allowing the model to maintain it's aerodynamic shape. The following paper describes the development of a patented wind tunnel balance designed to meet the higher load requirements of these advancing testing needs. Based on the floating frame or two-shell concept, the Unitized Flexured Force Balance (UFFB) incorporates a separate axial element thus allowing for higher load per unit diameter, reduced primary load interaction, and greater flexibility in load range selection. Described is the design process, fabrication steps, gaging and calibration results of the UFFB. Supporting data and accuracies are provided for the prototype as well as for one of the flexured balances recently finished. The repair and refurbishing process on this balance type as well as design changes for upgrades of this balance concept will also be discussed.
Author
Prototypes; Wind Tunnel Apparatus; Weight Indicators; Product Development; Design Analysis

19990041538 Central Research Inst. of Machine Building, Kaliningrad, Russia

Typical Balance Test Tasks for Aerogasdynamic Facilities of TsNIIMash

Lapygin, Vladimir I., Central Research Inst. of Machine Building, Russia; Lagutin, Vyacheslav I., Central Research Inst. of Machine Building, Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 385-392; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A general survey of balance tests is given. Among the tasks which are solved by balance tests are the following: (1) an investigation of complex systems (e.g. launch vehicle with strap-on blocks); (2) a study of loading of flight vehicle elements (stabilizers and control surfaces, nozzles, etc.); (3) an investigation of models with simulation of power or control engines jets; (4) an investigation of models with parachute; (5) a study of launch pad elements loading; (6) a study of model loading during heat protection cover erosion in an arc-heater tunnel; (7) the measuring of forces during models free oscillation; and (8) the measurement of short-time loading (e.g. in piston gasdynamic units, in shock tubes, in shock waves rigs, in vacuum chambers). to illustrate the peculiarities of utilized test technique and applied measuring means, several examples are given.

Author

Shock Tubes; Vacuum Chambers; Weight Indicators; Performance Tests; Certification; Wind Tunnel Apparatus; Strain Gage Balances

19990041539 Technion - Israel Inst. of Tech., Dept. of Aerospace Engineering, Haifa, Israel

Accurate Axial Force Measurement With Small Diameter Balances Under High Normal

Levin, Daniel, Technion - Israel Inst. of Tech., Israel; Ringel, M., Technion - Israel Inst. of Tech., Israel; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 393-401; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Accurate measurement of the aerodynamic drag by internal balances in wind tunnel testing is a difficult task to accomplish. The adverse relation between the balance sensitivity and stiffness leads to designs with high nonlinear interactions. The problems become even more acute when the balances are of small diameter (less than 3/4 inch), and when the loading in the pitch and yaw direction acting simultaneously are much higher than the axial load in the order of several hundreds kg x cm. There is no one solution that can be prescribed to overcome the problems. This paper presents several technical improvements that have yielded enhanced accuracy in the axial force measurement in the Technion wind tunnel laboratory. The first improvement was obtained by a modification of the drag measuring element design. Additional improvement was obtained by a new calibration rig, and a more comprehensive data reduction process. A different approach is based on disengaging the drag element from the other five components, thus evading the nonlinear interactions.

Author

Drag Measurement; Wind Tunnel Tests; Aerodynamic Characteristics; Wind Tunnel Apparatus; Weight Measurement; Axial Loads; Calibrating

19990041540 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Some Peculiarities of Balance Tests in the Transonic TsAGI T-128 Wind Tunnel

Gorbushin, Anton R., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 403-412; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The procedures for special balance tests in the T-128 wind tunnel is given and some test data for internal and external balance are considered. The method of taking account for zero balance reading variations is suggested. The repeatability test results obtained in the T-128 wind tunnel for TU-144 and reference models are presented to demonstrate the capabilities of the method of taking account for zero balance reading shift-before and after the run.

Author

Transonic Wind Tunnels; TU-144 Aircraft; Wind Tunnel Models; Strain Gage Balances; Wind Tunnel Apparatus; Wind Tunnel Tests; Semispan Models

19990041541 NASA Langley Research Center, Hampton, VA USA

Strain Gages in use at NASA Langley: A Technical Review

Moore, Thomas C., Sr., NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 413-429; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Surface mounted strain gages and strain gage application techniques are as varied as they are versatile. There is an abundance of technical literature, available throughout the strain gage community, offering techniques for installing strain gages and methods of obtaining useful information from them. This paper, while providing more of the same, will focus its discussions on recent Langley developments for using strain gages reliably and accurately in very harsh environments. With Langley's extensive use

of wind tunnel balances, its ongoing effort in materials development, and its currently focused activities in structural testing, the use of strain gages in unusual and demanding environments has led to several innovative improvements in the ”how to gage it” department. Several of these innovations will be addressed that hopefully will provide some practical information for the strain gage user who is finding the test environment and (or) the materials to be tested too demanding for previously utilized strain gage application technology. Specifically, this paper will include discussions in the following three areas: (1) technical considerations when gaging cryogenic wind tunnel balances, including areas for improving accuracy and reliability; (2) addressing technical difficulties associated with gaging composite test articles and certain alloys for testing at temperatures approaching -450F, or elevated temperatures up to 350F, or both temperatures inclusive during the same test scenario; (3) gaging innovations for testing metal/matrix and carbon/carbon composites at temperatures above 700F.
Author
Cryogenic Wind Tunnels; High Temperature; Strain Gages; Wind Tunnel Apparatus; Strain Gage Balances; Low Temperature; Accuracy

19990041581 Los Alamos National Lab., NM USA
Neutron detection and applications using a BC454/BGO array
Miller, M. C.; Biddle, R. S.; Bourret, S. C.; Dec. 31, 1998; 8p; In English; 9th; Symposium on radiation measurements and applications
Report No.(s): DE99-000668; LA-UR-98-1813; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Neutron detection and multiplicity counting has been investigated using a boron-loaded plastic scintillator (BC454)/bismuth germanate (BGO) phoswich detector array. Boron-loaded plastic combines neutron moderation (H) and detection (B-10) at the molecular level, thereby physically coupling increasing detection efficiency and decreasing die-away time with detector volume. Separation of the phoswich response into its plastic scintillator and bismuth germanate components was accomplished on an event-by-event basis using custom integrator and timing circuits, enabling a prompt coincidence requirement between the BC454 and BGO to be used to identify neutron captures. In addition, a custom time-tag module was used to provide a time for each detector event. Time-correlation analysis was subsequently performed on the filtered event stream to obtain shift-register-type singles and doubles count rates.
NTIS
Neutrons; Detection; Arrays

19990041618 NASA Marshall Space Flight Center, Huntsville, AL USA
Breakdown Limit Studies in High-Rate Gaseous Detectors
Ivaniouchenkov, Yu, Coimbra Univ., Portugal; Fonte, P., Coimbra Univ., Portugal; Peskov, V., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Nuclear Instruments and Methods in Physics Research A; 1999; ISSN 0168-9002; Volume 422, pp. 300-304; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report results from a systematic study of breakdown limits for novel high-rate gaseous detectors: MICROMEGAS, CAT and GEM, together with more conventional devices such as thin-gap parallel-mesh chambers and high-rate wire chambers. It was found that for all these detectors, the maximum achievable pin, before breakdown appears, drops dramatically with incident flux, and is sometimes inversely proportional to it. Further, in the presence of alpha particles, typical of the breakgrounds in high-energy experiments, additional gain drops of 1-2 orders of magnitude were observed for many detectors. It was found that breakdowns at high rates occur through what we have termed an ”accumulative” mechanism, which does not seem to have been previously reported in the literature. Results of these studies may help in choosing the optimum detector for given experimental conditions.
Author
Gas Detectors; Avalanches; Ions; Counters

19990041620 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Calibration of Anemometers used in the Ship Survivability Enhancement Program
Gamble, G. I., Defence Science and Technology Organisation, Australia; Marian, F. M., Defence Science and Technology Organisation, Australia; December 1998; In English; Sponsored in part by DNW
Report No.(s): DSTO-TN-0180; DODA-AR-010-685; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria, Australia 3001 UK), Hardcopy, Microfiche

Part of the Ship Survivability Enhancement Program (SSEP) was a series of smoke experiments. These experiments used cold smoke (training smoke cannisters) and hot smoke (produced from fires) to record the propagation of smoke through a naval vessel, in order to test the effectiveness of different smoke clearance techniques. Temperature, smoke density and air velocity data were recorded. Air velocity was measured with the use of bidirectional anemometer sensors, connected to Air Monitor Corpora-

tion Veltron 5000AZ series differential pressure transmitters. An air velocity calibration for these systems was required to interpret the measurements. Equations based on data recorded using known air velocities in a wind tunnel have been developed to enable this translation.
Author
Calibrating; Anemometers; Experimentation; Smoke; Navy; Ships; Effectiveness

19990041735 Los Alamos National Lab., NM USA
Neutron multiplicity assay of impure materials using four different neutron counters
Stewart, J. E.; Langner, D. G.; Wenz, T. R.; Dec. 31, 1998; 12p; In English; 39th; Institute of Nuclear Materials Management (INMM) annual meeting
Report No.(s): DE99-001219; LA-UR-98-2597; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
During an advanced IAEA inspector training course given at Los Alamos in November, 1997, the opportunity existed for an intercomparison study of various neutron detectors to quantify measurement performance using pure and impure plutonium oxide and mixed uranium-plutonium oxide (MOX) items. Because of the cost of counters designed specifically for multiplicity analysis, it was desired to explore the limits of other, less costly and less efficient detectors. This paper presents and intercompares neutron coincidence and multiplicity assay performance for five detectors, which vary widely in detection efficiency. Eight pure plutonium oxide and twelve impure plutonium oxide and MOX working standards were used in the study.
NTIS
Neutron Counters; Assaying

19990041969 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Analysis of the Applicability of Video Segmentation to Unmanned Aerial Vehicle Surveillance Video
Pyburn, Bradley L.; Mar. 1999; 109p; In English
Report No.(s): AD-A361626; AFIT/GCS/ENG/99M-17; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The focus of this research is to determine if applying edge detection segmentation (proposed by Ramin Zabih, Justin Miller, and Kevin Mai) to Unmanned Aerial Vehicle (UAV) video footage can provide meaningful segments for database storage and retrieval. The edge detection segmentation algorithm is applied to fifty-four UAV video sequences containing visual effects such as abrupt camera changes, camera zooms, motion (rapid and gradual), and cloud cover while varying the frame rate from 5 fps to 30 fps. An analysis of the results is performed to compare actual versus expected outcomes, similar sequences, and scenes with motion, along with explaining false positives/anomalies. Although the frame rate variation and analysis of the scenes with cloud cover are inconclusive, applying the edge detection segmentation algorithm to abrupt changes, rapid motion, and camera zooms produced favorable results, as these were all detected as scene changes. Several near-term and long-term benefits can be drawn from these results, and are provided at the conclusion of the paper, along with recommendations for future research.
DTIC
Vehicles; Video Signals; Storage; Aerial Photography

19990042135 Stanford Univ., Experimental Physics Lab., Stanford, CA USA
Study the Effects of Charged Particle Radiation on Gravitational Sensors in Space
Lipa, John A., Stanford Univ., USA; May 07, 1999; 9p; In English
Contract(s)/Grant(s): NAGw-4863; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Space-flight charging of free floating masses poses an unusual problem-- how can one control charge on the object without exerting a significant force on it? One approach is to make contact to the object with a fine wire. However, for many precision applications no physical contact is permissible, so charge must be conveyed in, a more sophisticated manner. One method has already been developed: Gravitational Probe B (GP-B) uses an ultraviolet photo-emission system described in ref 1. This system meets the experiment requirements, yet poses a number of constraints, including high power dissipation (approximately 10 W peak, approximately 1 W average), low current output (approximately 10(exp -13) A), and potential reliability problems associated with fiber optics system and the UV source. The aim of the current research is to improve this situation and, if possible, develop a more rugged and lower power alternative, USAble in a wide range of situations. An potential alternative to the UV electron source is a Spindt-type field emission cathode. These consist of an array of extremely sharp silicon tips mounted in a standard IC package with provision for biasing them relative to the case potential. They are attractive as electron sources for space applications due to their low power consumption (10(exp -5) W), high current levels (10(exp -9) to 10(exp -5) A), and the absence of mechanical switching. Unfortunately, existing cathodes require special handling to avoid contamination and gas absorption. These contaminants can cause severe current fluctuations and eventual destruction of the cathode tips. Another potential drawback is the absence of any data indicating the possibility of bipolar current flow. This capability is needed because of the large uncertain-

ties in the net charge transfer from cosmic rays to a free floating mass in space. More recent devices reduce the current fluctuations and destructive arcing by mounting the tips on a resistive substrate rather than a good conductor. This effectively wires a resistor to each individual tip, providing a current limit and thus greatly reducing the possibility of destructive arcing through an individual tip. An issue with this resistive layer is its range of operating temperatures. From the experience with the GP-B system, we hypothesized about using secondary electron emission for control of net charge transfer to an object. An important goal of the testing described below was to demonstrate the ability to apply both positive and negative charges to the test object from a single emitter.
Author
Charged Particles; Electron Sources; Fiber Optics; Gravity Probe B; Electron Emission

19990042170 NASA Goddard Space Flight Center, Greenbelt, MD USA
Photon-Weighted Midpoint Exposure Meter for Keck/HIRES Extrasolar Planet Research ***Progress Report No. 2***
Apr. 22, 1999; 5p; In English
Contract(s)/Grant(s): NAG5-4445; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

NASA Grant was received for research involving the construction of a photon-weighting midpoint exposure meter for the Keck HIRES spectrometer, and for support of our NASA/Keck-based planet research with this instrumentation. The research funds were also to be used to make our iodine cell calibration system and exposure meter available to the NASA Keck observing community. Progress this past year, the second of the 3-year granting period, involved work in 4 areas: 1) Further construction of the midpoint exposure meter. 2) Assisting observers with use of the Iodine system. 3) Acquisition of precision radial velocity data on our program star sample with continued monitoring to proceed in subsequent years as available telescope time permits. 4) Reduction and analysis of incoming precision radial velocity data to reject problematic and uninteresting program stars, and to identify promising planet candidates.
Author
Research; Fabrication; Photon Beams; Spectrometers; Construction

19990042227 Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany
Silicon Pixel Detectors for Future X-ray Missions
Strueder, L., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Truemper, J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; The Next Generation of X-Ray Observatories; 1997, pp. 89-97; In English; See also 19990042217
Contract(s)/Grant(s): DARA-500X-93025/XMM-EPIC; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Future X ray missions require improved focal instruments. Certainly, the straight forward extrapolation of the relevant physical quantities, which should all be achieved simultaneously, such as position resolution, energy resolution, time resolution, quantum efficiency, radiation and environmental tolerance, ease of operation, homogeneous, non-obstructed field of view and so forth, can not be easily achieved on the basis of the present detector concepts. Many of the actually developed detector systems are already close to the theoretical limits, e.g. the energy resolution of silicon Charge coupled Devices (CCDs), the time resolution of avalanche photodiodes, the spectral resolution Nb/Al/Al2O3/Al/Nb superconducting tunnel junctions in the optical domain. The aim of this article is to point out some of the areas, where silicon detectors could be the first choice for applications in future X ray astronomy. We will start with the description of the state of the art X ray pnCCDs to be flown onboard XMM and ABRIXAS. Large format high resolution X ray pixel detectors will then be treated, i.e. the DEPFET Pixel Array Detectors (DPAD) with non-destructive readout (NDR) capability, to go as low as one e-bar readout noise.
Author
Silicon; Pixels; X Ray Astronomy; X Ray Detectors; Space Missions

19990042331 Rutherford Appleton Lab., Chilton, UK
A Prototype Gas Microstrip Wide Angle X-Ray Detector
Bateman, J. E., Rutherford Appleton Lab., UK; Connolly, J. F., Rutherford Appleton Lab., UK; Derbyshire, G. E., Rutherford Appleton Lab., UK; Marsh, A. S., Rutherford Appleton Lab., UK; Stephenson, R., Rutherford Appleton Lab., UK; Simmons, J. E., Rutherford Appleton Lab., UK; Spill, E. J., Rutherford Appleton Lab., UK; Farrow, R. C., Daresbury Nuclear Physics Lab., UK; Helsby, W. I., Daresbury Nuclear Physics Lab., UK; Dobson, D. R., Daresbury Nuclear Physics Lab., UK; Mutikainen, R., Technical Research Centre of Finland, Finland; Suni, I., Technical Research Centre of Finland, Finland; Nov. 11, 1998; ISSN 1358-6254; 19p; In English; Original contains color illustrations
Report No.(s): RAL-TR-1998-073; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

A prototype high rate position sensitive detector for Wide Angle X-ray Scattering (WAXS) studies has been constructed and tested on beamline. The detector uses gas microstrip technology and allows for both high spatial (angular) resolution and high data rate to be achieved. The detector has the capability to be used over a wide range of X-ray energies (1 to 50 keV) and to achieve detected and processed photon rates in the range of MHz per strip (0.4 nun) with excellent detection efficiency. Typical of this detector technology is an energy resolution of better than 16% at 6 keV, which offers the possibility of energy discrimination on a photon by photon basis. The detector has been built on a modular basis for ease of support and expandability. The results of a demonstration using polymer samples on the SAXS / WAXS station 8.2 at the Daresbury Laboratory Sychrotron Radiation Source are presented.
Author
X Ray Detectors; Prototypes; Fabrication; Wide Angle Lenses; Performance Tests; Angular Resolution

19990042349 Los Alamos National Lab., NM USA
Analytical techniques for instrument design -- Matrix methods
Robinson, R. A.; Dec. 31, 1997; 12p; In English; Workshop on methods for neutron scattering instrumentation design
Report No.(s): DE98-002596; LA-UR-97-4064; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors take the traditional Cooper-Nathans approach, as has been applied for many years for steady-state triple-axis spectrometers, and consider its generalization to other inelastic scattering spectrometers. This involves a number of simple manipulations of exponentials of quadratic forms. In particular, they discuss a toolbox of matrix manipulations that can be performed on the 6-dimensional Cooper-Nathans matrix. They show how these tools can be combined to solve a number of important problems, within the narrow-band limit and the gaussian approximation. They will argue that a generalized program that can handle multiple different spectrometers could (and should) be written in parallel to the Monte-Carlo packages that are becoming available. They also discuss the complementarity between detailed Monte-Carlo calculations and the approach presented here. In particular, Monte-Carlo methods traditionally simulate the real experiment as performed in practice, given a model scattering law, while the Cooper-Nathans method asks the inverse question: given that a neutron turns up in a particular spectrometer configuration (e.g. angle and time of flight), what is the probability distribution of possible scattering events at the sample. The Monte-Carlo approach could be applied in the same spirit to this question.
NTIS
Inelastic Scattering; Neutron Spectrometers; Monte Carlo Method; Matrix Methods

19990042443 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design/Use of the Remotely Operated Bakeout Box Shutter (ROBBS)
Ottens, Brian P., NASA Goddard Space Flight Center, USA; Dec. 30, 1999; 22p; In English; Value Driven Testing and Best Practices: Challenges for 21st Century, 16-18 Mar. 1999, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A thermal vacuum box bakeout and certification allows orbital payloads to be cleaned and certified when the background TQCM measurements (a measure of how much molecular contamination is on a payload or chamber) are unacceptable or unmanageable in the standard thermal vacuum chamber. The box bakeout procedure is usually performed in 4 steps: bakeout the box, certify the box, bake out the payload, and finally certify the payload. In the procedure's current setup, the contaminant conduction hole ("lid") is initially open and a vacuum chamber break must occur between the bakeout and certification phases to close the box from the vacuum chamber. This exposure is necessary to allow the outgassed contaminants to escape the box's volume rapidly during bakeout phase, but payload certification isn't usually performed while the lid is still open, because it exposes the payload, TQCM, and box volume to chamber contaminants. The Remotely Operated Bakeout Box Shutter (ROBBS) is a new facility design and will allow the remote closure of the contamination hole while the chamber is still under vacuum, and with little or no time to do so.
Author
Contamination; Remote Control; Vacuum Chambers; Contaminants; Thermodynamic Properties

36
LASERS AND MASERS

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

19990041167 Los Alamos National Lab., NM USA
Acousto-optically tuned isotopic CO2 lasers for long-range differential absorption LIDAR
Thompson, D. C.; Busch, G. E.; Hewitt, C. J.; Remelius, D. K.; Shimada,; Dec. 31, 1998; 12p; In English; 12th; Aerospace/defense sensing, simulation and controls
Report No.(s): DE99-000643; LA-UR-98-1335; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors are developing 2--100 kHz repetition rate CO2 lasers with milliJoule pulse energies, rapid acousto-optic tuning and isotopic gas mixes, for Differential Absorption LIDAR (DIAL) applications. The authors explain the tuning method, which uses a pair of acousto-optic modulators and is capable of random access to CO2 laser lines at rates of 100 kHz or more. The laser system is also described, and they report on performance with both normal and isotopic gas mixes.
NTIS
Acousto-Optics; Differential Absorption Lidar; Carbon Dioxide Lasers; Tuning

19990041335 James Madison Univ., Coll. of Integrated Science and Technology, Harrisonburg, VA USA
Characterization of Infrared Diode Laser Beams and Atmospheric CO Imaging Instrument ***Final Report***
Miles, Jonathan J., James Madison Univ., USA; Mar. 01, 1999; 13p; In English
Contract(s)/Grant(s): NCC1-267; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During June-August 1997 Dr. Jonathan Miles participated in the ASEE-sponsored summer faculty research program at NASA Langley Research Center (LaRC). The Aerospace Electronic Systems Division (AESD), Sensor Systems Branch (SSB), at NASA LARC had proposed a new mission, GEOstationary TROpospheric Pollution SATellite (GEO TROPSAT), to address critical science questions of tropospheric chemistry. The troposphere is a complex system, comprising ”point” and distributed sources of natural and anthropogenic origin; complicated transport processes, both lateral and vertical; and photochemistry driven by UV flux, temperature, atmospheric composition, and other variables. GEO TROPSAT would be implemented about a geostationary Earth orbital (GEO) position at the equator between 600 and 80” West longitude to observe the Americas and large portions of the oceans of either coast. This mission would advance our knowledge of the atmosphere by capturing the wide temporal and spatial variability of tropospheric phenomena which is undetectable from low Earth orbit. A pre-prototype imaging carbon monoxide (CO) imaging system operating within a narrow waveband about 4.7 [Lm was built, demonstrated, and evaluated. This system applies the gas-filter correlation radiometry (GFCR) technique and produces digitized images comprising 4096 pixels, each representing a single CO mixing ratio measurement inferred from radiometric data. Associated tasks accomplished included specification for the next-generation prototype system to operate in the 2.3-@tm waveband; characterization of a 64x64, InSb focal-plane-array (FPA) imager; design, fabrication, and assembly of a filter wheel; and software development. Laboratory evaluation of this system involved imaging of a test cell placed in the path of radiant flux emanating from a blackbody source used to simulate the radiant energy reflected by Earth in real application. The cell was evacuated for system balancing and then charged with measured quantities of CO to provide a means for system characterization. Two related research efforts were undertaken during the term of the study reported here - continued development of an atmospheric CO imaging instrument and characterization of diode-laser beams. Both efforts were successful and are described within the body of this report. A second objective was to provide a means for undergraduate ISAT majors to become involved with the research described, to be afforded the opportunity to learn the technologies associated with the work performed. Two ISAT students gained a comprehensive understanding and interest in missions supported by NASA through direct involvement in this project. Many more students were exposed to these technologies through demonstrations, laboratory tours, and explanations provided in lectures.
Derived from text
Atmospheric Chemistry; Atmospheric Composition; Carbon Monoxide; Imaging Techniques; Laser Beams; Photochemical Reactions; Troposphere; Earth Observations (From Space); Infrared Imagery; Infrared Lasers

19990041350 Los Alamos National Lab., NM USA
Modeling of laser energy concentration in narrow gap joints
Milewski, J. O.; Mustaleski, T. M.; Dec. 31, 1998; 6p; In English; 5th; International conference on trends in welding research
Report No.(s): DE99-001138; LA-UR-98-2311; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A three-dimensional, computer based, optical ray tracing model is used to simulate the combined effect of key geometric parameters for laser welding. This allows one to characterize a range of joint designs for their ability to concentrate or dissipate laser energy. The effects of angle dependent absorption and diffuse reflections on beam transport are evaluated through simulation

to determine the contributions of these effects on the system. The effects of energy loss through weld joint gaps are modeled for common weld joint preparations. Practical applications of extending the optical design of the system to include the weld joint are proposed.
NTIS
Design Analysis; Lasers; Energy Dissipation; Narrowband; Welded Joints; Laser Welding; Computer Aided Design

19990041469 Argonne National Lab., IL USA
Integral equation based computer code for high-gain free-electron lasers
Dejus, R. J.; Shevchenko, O. A.; Vinokurov, N. A.; Dec. 31, 1998; 7p; In English; FEL '98: 20. international conference
Report No.(s): DE98-058308; ANL/XFD/CP-96333; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A computer code for gain optimization of high-gain free-electron lasers (FELs) is described. The electron motion is along precalculated period-averaged trajectories, and the finite-emittance electron beam is represented by a set of thin partial beams. The radiation field amplitudes are calculated at these thin beams only. The system of linear integral equations for these field amplitudes and the Fourier harmonics of the current of each thin beam is solved numerically. The code is aimed for design optimization of high-gain short-wavelength FELs with nonideal magnetic systems (breaks between undulators with quadrupoles and magnetic bunchers; field and steering errors). Both self- amplified spontaneous emission (SASE) and external input signal options can be treated. A typical run for a UV FEL, several gain lengths long, takes only one minute on a Pentium II personal computer (333 MHz) which makes it possible to run the code in optimization loops. Results for the Advanced Photon Source FEL project are presented.
NTIS
Computer Programs; Integral Equations; High Gain; Free Electron Lasers

19990041781 Lawrence Livermore National Lab., Livermore, CA USA
High-average-power diode-end-pumped intracavity-doubled Nd:YAG laser
Honea, E. C.; Ebbers, C. A.; Beach, R. J.; Speth, J. A.; Emanuel, M.; Feb. 12, 1998; 7p; In English; 13th; Topical meeting on advanced solid-state lasers and radiative processes and dephasing in semiconductors topical meeting
Report No.(s): DE98-057759; UCRL-JC-128683; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A compact diode-pumped ND:YAG laser was frequency-doubled to 0.532 (mu)m with an intracavity KTP or LBO crystal using a 'V' cavity configuration. Two acousto-optic Q-switches were employed at repetition rates of 10-30 kHz. Dichroic fold and end mirrors were used to output two beams with up to 140 W of 0.532 (mu)m power using KTP and 116 W using LBO as the frequency doubling crystal. This corresponds to 66% of the maximum output power at 1.064 (mu)m obtained with an optimized output coupler reflectivity. The minimum output pulse duration varied with repetition rate from 90 to 130 ns. The multimode output beam had a smooth profile and a beam quality of M(sup 2) = 5 1.
NTIS
YAG Lasers; High Power Lasers; Diodes; Neodymium Lasers

19990041807 Norwegian Defence Research Establishment, Kjeller, Norway
Intracavity Optical Parametric Oscillator
Lippert, Espen, Norwegian Defence Research Establishment, Norway; Jun. 30, 1998; 85p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 729/115
Report No.(s): FFI/RAPPORT-98/03423; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A technique for frequency shifting of a near infrared laser (Nd:YAG) further out into the infrared is studied. The frequency shifting is done by the use of optical parametric oscillator internal to the laser cavity. The parametric oscillator is non-critical phase matched and singly resonant with a KTP crystal as the converting nonlinear medium. The theory for laser amplification as well as the nonlinear parametric amplification is reviewed. Results from a experimental study of this system is presented. A advanced numerical model is used to simulate the system. Results from these simulations are presented and compared to the experimental results.
Author
Frequencies; Infrared Lasers; Simulation; Research; Cavities; Near Infrared Radiation

19990041928 Schafer Corp., Chelmsford, MA USA
IFE Reactor Studies
Feb. 1999; 182p; In English
Contract(s)/Grant(s): N00014-97-D-2014
Report No.(s): AD-A361981; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
No Abstract.
Author
Laser Fusion; Reactors

19990042198 Lawrence Livermore National Lab., Livermore, CA USA
Getting one-ton, phone-booth-sized optic modules into the world's largest laser
Yakuma, S. C.; Grasz, E. L.; May 12, 1998; 7p; In English; International conference on engineering design and automation
Report No.(s): DE98-058346; UCRL-JC-130308; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Ignition Facility (NIF), currently under design and construction at Lawrence Livermore National Laboratory (LLNL), will be the world's largest laser when complete. The NIF will use about 8,000 large optics of 41 different types to focus up to 192 laser beams on a dime-size target. Each laser component will be packaged into a line-replaceable unit (LRU) made up of a mechanical housing, laser optics (lenses and mirrors), utilities, actuators, and kinematic mounts. Given the constraints of the operating environment, such as high cleanliness and limited space, the tasks associated with LRU interchange require unique and flexible hardware system designs. This paper introduces the Optical Transport and Material Handling designs that will be used to deliver the LRUs in the NIF Laser Bays. These systems use a novel and versatile automated guided vehicle (AGV) for transport. The transport and handling hardware is being designed to allow autonomous, semiautonomous, and manual operations.
NTIS
Lasers; Optical Equipment; Laser Beams

19990042414 Mitsubishi Heavy Industries Ltd., Administration Dept., Tokyo, Japan
Microwave Excited CO2 Laser
Ikeda, Tetsuya, Mitsubishi Heavy Industries Ltd., Japan; Abe, Takao, Mitsubishi Heavy Industries Ltd., Japan; Tanaka, Jiro, Mitsubishi Heavy Industries Ltd., Japan; Danno, Minoru, Mitsubishi Heavy Industries Ltd., Japan; Shimazutsu, Hiroaki, Mitsubishi Heavy Industries Ltd., Japan; Nov. 1993; ISSN 0540-469X, No. 200, pp. 1-5; In English
Report No.(s): MTB-200; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Microwave discharges (2.45 GHz) for excitation of CO2 laser have been investigated. A resonant microwave cavity has been employed to get a high power laser operation. Laser experiments in the systems with axial fast flow, electric field, and laser beam are performed. Homogeneous discharges are obtained by a TM(sub 010)-mode cavity with the reentrant type tuners on both end plates. Calculations of the electric field inside the cylindrical cavity filled with a dielectric tube using the program SUPERFISH are compared with the results of the measurements. The laser output of 259W and the efficiency of 14% were obtained.
Author
Microwaves; Carbon Dioxide Lasers; Cylindrical Bodies; Electric Fields; Excitation; Axial Flow; High Power Lasers

37
MECHANICAL ENGINEERING

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

19990041880 Rockwell International Corp., Rocketdyne Div., Canoga Park, CA USA
Space Shuttle Main Engine: Part Number RS007001
Guinzburg, A., Rockwell International Corp., USA; Jul. 07, 1977; 9p; In English
Contract(s)/Grant(s): NAS8-27980
Report No.(s): E41000; RSS-8559-1-1-1; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Topics considered include: low-pressure oxidizer turbopump; low-pressure fuel turbopump; high-pressure oxidizer turbopump; high-pressure oxidizer turbopump turbine; high-pressure fuel turbopump; and SSME propellant flow schematic.
CASI
Space Shuttle Main Engine; Turbine Pumps; Propellants

19990041942 Ecole Polytechnique Federale de LaUSAnne, Laboratoire de Metallurgie Physique, Switzerland
Analysis of ripple formation in single crystal spot welds
Rappaz, M., Ecole Polytechnique Federale de LaUSAnne, Switzerland; Corrigan, D., Oak Ridge National Lab., USA; Boatner, L. A., Oak Ridge National Lab., USA; Oct. 31, 1997; 10p; In English; 8th; Modeling of Casting, Welding and Advanced Solidification Processes, San Diego, CA, USA
Contract(s)/Grant(s): NASA Order H-13039-D; RTOP 962-25-08-23
Report No.(s): DE98-000897; ORNL/CP-94924; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Stationary spot welds have been made at the (001) surface of Fe-l5%Ni-15%Cr single crystals using a Gas Tungsten Arc (GTA). On the top surface of the spot welds, very regular and concentric ripples were observed after solidification by differential interference color microscopy. Their height (typically 1--5 micrometers and spacing, typically approximately 60 micrometers) decreased with the radius of the pool. These ripples were successfully accounted for in terms of capillary-wave theory using the fundamental mode frequency f(sub 0) given by the first zero of the zero-order Bessel function. The spacing d between the ripples was then equated to v(sub s)/f(sub 0), where v(sub s) is the solidification rate. From the measured ripple spacing, the velocity of the pool was deduced as a function of the radius, and this velocity was in good agreement with the results of a heat-flow simulation.
NTIS
Welded Joints; Arc Welding; Microstructure; Single Crystals; Solidification; Spot Welds

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990041740 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
Electronics and Electrical Engineering Laboratory: 1999 Program Plan
Sachet, L. L.; Feb. 1999; 228p; In English
Report No.(s): PB99-122053; NISTIR-6284; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This program plan provides a detailed description of the important work that the Electronics and Electrical Engineering Laboratory at the National Institute of Standards and Technology is undertaking to provide measurement capability for U.S. industry. This measurement capability underlies the development, manufacturing, marketing, and after-sales support of new products in industry. The Electronics and Electrical Engineering Laboratory focuses on measurement capability needed especially by the electronics industry, the electric-power industry, and the electrical-equipment industry. This measurement capability also serves government, educational institutions, and the public broadly, either as users of that capability or as customers for the products and services of the supported industries.
NTIS
Electrical Engineering; Research Management; Management Planning; Electronic Equipment; Measurement

19990041741 National Inst. of Standards and Technology, Office of Weights and Measures, Gaithersburg, MD USA
Report of the 83rd National Conference on Weights and Measures
Ugiansky, G. M.; Land, J. L.; Nov. 1998; 390p; In English
Report No.(s): PB98-172604; NIST/SP-932; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The 83rd Annual Meeting of the National Conference on Weights and Measures (NCWM) was held July 12 through July 16, 1998, at the Hilton Hotel in Portland, Oregon. The theme of the meeting was 'Working Together for Equity'. Reports by the Standing and Annual Committees of the Conference constitute the major portion of this publication, along with the addresses delivered by Conference officials and other authorities from government and industry. Special meetings included those of the OIML, Meter Manufacturers Association, Gasoline Pump Manufacturers Association, the National Association of State Departments of Agriculture Weights and Measures Division, the Industry Committee on Packaging and Labeling, National Industrial Committee on Packaging and Labeling, National Industrial Scale Association, Associate Membership Committee, and metrology Subcommittee.
NTIS
Weight Measurement; Metrology; Conferences; Agriculture

19990041805 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Characterization of Disbonds by Speckle Shearing Interferometry with Thermal or Mechanical Stressing ***Caracterisation de Delaminages par Interferometrie de Speckle a Cisaillement avec Sollicitation Thermique ou Mecanique***

Lamarque, Thierry, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 206p; In French; Original contains color illustrations

Report No.(s): ONERA-NT-1998-11; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The work presented in this report contributes to the development of Non Destructive Testing by speckle interferometry. These techniques, derived from holographic interferometry, provide a non-contact full-field inspection at a video frame rate. Among them, shearography proved to be easy to implement and more immune to spurious vibrations. Nevertheless, its use is often limited to qualitative evaluation as the quantitative characterization requires a precise understanding of the behavior of flawed materials when submitted to a know stress. Systematic studies are performed in order to calculate the deformation of a delaminated material in the case of thermal and vacuum stressing. Temperatures and displacements are computed with a Finite Element Method. In both case, abacuses depicting the behavior of the response versus defect parameters are obtained. An inversion procedure to estimate the diameter and the depth of the disband from experimental measurements is then presented. In the last part, a new application of shearography providing full-field visualization of ultrasonic waves such as surface waves or Lamb waves is described. This technique relies on a stroboscopic modulation of the laser illumination. The ultrasonic wavelength can be measured from the images just as the interaction between the propagating wave and a disbond. Thanks to a specific lighting synchronization, it is possible to visualize bursts instead of continuous waves in order to get rid of the reflections on the edge of the sample.
Author

Nondestructive Tests; Speckle Interferometry; Deformation; Displacement; Inspection; Vibration

19990041960 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

SMARTweave: An Electrical NDE System ***Final Report, Jan. - Oct. 1998***

Strand, Douglas J.; Mar. 1999; 31p; In English

Report No.(s): AD-A361610; ARL-TR-1928; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

SMARTweave (SW) was patented in May 1993 as an electromagnetic method to monitor the flow of resin in composite manufacturing processes. It has been found to be very rapid and effective for this purpose, and its uses have expanded since this date. Using a Labview software package and 16 conductive nodes, both processes and properties of composite materials can be characterized. SW has specifically been used at our laboratory to investigate the resin transfer molding (RTM) process. The speed of entry of the resin for different composite fabrics can be visually studied and adjusted. Composites are typically difficult to examine with nondestructive evaluation (NDE), so this new technique is a valuable addition. There are eight excitation probes and eight sensor probes, unlike the usual one excitation probe and one sensor probe.
DTIC

Composite Materials; Computer Aided Manufacturing; Applications Programs (Computers)

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.

19990041188 Bettis Atomic Power Lab., West Mifflin, PA USA

Stress intensity magnification factors for fully circumferential cracks in valve bodies (thick cylinders)

Toor, P. M.; Dec. 31, 1998; 15p; In English; 28th; Fatigue and fracture mechanics; Sponsored by American Society for Testing and Materials, USA

Report No.(s): DE99-000485; WAPD-T-3112; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The stress intensity solutions presented herein were obtained using an energy method in conjunction with a two-dimensional finite element program in order to explicitly account for curvature effect for fully circumferential cracks. The magnification factors for a specific crack depth were calculated by successively loading the crack surface by a uniform, linear, quadratic, and a cubic loading distribution. The magnification factors can be used to calculate the stress intensity factors by superposition method. The functions for each load condition in terms of radius to thickness ratio (R/t) and a fractional distance in terms of crack depth to

thickness ratio (a/t) were developed. The validity of these functions is R/t = 1.5 to 10.0 and for 0.0125 (le) a/t (le) 0.8125. The functions agree to within 1% of the finite elements solutions for most magnification factors.
NTIS
Stress Intensity Factors; Magnification; Cracks; Valves

19990041443 NASA Marshall Space Flight Center, Huntsville, AL USA
Application of the Probabilistic Dynamic Synthesis Method to Realistic Structures
Brown, Andrew M., NASA Marshall Space Flight Center, USA; Ferri, Aldo A., Georgia Inst. of Tech., USA; [1998]; 29p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Probabilistic Dynamic Synthesis method is a technique for obtaining the statistics of a desired response engineering quantity for a structure with non-deterministic parameters. The method uses measured data from modal testing of the structure as the input random variables, rather than more ”primitive” quantities like geometry or material variation. This modal information is much more comprehensive and easily measured than the ”primitive” information. The probabilistic analysis is carried out using either response surface reliability methods or Monte Carlo simulation. In previous work, the feasibility of the PDS method applied to a simple seven degree-of-freedom spring-mass system was verified. In this paper, extensive issues involved with applying the method to a realistic three-substructure system are examined, and free and forced response analyses are performed. The results from using the method are promising, especially when the lack of alternatives for obtaining quantitative output for probabilistic structures is considered.
Author
Monte Carlo Method; Probability Theory; Modal Response; Surface Properties; Structural Reliability; Distribution Functions; Substructures; Structural Design

19990041583 Los Alamos National Lab., NM USA
Viscoplastic model of expanding cylindrical shells subject to internal explosive detonations
Martineau, R. L.; Anderson, C. A.; Smith, F. W.; Dec. 31, 1998; 8p; In English; 1998 international conference on computational engineering science
Report No.(s): DE99-000621; LA-UR-98-1246; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thin cylindrical shells subjected to internal explosive detonations expand outwardly at strain-rates on the order 10(exp 4) s(sup -1). At approximately 150% strain, multiple plastic instabilities appear on the surface of these shells in a quasi-periodic pattern. These instabilities continue to develop into bands of localized shear and eventually form cracks that progress in a way that causes the shell to break into fragments. The entire process takes less than 100 microseconds from detonation to complete fragmentation. Modeling this high strain-rate expansion and generation of instabilities prior to fragmentation is the primary focus of this paper. Applications for this research include hypervelocity accelerators, flux compression generators, and explosive containment vessels for terrorist threats and power plants.
NTIS
Viscoplasticity; Cylindrical Shells; Detonation; Explosions; Mathematical Models

19990041804 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Elastoplastic Analysis of Notch-Tip Fields in Strain Hardening Materials
Guo, W., Defence Science and Technology Organisation, Australia; Wang, C. H., Defence Science and Technology Organisation, Australia; Rose, L. R. F., Defence Science and Technology Organisation, Australia; Aug. 1998; 35p; In English
Report No.(s): DSTO-RR-0137; DODA-AR-010-615; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

The elastic-plastic fields near a notch tip in strain hardening materials are investigated and modelled for a wide range of notch configuration, geometry, and load levels. Two engineering methods that are commonly employed for determining the elastic-plastic response at a notch tip are first assessed, and the results indicate that Neuber’s rule and its various extensions tend to overestimate the plastic strain at the notch-tip, and under-estimate the plastic strain away from the notch-tip. by contrast, the ESED method tends to underestimate the plastic strain at the notch-tip and its accuracy deteriorates as the load level increases. It is found that both methods are unable to provide satisfactory predictions of the stress-strain distribution ahead of a notch tip. To this end, an engineering approach is developed to characterize the stress-strain distribution in the notch-tip plastic zone, taking into account of the in-plane and through- thickness constraints near the notch root. Predictions are compared with finite element results, showing a good correlation for all the cases investigated.
Author
Elastoplasticity; Notches; Strain Hardening; Stress-Strain Relationships

19990041845 NASA Langley Research Center, Hampton, VA USA

Response of Composite Shells with Cutouts to Internal Pressure and Compression Loads

Hilburger, Mark W., National Academy of Sciences - National Research Council, USA; Waas, Anthony M., Michigan Univ., USA; Starnes, James H., Jr., NASA Langley Research Center, USA; February 1999; In English; Structures, Structural Dynamics, and Materials, 20-23 Apr. 1998, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 98-1768; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Results from a numerical study of the response of composite shells with cutouts and subjected to internal pressure and axial compression are presented. The numerical results are obtained using a geometrically nonlinear finite element code. Results for axial compression and combined internal pressure and axial compression are presented. The effects of varying internal pressure and cutout size on the prebuckling, buckling, and postbuckling responses of the shell are described. Results indicate that the nonlinear interaction between destabilizing in-plane compressive resultant stresses and out-of-plane displacements near the cutout can cause a local buckling response to occur near the cutout. The local load distributions and displacements near the cutout can be affected by the size of the cutout and by the internal pressure load. Numerical results indicate that the buckling load decreases as the size of the cutout is increased. In addition, the results indicate that the buckling load increases as the internal pressure is increased.

Author

Buckling; Finite Element Method; Internal Pressure; Shells (Structural Forms); Composite Materials; Openings; Axial Compression Loads

19990042143 NASA Langley Research Center, Hampton, VA USA

BLISS/S: A New Method for Two-Level Structural Optimization

Sobieszczanski-Sobieski, Jaroslaw, NASA Langley Research Center, USA; Kodiyalam, Srinivas, Engineous Software, Inc., 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

Contract(s)/Grant(s): NASA Order L-68259-D

Report No.(s): AIAA Paper 99-1345; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The paper describes a two-level method for structural optimization for a minimum weight under the local strength and the displacement constraints. The method divides the optimization task into separate optimizations of the individual substructures (in the extreme, the individual components) coordinated by the assembled structure optimization. The substructure optimizations use local cross-sections as design variables and satisfy the highly non-linear local constraints of strength and buckling. The design variables in the assembled structure optimization govern the structure overall shape and handle the displacement constraints. The assembled structure objective function is the objective in each of the above optimizations. The substructure optimizations are linked to the assembled structure optimization by the sensitivity derivatives. The method was derived from a previously reported two-level optimization method for engineering systems, e.g., aerospace vehicles, that comprise interacting modules to be optimized independently, coordination provided by a system-level optimization. This scheme was adapted to structural optimization by treating each substructure as a module in a system, and using the standard finite element analysis as the system analysis. A numerical example, a hub structure framework, is provided to show the new method agreement with a standard, no-decomposition optimization. The new method advantage lies primarily in the autonomy of the individual substructure optimization that enables concurrency of execution to compress the overall task elapsed time. The advantage increases with the magnitude of that task.

Author

Linear Programming; Design Analysis; Substructures; Systems Analysis; Linear Systems

19990042306 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

A Model for Ballistic Impact on Soft Armour

Billon, Horace, Defence Science and Technology Organisation, Australia; October 1998; 13p; In English

Report No.(s): DSTO-TR-0730; DODA-AR-010-653; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

A model has been developed at AMRL to describe the impact penetration of soft armour. This model uses a direct - step method to determine the motion of the impacting projectile and of the fabric undergoing impact. The determination of the ballistic limit, residual velocity and the dependence of the ballistic limit on the areal density of the impacted fabric are discussed. Comparisons with experimental results are presented.

Author

Models; Impact; Penetration; Armor

19990042334 NASA Langley Research Center, Hampton, VA USA

Sensitivity of Lumped Constraints Using The Adjoint Method

Akgun, Mehmet A., Middle East Technical Univ., Turkey; Haftka, Raphael T., Florida Univ., USA; Wu, K. Chauncey, NASA Langley Research Center, USA; Walsh, Joanne L., 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

Contract(s)/Grant(s): NCC1-268

Report No.(s): AIAA Paper 99-1314; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Adjoint sensitivity calculation of stress, buckling and displacement constraints may be much less expensive than direct sensitivity calculation when the number of load cases is large. Adjoint stress and displacement sensitivities are available in the literature. Expressions for local buckling sensitivity of isotropic plate elements are derived in this study. Computational efficiency of the adjoint method is sensitive to the number of constraints and, therefore, the method benefits from constraint lumping. A continuum version of the Kreisselmeier-Steinhauser (KS) function is chosen to lump constraints. The adjoint and direct methods are compared for three examples: a truss structure, a simple HSCT wing model, and a large HSCT model. These sensitivity derivatives are then used in optimization.

Author

Technology Utilization; Derivation; Displacement; Loads (Forces); Lumping; Models; Stress Analysis

19990042346 Los Alamos National Lab., NM USA

Predicting and modeling material failure under impact loading

Lewis, M. W.; Dec. 31, 1998; 11p; In English

Report No.(s): DE98-006309; LA-UR-98-912; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A method for predicting and modeling material failure in solids subjected to impact loading is outlined. The method uses classical void growth models of Gurson and Tvergaard in a material point method (MPM). Because of material softening, material stability is lost. At this point, the character of the governing partial differential equations changes, and localization occurs. This localization results in mesh dependence for many problems of interest. For many problems, predicting the occurrence of material failure and its extent is necessary. to enable this modeling, it is proposed that a discontinuity be introduced into the displacement field. by including a dissipation-based force- displacement relationship, the mesh dependence of energy dissipation can be avoided. Additionally, the material point method provides a means of allowing large deformations without mesh distortion or introduction of error through remapping.

NTIS

Impact Loads; Mathematical Models; Failure; Solids; Performance Prediction

42
GEOSCIENCES (GENERAL)

19990041580 Los Alamos National Lab., NM USA

Photon burst mass spectrometry for the measurement of Kr-85 at ambient levels

Fairbank, W. M.; LaBelle, R. D.; Hansen, C. S.; Dec. 31, 1998; 5p; In English; BIOS ’98: an international symposium on biomedical optics

Report No.(s): DE99-000695; LA-UR-98-1409; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Photon Burst Mass Spectrometry has been used to measure Kr-85 in a sample with an abundance of 6 x 10(exp -9). Improvements in detection efficiency by the use of avalanche photodiodes cooled to liquid nitrogen temperature are reported, which should make possible measurement of Kr-85 at the ambient atmospheric abundance of 10(exp 11). Potential applications include nuclear monitoring, atmospheric transport, and dating young ground water up to 40 years.

NTIS

Photons; Mass Spectroscopy; Krypton 85; Chronology

19990041604 Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA USA

Flower Garden Banks (Northwest Gulf of Mexico): Environmental Characteristics and Human Interaction ***Final Report***

Deslarzes, K. J. P.; Oct. 1998; 122p; In English

Report No.(s): PB99-134116; OCS/MMS-98-0010; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report is a multidisciplinary update of various topics concerning the Banks--oceanography, meteorology, commercial fishing, recreation, military activities, hydrocarbon development, and potential environmental impacts. The area surrounding the Flower Garden Banks is increasingly active with oil and gas development.
NTIS
Man Environment Interactions; Oceanography; Meteorology

19990041668 Geological Survey, Denver, CO USA
Audio-magnetotelluric data collected in the area of Beatty, Nevada
Williams, J. M.; Dec. 31, 1998; 149p; In English
Report No.(s): DE99-000506; USGS/OFR-98-231; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In the summer of 1997, electrical geophysical data was collected north of Beatty, Nevada. Audio-magnetotellurics (AMT) was the geophysical method used to collect 16 stations along two profiles. The purpose of this data collection was to determine the depth to the alluvial basement, based upon the needs of the geologists requesting the data.
NTIS
Data Acquisition; Magnetic Surveys; Audio Data; Geological Surveys; Geology

19990041718 Geological Survey, Water Resources Div., Altamonte Springs, FL USA
Water Resources Data for Florida, Water Year 1998. Volume 1B. Northeast Florida Ground Water ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Feb. 10, 1999; 336p; In English
Report No.(s): PB99-133936; USGS/WDR/FL-98/1B; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
The data for northeast Florida include continuous or daily discharge for 120 streams, periodic discharge for 14 streams, continuous or daily stage for 19 streams, periodic stage for 0 streams; peak stage and discharge for 1 stream; continuous or daily elevations for 19 lakes, periodic elevations for 25 lakes; continuous ground water levels for 55 wells, periodic ground-water levels for 938 wells; quality-of-water data for 17 surface-water sites and 61 wells.
NTIS
Florida; Ground Water; Hydrology; Tables (Data); Water Balance; Data Bases

19990041769 Geological Survey, Water Resources Div., Little Rock, AR USA
Water Resources Data for Arkansas, Water Year 1998 ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Porter, J. E.; Evans, D. A.; Remsing, L. M.; Feb. 1999; 372p; In English
Report No.(s): PB99-133944; USGS/WDR/AR-98-1; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche
Water resources data reported for the 1998 water year for Arkansas consist of records of discharge and water quality (physical measurements and chemical concentrations) of streams; water quality of lakes; and ground-water levels and ground-water quality. Data from selected sites in Missouri and Oklahoma are also included. The report contains daily discharge records for 61 surface-water stations and 4 daily sediment stations; water quality for 61 surface-water stations, 5 ground-water quality wells and springs, 8 ground-water-level observation wells, and 1 precipitation-quality station. Also included are data for 95 peak-discharge partial-record stations and 10 stage-only stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements.
NTIS
Arkansas; Ground Water; Hydrology; Tables (Data); Surface Water; Water Treatment

19990042078 Los Alamos National Lab., NM USA
Infrasonic observation of earthquakes
Mutschlecner, J. P.; Whitaker, R. W.; Dec. 31, 1998; 8p; In English; International workshop on radar polarimetry
Report No.(s): DE99-001235; LA-UR-98-2689; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Infrasound signals generated by earthquakes have been detected at arrays operated by the Los Alamos National Laboratory. Three modes of propagation are possible and all have been observed by the authors. The observations suggest that regions remote from the epicenters are excited and may serve as secondary source regions. A relation is found between the normalized peak amplitudes and the seismic magnitudes.
NTIS
Infrasonic Frequencies; Earthquakes; Sound Detecting and Ranging

19990042272 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Minerals of the earth's deep interior
Schiferl, D.; Zhao, Y.; Shankland, T. J.; Dec. 31, 1998; 10p; In English
Report No.(s): DE99-000833; LA-UR-98-1864; 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 addresses the major geophysical issue of the nature of the seismic velocity and density discontinuity at 670 km depth (the boundary between upper and lower mantle with temperature about 1,900 K and pressure about 23 GPa). A phase change at this depth would represent a relatively small barrier to mantle convection through the discontinuity, but compositional change would inhibit thermal convection throughout the mantle. to address this problem the authors measured equation of state parameters in mantle minerals as functions of high P-T using single crystal x-ray diffraction with a unique, new diamond-anvil cell (DAC) at simultaneous high temperature and pressure. Single-crystal diffraction improves absolute accuracy in lattice constants over those from powder diffraction by a factor of 5 to 10. The authors have measured equations of state of orthoenstatite MgSiO3 and hexagonal boron nitride hBN.
NTIS
Minerals; Earth (Planet); Geophysics; Core-Mantle Boundary

19990042428 Department of Energy, Office of Energy Research, Washington, DC USA
Energetics of melts from thermal diffusion studies ***Final Report***
Lesher, C. E.; Dec. 31, 1998; 4p; In English
Report No.(s): DE99-001169; DOE/ER/14240-T6; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Most processes in geology are a consequence at some level of the flow of energy or mass. Heat conduction and chemical diffusion are examples of two of these sorts of flows which are driven by temperature and chemical potential imbalances, respectively. In the general case these flows may be coupled so that, for instance, a temperature gradient may result in a flow of mass as well as heat. This effect in liquids was demonstrated by Soret (1879) and bears his name. In gases or solids the phenomenon is given the general name thermal diffusion. It was the purpose of this research program to examine the Soret effect in molten silicates under laboratory conditions. Results of these experiments are used to evaluate the form and quantitative values of many thermodynamic and kinetic properties of silicate melts over a range of temperature, pressure, and bulk composition. The author published a comprehensive review and synthesis with a microscopic theoretical explanation for the effect at low pressure in silicate liquids of geological interest. He conducted experimental investigations of molecular diffusion in the absence of a thermal gradient through experiments involving dissolution of solid silicates in molten silicate and interdiffusion of species between miscible silicate liquids. Collectively these results enable the author to construct a more comprehensive model of molecular diffusion in magmatic liquids. He has applied this model to problems of magma mixing and crustal assimilation.
NTIS
Melts (Crystal Growth); Thermal Diffusion; Geology; Molecular Diffusion

43
EARTH RESOURCES AND REMOTE SENSING

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

19990041150 NASA Goddard Space Flight Center, Greenbelt, MD USA
Textural-Contextual Labeling and Metadata Generation for Remote Sensing Applications
Kiang, Richard K., NASA Goddard Space Flight Center, USA; 1999; 6p; In English; Aerosense, 5-9 Apr. 1999, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Despite the extensive research and the advent of several new information technologies in the last three decades, machine labeling of ground categories using remotely sensed data has not become a routine process. Considerable amount of human intervention is needed to achieve a level of acceptable labeling accuracy. A number of fundamental reasons may explain why machine labeling has not become automatic. In addition, there may be shortcomings in the methodology for labeling ground categories. The spatial information of a pixel, whether textural or contextual, relates a pixel to its surroundings. This information should be utilized to improve the performance of machine labeling of ground categories. LANDSAT-4 Thematic Mapper (TM) data taken in July 1982 over an area in the vicinity of Washington, D.C. are used in this study. On-line texture extraction by neural networks may not be the most efficient way to incorporate textural information into the labeling process. Texture features are pre-computed from cooccurrence matrices and then combined with a pixel's spectral and contextual information as the input to a neural network.

The improvement in labeling accuracy with spatial information included is significant. The prospect of automatic generation of metadata consisting of ground categories, textural and contextual information is discussed.
Author
Data Management; Thematic Mappers (LANDSAT); Remote Sensing; Neural Nets; LANDSAT 4

19990041199 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Application of Rotation- and Translation-Invariant Overcomplete Wavelets to the registration of Remotely Sensed Imagery
LeMoigne, Jacqueline, NASA Goddard Space Flight Center, USA; Zavorine, Ilya, Maryland Univ., USA; 1999; 11p; In English; Aerosence '99, 5-9 Apr. 1999, Orlando, FL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A wavelet-based image registration approach has previously been proposed by the authors. In this work, wavelet coefficient maxima obtained from an orthogonal wavelet decomposition using Daubechies filters were utilized to register images in a multi-resolution fashion. Tested on several remote sensing datasets, this method gave very encouraging results. Despite the lack of translation-invariance of these filters, we showed that when using cross-correlation as a feature matching technique, features of size larger than twice the size of the filters are correctly registered by using the low-frequency subbands of the Daubechies wavelet decomposition. Nevertheless, high-frequency subbands are still sensitive to translation effects. In this work, we are considering a rotation- and translation-invariant representation developed by E. Simoncelli and integrate it in our image registration scheme. The two types of filters, Daubechies and Simoncelli filters, are then being compared from a registration point of view, utilizing synthetic data as well as data from the LANDSAT/ Thematic Mapper (TM) and from the NOAA Advanced Very High Resolution Radiometer (AVHRR).
Author
Wavelet Analysis; Rotation; Remote Sensing; Translating; Thematic Mappers (LANDSAT); Image Processing

19990041333 NASA Goddard Space Flight Center, Greenbelt, MD USA
Internal Physical Features of a Land Surface Model Employing a Tangent Linear Model
Yang, Runhua, NASA Goddard Space Flight Center, USA; Cohn, Stephen E., NASA Goddard Space Flight Center, USA; daSilva, Arlindo, NASA Goddard Space Flight Center, USA; Joiner, Joanna, NASA Goddard Space Flight Center, USA; Houser, Paul R., NASA Goddard Space Flight Center, USA; [1997]; 44p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Earth's land surface, including its biomass, is an integral part of the Earth's weather and climate system. Land surface heterogeneity, such as the type and amount of vegetative covering., has a profound effect on local weather variability and therefore on regional variations of the global climate. Surface conditions affect local weather and climate through a number of mechanisms. First, they determine the re-distribution of the net radiative energy received at the surface, through the atmosphere, from the sun. A certain fraction of this energy increases the surface ground temperature, another warms the near-surface atmosphere, and the rest evaporates surface water, which in turn creates clouds and causes precipitation. Second, they determine how much rainfall and snowmelt can be stored in the soil and how much instead runs off into waterways. Finally, surface conditions influence the near-surface concentration and distribution of greenhouse gases such as carbon dioxide. The processes through which these mechanisms interact with the atmosphere can be modeled mathematically, to within some degree of uncertainty, on the basis of underlying physical principles. Such a land surface model provides predictive capability for surface variables including ground temperature, surface humidity, and soil moisture and temperature. This information is important for agriculture and industry, as well as for addressing fundamental scientific questions concerning global and local climate change. In this study we apply a methodology known as tangent linear modeling to help us understand more deeply, the behavior of the Mosaic land surface model, a model that has been developed over the past several years at NASA/GSFC. This methodology allows us to examine, directly and quantitatively, the dependence of prediction errors in land surface variables upon different vegetation conditions. The work also highlights the importance of accurate soil moisture information. Although surface variables are predicted imperfectly due to inherent uncertainties in the modeling process, our study suggests how satellite observations can be combined with the model, through land surface data assimilation, to improve their prediction.
Author
Biomass; Climatology; Earth Surface; Prediction Analysis Techniques; Surface Properties; Weather; Mathematical Models; Linear Systems

19990041587 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Evaluation of Suits and Sail Models for Soybean (Glycine max (L.) Merrill) Canopy Reflectance Study ***Avaliaca dos Modelos Suits e Sail no Estudo da Reflectancia da Soja (Glycine max (L.) Merrill)***

Antunes, Mauro Antonio Homem, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 166p; In Portuguese

Report No.(s): INPE-6988-TDI/657; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The radiative transfer model is applied to the spectral behavior of the agricultural crop canopy studies. It consist of an aid-efficient instrument to carry out the use of remote sensing techniques for agriculture. In this work SUITS and SAIL canopy reflectance models performance was evaluated, based on the comparison between calculated and measured Bidirectional Reflectance Factor (BRF) in a soybean growth (Glycine max (L.) Merrill) under the same conditions. According to this research, it was concluded that: (1) SUITS and SAIL models had similar tendencies, but SAIL model performance was better than SUITS model; (2) for the SAIL model the linear regression between calculated and measured BRF had a r-square value of 0.77 for the wavelength in the red spectral region, and r-square value of 0.74 from 740 m-n to 861 mn spectral range; (3) both models do not depend on the canopy vertical density; (4) through sensitivity analysis, it was found that a good precision in the input data for SAIL model namely angular distribution and spectral attributes of leaves, is needed to obtain a good performance in the BRF simulation.

Author

Bidirectional Reflectance; Canopies (Vegetation); Radiative Transfer; Reflectance; Remote Sensing; Mathematical Models; Biological Models (Mathematics)

19990041597 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Description of Large Scale Bedforms by LANDSAT Thematic Mapper in the Northern Shelf of the Rio Grand Do Norte State ***Descricao de Corpos Arenosos de Grande Escala na Zona Costeira e na Platfaforma Continental Norte do Rio Grande do Norte por Imagens TM/LANDSAT***

Santos, Marciel Silva, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 178p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7010-TDI/659; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This work presents a study of large scale bedforms observable by the LANDSAT Thematic Mapper on the northern shelf of the State of ”Rio Grande do Norte”, in northeast Brazil. The area is located between 4 degree 20’00” S; 5 degree 10’00” S and 35 degree 50’00” W; 37 degree 20’00” W. Mapping of the area is accomplished by registration of the images with a single bathymetric chart issued by the Directorate of Hydrography and Navigation (DHN) of the Brazilian Navy. Despite the lack of current and wave data for the study area it is possible to suggest oceanic processes are likely to be forcing the generation of the observed bedforms. Besides a depth profile obtained from an old ship transect is also used to compare with the gray level variation along an adjacent image transect in order to suggest that the photobathymetric analysis and mapping based on a single image is feasible. The bedform types identified in the present study area: (1) large dunes (unidirectional current generated, asymetrical) of about 10m height; (2) large tidal sand waves (symetrical); (3) Sand Ridge/ Barrier Island complexes of unknown origin, probably caused by wave/tidal current interactions; (4) hard substrates possibly of coral/coralline algae/beach rock associations and erosive spits. The mapping and description of large scale bedforms using data from LANDSAT Thematic Mapper, indicate that there weren’t displacements for them in the period of 1984-1990. However, it was possible to identify the changes in the shelf line. The use of Fourier Transform was helpful in image restoration and noise removal.

Author

Dunes; Erosion; Wave Interaction; Topography; Altimetry; Reefs; Sands; Ocean Currents; Tides; Interactions

19990042020 New Hampshire Univ., Inst. for the Study of Earth, Oceans and Space, Durham, NH USA

Relationship between Ecosystem Productivity and Photosynthetically Active Radiation for Northern Peatlands

Frolking, S. E., New Hampshire Univ., USA; Bubier, J. L., New Hampshire Univ., USA; Moore, T. R., McGill Univ., Canada; Ball, T., McGill Univ., Canada; Bellisario, L. M., McGill Univ., Canada; Bhardwaj, A., McGill Univ., Canada; Carroll, P., New Hampshire Univ., USA; Crill, P. M., New Hampshire Univ., USA; Lafleur, P. M., Trent Univ., Canada; McCaughey, J. H., Queens Univ., Canada; Roulet, N. T., McGill Univ., Canada; Suyker, A. E., Nebraska Univ., USA; Verma, S. B., Nebraska Univ., USA; Waddington, J. M., McMaster Univ., Canada; Whiting, G. J., Christopher Newport Univ., USA; Global Biogeochemical Cycles; Mar. 1998; ISSN 0886-6236; Volume 12, No. 1, pp. 115-126; In English

Report No.(s): Paper 97GB03367; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We analyzed the relationship between net ecosystem exchange of carbon dioxide (NEE) and irradiance (as photosynthetic photon flux density or PPFD), using published and unpublished data that have been collected during midgrowing season for carbon balance studies at seven peatlands in North America and Europe, NEE measurements included both eddy-correlation tower and clear, static chamber methods, which gave very similar results. Data were analyzed by site, as aggregated data sets by peatland

type (bog, poor fen, rich fen, and all fens) and as a single aggregated data set for all peatlands. In all cases, a fit with a rectangular hyperbola (NEE = alpha PPFD P(sub max)/(alpha PPFD + P(sub max) + R) better described the NEE-PPFD relationship than did a linear fit (NEE = beta PPFD + R). Poor and rich fens generally had similar NEE-PPFD relationships, while bogs had lower respiration rates (R = -2.0 micro mol m(exp -2) s(exp -1) for bogs and -2.7 micro mol m(exp -2) s(exp -1)) for fens) and lower NEE at moderate and high light levels (P(sub max)= 5.2 micro mol m(exp -2) s(exp -1) for bogs and 10.8 micro mol m(exp -2) s(exp -1) for fens). As a single class, northern peatlands had much smaller ecosystem respiration (R = -2.4 micro mol m(exp -2) s(exp -1)) and NEE rates (alpha = 0.020 and P(sub max)= 9.2 micro mol m(exp -2) s(exp -1)) than the upland ecosystems (closed canopy forest, grassland, and cropland). Despite this low productivity, northern peatland soil carbon pools are generally 5-50 times larger than upland ecosystems because of slow rates of decomposition caused by litter quality and anaerobic, cold soils.
Author
Carbon; Carbon Dioxide; Decomposition; Ecosystems; Marshlands; Photosynthesis; Respiration; Soils; Peat; Photon Density

19990042021 New Hampshire Univ., Inst. for the Study of Earth, Oceans and Space, Durham, NH USA
Sensitivity of Spruce/Moss Boreal Forest Net Ecosystem Productivity to Seasonal Anomalies in Weather
Frolking, Steve, New Hampshire Univ., USA; Journal of Geophysical Research; Dec. 26, 1997; ISSN 0148-0227; Volume 102, No. D24; 12p; In English
Report No.(s): Paper 96JD03707; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Abstract. A process-oriented, daily time step model of a spruce/moss boreal ecosystem simulated 1994 and 1995 productivity for a Boreal Ecosystem-Atmosphere Study site near Thompson, Manitoba. Simulated black spruce net primary productivity (NPP) was 139 g C m(exp -2) in 1994 and 112 in 1995; feathermoss NPP was 13.0 g C m(exp -2) in 1994 and 9.7 in 1995; decomposition was 126 g C m(exp -2) in 1994 and 130 in 1995; net ecosystem productivity (NEP) was an uptake of 26.3 g C m(exp -2)in 1994 and 2.5 in 1995. A very dry period for the first half of the 1995 summer was the major cause of that year's lower productivity. Sensitivity simulations explored the impact of 2-month long warmer, cooler, wetter, and drier spells on ecosystem productivity. Warmer summers decreased spruce NPP, moss NPP, and NEP; cooler summers had the opposite effect. Earlier snowmelt (due to either warmer spring temperatures or reduced winter precipitation) increased moss and spruce NPP; later snowmelt had the opposite effect. The largest effect on decomposition was a 5% reduction due to a drier summer. One-month droughts (April through October) were also imposed on 1975 base year weather. Early summer droughts reduced moss annual NPP by -30-40%; summer droughts reduced spruce annual NPP by 10%; late summer droughts increased moss NPP by about 20% due to reduced respiration; May to September monthly droughts reduced heterotrophic respiration by about 10%. Variability in NEP was up to roughly +/- 35%. Finally, 1975 growing season precipitation was redistributed into frequent, small rainstorms and infrequent, large rainstorms. These changes had no effect on spruce NPP. Frequent rainstorms increased decomposition by a few percent, moss NPP by 50%, and NEP by 20%. Infrequent rainstorms decreased decomposition by 5%, moss NPP by 50% and NEP by 15%. The impact of anomalous weather patterns on productivity of this ecosystem depended on their timing during the year. Multiyear data sets are necessary to understand this behavior and test these types of models.
Author
Conifers; Drought; Ecosystems; Respiration; Decomposition; Bryophytes; Seasons; Weather; Carbon

19990042022 NASA, Washington, DC USA
Modelling Temporal Variability in the Carbon Balance of a Spruce/Moss Boreal Forest
Frolking, S., New Hampshire Univ., USA; Goulden, M. L., Harvard Univ., USA; Wofsy, S. C., Harvard Univ., USA; Fan, S.-M., Harvard Univ., USA; Sutton, D. J., Harvard Univ., USA; Munger, J. W., Harvard Univ., USA; Bazzaz, A. M., Harvard Univ., USA; Daube, B. C., Harvard Univ., USA; Crill, P. M., New Hampshire Univ., USA; Aber, J. D., New Hampshire Univ., USA; Band, L. E., Toronto Univ., Canada; Wang, X., Toronto Univ., Canada; Savages, K., McGill Univ., Canada; Moore, T., McGill Univ., Canada; Harriss, R. C., NASA, USA; Blobal Change Biology; 1996; Volume 2, pp. 343-366; In English
Contract(s)/Grant(s): NAGw-3082; NAG5-2253; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A model of the daily carbon balance of a black spruce/feathermoss boreal forest ecosystem was developed and results compared to preliminary data from the 1994 BOREAS field campaign in northern Manitoba, Canada. The model, driven by daily weather conditions, simulated daily soil climate status (temperature and moisture profiles), spruce photosynthesis and respiration, moss photosynthesis and respiration, and litter decomposition. Model agreement with preliminary field data was good for net ecosystem exchange (NEE), capturing both the asymmetrical seasonality and short-term variability. During the growing season simulated daily NEE ranged from -4 g C m(exp -2) d(exp -1) (carbon uptake by ecosystem) to + 2 g C m(exp -2) d(exp -1) (carbon flux to atmosphere), with fluctuations from day to day. In the early winter simulated NEE values were + 0.5 g C m(exp -2) d(exp -1), dropping to + 0.2 g C m(exp -2) d(exp -1) in mid-winter. Simulated soil respiration during the growing season (+ 1 to + 5 g C m(exp -2) d(exp -1)) was dominated by metabolic respiration of the live moss, with litter decomposition usually contributing

less than 30% and live spruce root respiration less than 10% of the total. Both spruce and moss net primary productivity (NPP) rates were higher in early summer than late summer. Simulated annual NEE for 1994 was -51 g C m(exp -2) y(exp -1), with 83% going into tree growth and 17% into the soil carbon accumulation. Moss NPP (58 g C m(exp -2) d(exp -1)) was considered to be litter (i.e. soil carbon input; no net increase in live moss biomass). Ecosystem respiration during the snow-covered season (84 g Cm(exp -2)) was 58% of the growing season net carbon uptake. A simulation of the same site for 1968-1989 showed about 10-20% year-to-year variability in heterotrophic respiration (mean of + 113 g C m-2 y@1). Moss NPP ranged from 19 to 114 g C m(exp -2) y(exp -1); spruce NPP from 81 to 150 g C nt-2 y,@l; spruce growth (NPP minus litterfall) from 34 to 103 g C m(exp -2) y(exp -1); NEE ranged from +37 to -142 g C m(exp -2) y(exp -1). Values for these carbon balance terms in 1994 were slightly smaller than the 1969 - 89 means. Higher ecosystem productivity years (more negative NEE) generally had early springs and relatively wet summers; lower productivity years had late springs and relatively dry summers.
Author
Biomass; Carbon; Conifers; Decomposition; Ecosystems; Forests; Photosynthesis; Respiration; Soils; Variability; Bryophytes

19990042088 NASA Goddard Space Flight Center, Greenbelt, MD USA
Analysis of Daily, Seasonal, and Interannual Changes in Hofsjokull Ice Cap, Iceland, using Satellite Data
Hall, D. K., NASA Goddard Space Flight Center, USA; Garvin, J. B., NASA Goddard Space Flight Center, USA; Williams, R. S., Jr., Geological Survey, USA; Barton, J. S., General Sciences Corp., USA; Sigurosson, O., National Energy Authority, Iceland; Smith, L. C., California Univ., USA; 1998; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Analysis of a time series of European Remote Sensing Satellite (ERS)-1 and -2, RADARSAT ScanSAR synthetic aperture radar (SAR) and LANDSAT images from 1973 to 1998, shows daily to interannual changes in Hofsjokull, a 923 sq km ice cap in central Iceland. A digital elevation model of Hofsjokull was constructed using interferometry, and then SAR backscatter coefficient (d) was plotted with elevation, and air temperature along a transect across the ice cap. Most of the a' changes measured along the transect are caused by a change in the state (frozen or thawed) of the surficial snow or ice when air temperature rises above or below about -5 to O C. Seasonal (sigma)deg patterns are identified in a 4-year time series of 57 ERS-1 and -2 images. In addition, June 1997 ScanSAR images display rapid changes in brightness that are tied closely to daily meteorological events. SAR and LANDSAT data were also used to measure changes in the areal extent of Hofsjokull, from 1973 to 1997, and to locate (sigma)deg and reflectance boundaries that relate to the glacier facies. Late-summer 1997 (sigma)deg and reflectance boundaries agree and are coincident with the approximate location of the fim line, and the January 1998 position of the equilibrium line as determined from ERS-2 data.
Author
Annual Variations; Iceland; Remote Sensing; Time Series Analysis; Synthetic Aperture Radar; Satellite Observation; Satellite Imagery

19990042317 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Biophysical Properties Estimation of Eucalyptus Plantations from TM/LANDSAT Data ***Estimativa de Propriedades Biofisicas de Plantacoes de Eucaliptos a Partir de Dados LANDSAT-TM***
Xavier, Alexandre Candido, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 126p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6832/TDI/645; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In this study we carried out a feasibility assessment of remote sensing techniques to estimate Leaf Area Index (LAI), Diameter at the Breast Height (DBH), Height and the Age of different Eucalyptus genetic materials, from 12 to 78 months of age. The test-area is the Aracruz regional from Aracruz Celulose S.A., in the Espirito Santo State, Brazil. In a reforestation area, LAI, DBH and height are important parameters: the LAI is one of the principal variables defining the energy and mass exchanges at atmosphere-vegetation interface, while DBH and height are used to estimate the wood volume at the area, from allometric equations. Initially, tests were made with the LAI-2000 equipment to define a methodology to collect LAI data in the Eucalyptus plantation. Remote sensing data used was a LANDSAT-TM5 image acquired in 1997, during the field work. The image processing steps were digital number to reflectance conversion and the calculation of the Normalized Difference Vegetation Index, NDVL Soil-Adjusted Vegetation Index, SAVI, vegetation proportion, soil proportion and shade proportion. The LAI behavior of the Eucalyptus plantation was distinct for different genetic materials. It was not always possible to find a mathematical relationship between both the vegetation indexes and the proportion images with biophysical variables. In general SAVI was better than NDVI to estimate the

biophysical variables. Vegetation among and shade proportion and SAVI variables were highly correlated among themselves and any of them could be used to estimate the biophysical variables in Eucalyptus plantations with the same precision.
Author
Biophysics; Estimating; Research; Feasibility Analysis; Remote Sensing; Technology Assessment; Leaf Area Index

44
ENERGY PRODUCTION AND CONVERSION

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

19990041203 Los Alamos National Lab., NM USA
Investigations of biomimetic light energy harvesting pigments
Van Patten, P. G.; Donohoe, R. J.; Lindsey, J. S.; Bocian, D. F.; Dec. 31, 1998; 6p; In English
Report No.(s): DE99-001265; LA-UR-98-2617; 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). Nature uses chlorophyll and other porphyritic pigments to capture and transfer light energy as a preliminary step in photosynthesis. The design of synthetic assemblies of light harvesting and energy directing pigments has been explored through synthesis and characterization of porphyrin oligomers. In this project, pigment electronic and vibrational structures have been explored by electrochemistry and dynamic and static optical measurements. Transient absorption data reveal energy transfer between pigments with lifetimes on the order of 20--200 picoseconds, while Raman data reveal that the basic porphyrin core structure is unperturbed relative to the individual monomer units. These two findings, along with an extensive series of experiments on the oxidized oligomers, reveal that coupling between the pigments is fundamentally weak, but sufficient to allow facile energy transfer as the predominant excited state process. Modeling of the expected quantum yields for energy transfer within a variety of arrays was accomplished, thereby providing a tool to guide synthetic goals.
NTIS
Pigments; Energy Transfer; Light (Visible Radiation)

19990041472 Lawrence Livermore National Lab., Livermore, CA USA
Core testing of zinc/air refuelable battery modules
Cooper, J.; Aug. 20, 1998; 6p; In English
Report No.(s): DE98-058585; UCRL-ID-131729; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We are developing a refuelable zinc/air battery (6-cells) for evaluation under the five USABC 'core' test protocols. In the first half of the two year project ($100 K, FY1997), an advanced refuelable design was developed, fabricated and tested at power levels up to 415 W. Performance matched or exceeded that of earlier multicell systems. A computer program was developed for automated data acquisition and drive cycle simulation. Small mockup cells (80 cm 2) were constructed for rapid testing of components. In the follow-on effort (FY1998, $100 K) we will make minor advances in system design and fabrication efficiency, and seek to improve cathode performance and life, before delivery of two final units for test at DOE laboratory.
NTIS
Zinc; Metal Air Batteries; Performance Tests

19990041601 Florida Solar Energy Center, Cape Canaveral, FL USA
Solar Domestic Hot Water Technology Evaluation Program ***Final Report***
Jul. 1998; 156p; In English
Report No.(s): PB99-136343; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Florida Solar Energy Center, under contract to the New York State Energy Research and Development Authority (NYSERDA), installed 12 solar domestic hot water (SDHW) systems in single-family residences in downstate New York and instrumented them to determine energy consumption and time-of-day electrical demand. Annual performance data was collected on both the SDHW systems and the original electric resistance water heaters and has been analyzed to determine energy efficiency, cost effectiveness, and the impact on electrical utility peak demand. The average New York SDHW system installed during this program operated with approximately 63 percent higher annual electrical energy efficiency than the average electric resistance water heater. The energy savings for the twelve New York SDHW systems ranged from approximately 900 to 3,100 kWh per year, with a mean of 1,980 kWh per year. Hence, at the 1995 residential electricity rates of LILCO, Con Edison, and Orange and Rockland Utilities, the average utility customer could save approximately $325 per year due to a typical SDHW system. The average

installed cost for a SDHW system in this program was $3,850, so the average tax-free rate of return for the 12 SDHW systems was 8.4 percent. However if the utility owned the SDHW system and sold the hot water to the customer for a monthly fee, the after-tax internal rate of return to the utility could be higher than the customer's rate of return, because of the utility's ability to take depreciation and the federal solar energy investment tax credit.
NTIS
Solar Energy; Water Heating; Energy Technology

19990041667 Sandia National Labs., Albuquerque, NM USA
Plasma etching, texturing, and passivation of silicon solar cells
Ruby, D. S.; Yang, P.; Zaidi, S.; Brueck, S.; Roy, M.; Dec. 31, 1998; 7p; In English; 15th; National Center for Photovoltaics program review conference
Report No.(s): DE99-000545; SAND-98-2062C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors improved a self-aligned emitter etchback technique that requires only a single emitter diffusion and no alignments to form self-aligned, patterned-emitter profiles. Standard commercial screen-printed gridlines mask a plasma-etchback of the emitter. A subsequent PECVD-nitride deposition provides good surface and bulk passivation and an antireflection coating. The authors used full-size multicrystalline silicon (mc-Si) cells processed in a commercial production line and performed a statistically designed multiparameter experiment to optimize the use of a hydrogenation treatment to increase performance. They obtained an improvement of almost a full percentage point in cell efficiency when the self-aligned emitter etchback was combined with an optimized 3-step PECVD-nitride surface passivation and hydrogenation treatment. They also investigated the inclusion of a plasma-etching process that results in a low-reflectance, textured surface on multicrystalline silicon cells. Preliminary results indicate reflectance can be significantly reduced without etching away the emitter diffusion.
NTIS
Plasma Etching; Passivity; Solar Cells; Textures

19990041789 EMCON, Tuxedo, NY USA
Leachate Evaporation Demonstration Project at Brookhaven Municipal Landfill ***Final Report***
Sep. 1998; 84p; In English
Report No.(s): PB99-133159; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
A demonstration leachate evaporation project using landfill gas as the primary energy source was successfully conducted at the Brookhaven Municipal Landfill. A submerged flame evaporator was used for the process. Leachate generated at the landfill could be concentrated to greater than 25% total solids. At the highest level of solids achieved, the evaporation equipment continued to meet design capacity. Effluent produced in the process passed the USA Environmental Protection Agency's Toxicity Characteristics Leaching Procedure (TCLP). In addition, effluent was virtually odor-free. Based on these results, according to applicable permits for the project, the effluent material could be returned directly to the landfill.
NTIS
Evaporation; Environment Protection; Effluents; Landfills

19990041819 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Intrinsic Creep Resistance of Two Solid Oxygen Fuel Cell Electrolytes: Cubic Zirconia Versus Doped Lanthanum Gallate ***Interim Report, Dec. 1998 - Jan. 1999***
Wolfenstine, Jeff; Mar. 1999; 13p; In English
Contract(s)/Grant(s): Proj-AH94
Report No.(s): AD-A362026; ARL-TN-133; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Knowledge of the creep parameters for cubic zirconia and doped lanthanum gallate allowed for a determination of the intrinsic creep resistance of each material in the temperature range from 800 to 1000 deg C, where they are to be utilized as electrolytes in solid oxygen fuel cells. The results revealed that the intrinsic creep resistance of cubic zirconia is much higher than that of doped lanthanum gallate. This is most likely a result of their different crystal structures.
DTIC
Fuel Cells; Solid Electrolytes; Lanthanum; Creep Strength; Creep Properties

19990041856 Iowa State Univ. of Science and Technology, Inst. For Physical Research and Technology, Ames, IA USA
Investigation of an integrated switchgrass gasification/fuel cell power plant ***Final Report***
Brown, R. C.; Smeenk, J.; Steinfeld, G.; Sep. 30, 1998; 32p; In English
Report No.(s): DE99-001469; DOE/GO/10148-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Chariton Valley Biomass Power Project, sponsored by the US Department of Energy Biomass Power Program, has the goal of converting switchgrass grown on marginal farmland in southern Iowa into electric power. Two energy conversion options are under evaluation: co-firing switchgrass with coal in an existing utility boiler and gasification of switchgrass for use in a carbonate fuel cell. This paper describes the second option under investigation. The gasification study includes both experimental testing in a pilot-scale gasifier and computer simulation of carbonate fuel cell performance when operated on gas derived from switchgrass. Options for comprehensive system integration between a carbonate fuel cell and the gasification system are being evaluated. Use of waste heat from the carbonate fuel cell to maximize overall integrated plant efficiency is being examined. Existing fuel cell power plant design elements will be used, as appropriate, in the integration of the gasifier and fuel cell power plant to minimize cost complexity and risk. The gasification experiments are being performed by Iowa State University and the fuel cell evaluations are being performed by Energy Research Corporation.
NTIS
Gasification; Fuel Cells; Systems Integration; Plant Design; Electric Power Plants

19990041964 Radian International, LLC, Austin, TX USA
Methane Emissions from the US Petroleum Industry ***Final Report, Apr. 1995 - Apr. 1996***
Harrison, M. R.; Shires, T. M.; Baker, R. A.; Loughran, C. J.; Feb. 1999; 158p; In English
Report No.(s): PB99-128159; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The report quantifies methane (CH4) emissions from the U.S. petroleum industry by identifying sources of CH4 from the production, transportation, and refining of oil. Emissions are reported for the base year 1993 and for the years 1986 through 1992, based on adjustments to the base year calculations. An extensive literature search identified 54 reports as having some potential applicability for estimating CH4 emissions from the petroleum industry. Each report was reviewed and subjectively ranked based on data quality. Methods for estimating emissions were developed when data gaps were identified. For the base year 1993, approximately 98 billion (10(exp 9)) standard cubic feet (Bscf) +/- 44% of CH4 emissions are attributed to the petroleum industry. Standard error propagation techniques were used to determine the precision of the estimate to a 90% confidence bound.
NTIS
Methane; Pollution Monitoring; Emission; Petroleum Products; Air Pollution

19990042046 Argonne National Lab., Energy Technology Div., IL USA
Ice Slurry Cooling Research: Storage Tank Ice Agglomeration and Extraction
Kasza, K.; Hayashi,; Dec. 31, 1999; 17p; In English; American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) winter meeting
Report No.(s): DE98-057947; ANL/ET/CP-96499; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new facility has been built to conduct research and development on important issues related to implementing ice slurry cooling technology. Ongoing studies are generating important information on the factors that influence ice particle agglomeration in ice slurry storage tanks. The studies are also addressing the development of methods to minimize and monitor agglomeration and improve the efficiency and controllability of tank extraction of slurry for distribution to cooling loads. These engineering issues impede the utilization of the ice slurry cooling concept that has been under development by various groups.
NTIS
Thermal Energy; Storage Tanks; Latent Heat

19990042081 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Flight Prediction for Performance of the SWAS Solar Array Deployment Mechanism
Sneiderman, Gary, NASA Goddard Space Flight Center, USA; Daniel, Walter K., Mechanical Dynamics, Inc., USA; 1999; 15p; In English; Aerospace Mechanics, 11-14 May 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The focus of this paper is a comparison of ground-based solar array deployment tests with the on-orbit deployment. The discussion includes a summary of the mechanisms involved and the correlation of a dynamics model with ground based test results. Some of the unique characteristics of the mechanisms are explained through the analysis of force and angle data acquired from the test deployments. The correlated dynamics model is then used to predict the performance of the system in its flight application.
Author
Performance Prediction; Flight Tests; Solar Arrays; Deployment

19990042091 NASA Lewis Research Center, Cleveland, OH USA

A Review of Recent Thermophotovoltaic Energy Conversion Technology Development at NASA Lewis Research Center

Wilt, David M., NASA Lewis Research Center, USA; Chubb, Donald L., NASA Lewis Research Center, USA; 1998; 6p; In English; STAIF-'98, 25-29 Jan. 1998, New Mexico, USA

Contract(s)/Grant(s): RTOP 632-1A-1A; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

NASA Lewis Research Center (LeRC) has had an ongoing research program in TPV since the late 1980's. This effort has included both in-house research programs on critical components such as photovoltaic cells (PV) and emitter materials, as well as an active contracting effort directed toward system, and component development. of particular note is the in-house development of thin film selective emitters fabricated from rare-earth yttrium aluminum garnets (YAG). Also developed at LeRC is a Monolithic Interconnect Module (MIM) consisting of many small InGaAs cells series interconnected on a single InP substrate. An infrared reflector placed on the rear surface of the substrate returns unabsorbed photons to the emitter for recycling. The current contracted efforts include two TPV system developments by Tecogen, Inc., a solar powered TPV system development, a GaInAsSb cell development and several emitter development efforts (plasma-sprayed selective emitters, flexible SiC and a selective emitting light pipe).

Author

Thermophotovoltaic Conversion; Energy Conversion; Photovoltaic Cells; Emitters; Thin Films; Yttrium-Aluminum Garnet

19990042247 Lockheed Martin Astronautics, Denver, CO USA

Mars Atmospheric Acquisition and Compression System: Initial Results

Clark, L. D., Lockheed Martin Astronautics, USA; In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts; 1999, pp. 3; In English; See also 19990042245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Most concepts for In-Situ-Resource Utilization (ISRU) on Mars require the acquisition and compression of atmospheric carbon dioxide. One of the most favorable compression methods is the use of an adsorption bed in terms of reliability and power consumption. The cold Martian environment can provide enough cooling to adsorb up to 16 percent of the bed mass with CO2. Heating will then drive off and compress the CO2 with some of the thermal energy provided by waste heat from the propellant production process. A large, flight-like adsorption compressor was designed, built and tested at Lockheed Martin Astronautics in the Engineering Propulsion Laboratory in Denver, Colorado under a contract with NASA-Jet Propulsion Laboratory. The size and performance was designed to provide the quantity of CO2 expected for a sample return mission. The target value for CO2 production selected was 3 kg of CO2 per sol.

Derived from text

Mars (Planet); Mars Atmosphere; Atmospheric Composition; Carbon Dioxide; Mars Environment; Mars Sample Return Missions

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990041145 University Corp. for Atmospheric Research, Office for Interdisciplinary Earth Studies, Boulder, CO USA

Pilot Institute on Global Change on Trace Gases and the Biosphere, 1988

Eddy, J. A., University Corp. for Atmospheric Research, USA; Moore, B., University Corp. for Atmospheric Research, USA; 1998; 66p; In English

Report No.(s): PB99-109936; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Table of Contents: Summary; Background; General Framework for a Series of Institutes on Global Change; The 1988 Pilot Institute on Global Changes: Trace Gases and the Biosphere; Budget; List of Acronyms; and Attachments.

NTIS

Climate Change; Trace Elements; Biosphere; Atmospheric Composition; Biogeochemistry

19990041152 Atmospheric and Environmental Research, Inc., Cambridge, MA USA

Coupling Processes between Atmospheric Chemistry and Climate ***Semiannual Report No. 4, Jul. - Dec. 1998***

Ko, Malcolm K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, Debra K., Atmospheric and Environmental Research, Inc., USA; Shia, Run-Lie, Atmospheric and Environmental Research, Inc., USA; Scott, Courtney J., Atmo-

spheric and Environmental Research, Inc., USA; Sze, Nien Dak, Atmospheric and Environmental Research, Inc., USA; Mar. 18, 1998; 34p; In English
Contract(s)/Grant(s): NAS5-97039
Report No.(s): NASA/CR-1999-209207; NAS 1.26:209207; P698; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the fourth semi-annual report for NAS5-97039, covering the time period July through December 1998. The overall objective of this project is to improve the understanding of coupling processes between atmospheric chemistry and climate. Model predictions of the future distributions of trace gases in the atmosphere constitute an important component of the input necessary for quantitative assessments of global change. We will concentrate on the changes in ozone and stratospheric sulfate aerosol, with emphasis on how ozone in the lower stratosphere would respond to natural or anthropogenic changes. The key modeling tools for this work are the Atmospheric and Environmental Research (AER) two-dimensional chemistry-transport model, the AER two-dimensional stratospheric sulfate model, and the AER three-wave interactive model with full chemistry. For this six month period, we report on a modeling study of new rate constant which modify the NOx/NOy ratio in the lower stratosphere; sensitivity to changes in stratospheric water vapor in the future atmosphere; a study of N2O and CH4 observations which has allowed us to adjust diffusion in the 2-D CTM in order to obtain appropriate polar vortex isolation; a study of SF6 and age of air with comparisons of models and measurements; and a report on the Models and Measurements II effort.
Author
Air Pollution; Atmospheric Chemistry; Atmospheric Composition; Climate; Environment Effects; Man Environment Interactions; Ozone; Reaction Kinetics; Stratosphere; Trace Elements; Two Dimensional Models

19990041206 ARCADIS Geraghty and Miller, Inc., Research Triangle Park, NC USA
Investigation of Remote Sensing Devices for Chemical Characterization of Motor Vehicle Exhaust ***Final Report, Feb. 1995 - Sep. 1998***
Jones, J. W.; Ripberger, C. T.; Vescio, N.; Dec. 1998; 43p; In English
Report No.(s): PB99-127987; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report summarizes results of tests to: (1) evaluate the accuracy and precision of two different remote sensing devices (RSDs) for measuring carbon monoxide (CO), hydrocarbons (HCs), and nitric oxide (NO), and (2) evaluating the capabilities of three RSDs for characterizing fleet emissions of NO. 'Puff' tests (in which simulated motor vehicle exhaust gas was repeatedly injected in bursts or puffs into the RSDs) were conducted. The accuracy and precision of data from these measurements, which showed a generally linear response over a range of concentrations, were in the order CO greater than HCs greater than NO. Subsequently, three vehicles were driven at constant speed on a dynamometer and on a test track. The average emissions data measured by the three RSDs at the track, when compared to the dynamometer emissions data (which were used as the standard), in general showed just the opposite result; i.e., NO greater than HCs greater than CO. However, the test track data showed a considerable amount of variation. The three RSDs were tested for several hours on a freeway ramp in Raleigh, NC.
NTIS
Remote Sensors; Research; Evaluation; Accuracy; Air Pollution; Exhaust Emission

19990041439 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Three-Dimensional Total Odd Nitrogen (NO(y)) Simulation During SONEX using a Stretched-Grid Chemical Transport Model
Allen, Dale, Maryland Univ., USA; Pickering, Kenneth, Maryland Univ., USA; Stenchikov, Georgiy, Maryland Univ., USA; Thompson, Anne M., NASA Goddard Space Flight Center, USA; Kondo, Yutaka, Nagoya Univ., Japan; Mar. 12, 1999; 84p; In English
Contract(s)/Grant(s): NCC5-55; NAG5-7263; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The relative importance of various odd nitrogen (NOy) sources including lightning, aircraft, and surface emissions on upper tropospheric total odd nitrogen is illustrated as a first application of the three-dimensional Stretched-Grid University of Maryland/Goddard Chemical-Transport Model (SG-GCTM). The SG-GCTM has been developed to look at the effect of localized sources and/or small scale mixing processes on the large-scale or global chemical balance. For this simulation, the stretched-arid was chosen so that its maximum resolution is located over eastern North America and the North Atlantic; a region that includes most of the SONEX (the SASS (Subsonic Assessment) Ozone and Nitrogen Oxides Experiment) flight paths. The SONEX period (October-November 1997) is simulated by driving the SG-GCTM with assimilated data from the GEOS-STRAT DAS (Goddard Earth Observing System-STRAT Data Assimilation System). A new algorithm is used to parameterize the lightning, flash rates that are needed to calculate emissions of NOy by lightning. Model-calculated upper tropospheric NOy and NOy measurements from the NASA DC-8 aircraft are compared. Spatial variations in NOy were well captured especially with the stretched-grid run; however, model-calculated concentrations were often too high in the upper troposphere, particularly during the first several flights. The

lightning algorithm does a reasonably good job; however, the use of emissions from observed lightning, flashes significantly improves the simulation on a few occasions, especially November 3, 1997, indicating that significant uncertainty remains in parameterizing lightning in CTMS. Aircraft emissions play a relatively minor role (about 12%) in the upper tropospheric NOY budget averaged along SONEX flight paths; however, the contribution of such emmissions is as large as about 30% during portions of some flights.
Author
Lightning; Nitrogen Oxides; Simulation; Troposphere; Three Dimensional Models; Aircraft; Air Pollution; Pollution Transport; Atmospheric Circulation; Mathematical Models

19990041446 NASA Marshall Space Flight Center, Huntsville, AL USA
A New ERA in Global Temperature Monitoring with the Advanced Microwave Sounding Unit (AMSU)
Spencer, Roy W., NASA Marshall Space Flight Center, USA; Braswell, William D., Nichols Research Corp., USA; Christy, John R., Alabama Univ., USA; January 1999; 4p; In English, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The launch of the first Advanced Microwave Sounding Unit (AMSU) on the NOAA-15 spacecraft on 13 May 1998 marked a significant advance in our ability to monitor global temperatures. Compared to the Microwave Sounding Units (MSU) flying since 1978 on the TIROS-N series of NOAA polar orbiters, the AMSU offers better horizontal, vertical, and radiometric resolutions. It will allow routine monitoring of 1 1 (mostly) separate layers, compared to 2 or 3 with the MSU, including layers in the middle and upper stratosphere (2.5 hPa) where increasing carbon dioxide concentrations should be causing a cooling rate of about 1 deg. C per decade. More precise limb corrections combined with low noise will allow identification of subtle spatial temperature patterns associated with global cyclone activity.
Author
Temperature Control; Radiometers; Correction; Advanced Microwave Sounding Unit

19990041470 Lawrence Livermore National Lab., Livermore, CA USA
ARM single column model (SCM) intercomparison, procedures for case 1: summer 1995 SCM IOP
Cederwall, R. T.; Krueger, S. K.; Apr. 01, 1998; 24p; In English
Report No.(s): DE98-058326; UCRL-ID-130561; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Atmospheric Radiation Measurement (ARM) Program is a multi-laboratory, interagency program that was created in 1989 with funding from the US Department of Energy (DOE). The ARM Program is part of DOE's effort to resolve scientific uncertainties about global climate change with a specific focus on improving the performance of general circulation models (GCMS) used for climate research and prediction. These improved models will help scientists better understand the influences of human activities on the earth's climate. The objectives of the ARM Program are: (1) to relate observed atmospheric radiation to the temperature and composition of the atmosphere, especially water vapor and clouds, across a wide range of climatologically relevant possibilities, and (2) to develop and test improved parameterizations of radiation and radiative interactions with water vapor, aerosols, and clouds, for use in GCMS.
NTIS
Atmospheric Radiation; Climatology; Radiation Measurement

19990041579 Los Alamos National Lab., NM USA
Real time chemical detection using species selective thin films and waveguide Zeeman interferometry
Grace, K. M.; Shrouf, K.; Honkanen, S.; Dec. 31, 1998; 7p; In English; 12th; Annual international symposium on aerospace/defense sensing, simulation and controls
Report No.(s): DE99-000703; LA-UR-98-1530; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present a chemical sensor scheme based on selective sensing surfaces and highly sensitive integrated optical transduction methods. Using self-assembly techniques, species selective thin-films are covalently attached to the surface of Si3N4 channel waveguides to produce robust sensor elements. Exposure to targeted analytes results in the selective absorption of these molecules onto the waveguide surface causing a change in the effective index of the guided modes. These relative changes in effective index between TE and TM modes are precisely measured using Zeeman interferometry. Measurements demonstrate reversible, real time sensing of volatile organic compounds at ppm levels.
NTIS
Real Time Operation; Detection; Thin Films; Waveguides; Zeeman Effect; Interferometry; Selective Surfaces

19990041582 Los Alamos National Lab., NM USA
Applications of dielectric barrier discharges
Falkenstein, Z.; Dec. 31, 1998; 22p; In English; 12th; Internatinal conference on high power particle beams
Report No.(s): DE99-000625; LA-UR-98-1233; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Dielectric barrier discharges (DBDs) in oxygen and air are well established for the production of large quantities of ozone and are more recently being applied to a wider range of plasmachemical processes. As an introduction of this type of gas discharge, the main plasmaphysical features of sinusoidal-driven DBDs (transient, non-thermal plasmas at atmospheric pressure) will be described, and plasmachemical reaction pathways for the generation of ozone will be briefly discussed. The generation of atomic oxygen for ozone synthesis leads inevitably to the second application of DBDs, the non-thermal oxidation of volatile organic compounds (VOCs) in dry and humid air. Another application of DBDs is the generation of excited dimers and exiplexes for the production of incoherent (V)UV/visible light. The last and latest application of DBDs is the surface processing near atmospheric pressures. As an example, results of photoresist ashing on Si wafers in an oxygen plasma will be shown as function of gas pressure, gap spacing, and applied frequency. The surface of the etched photoresist is characterized by profilometry and scanning electron microscopy (SEM). The possibility of material deposition with DBDs will also be presented, where DBDs in acetylene lead to fast substrate deposition. Here, only the effects of the gas pressure and gap distance are explored.
NTIS
Dielectrics; Electric Discharges

19990041602 New York State Energy Research and Development Authority, Albany, NY USA
Shaping the Future: R and D for the 21st Century, 1998-2001. A Three-Year Research Plan for New York's Energy, Economic and Environmental Future
Sep. 1998; 94p; In English
Report No.(s): PB99-136327; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Oxygen-enhanced multiple-hearth sludge incineration was the focus of a five-month joint study by Praxair and the New York State Energy Research and Development Authority. Testing and demonstration were conducted in Rochester, NY, at Monroe County's Frank E. Van Lare Sewage Treatment Plant. A simple retrofit of high-momentum oxygen lances created a convection hearth in which convective heat and mass transfer with the drying sludge were greatly enhanced, while heart temperatures were moderated by the wet sludge to prevent overheating. Based on the results of short- and long-term controlled tests discussed in this report, oxygen enhancement of multiple-hearth sludge incinerators can be economically viable, with a savings between $30 and $60 per hour at Van Lare based upon increased sludge throughput and reduced fuel consumption.
NTIS
Energy Technology; Oxygen; Hearths; Sludge; Incinerators; Sewage Treatment

19990041603 Praxair, Inc., Tarrytown, NY USA
Oxygen-Enriched Multiple-Hearth Sewage Sludge Incineration Demonstration ***Final Report***
Jul. 1998; 132p; In English
Report No.(s): PB99-136319; NYSERDA-98-9; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Oxygen-enhanced multiple-hearth sludge incineration was the focus of a five-month joint study by Praxair and the New York State Energy Research and Development Authority. Testing and demonstration were conducted in Rochester NY, at Monroe County's Frank E. Van lare Sewage Treatment Plant. A simple retrofit of high-momentum oxygen lances created a convention hearth in which convective heat and mass transfer with the drying sludge were greatly enhanced, while hearth temperatures were moderated by the wet sludge to prevent overheating. Based on the results of short- and long-term controlled tests discussed in this report, oxygen enhancement of multiple-hearth sludge incinerators can be economically viable, with a savings between $30 and $60 per hour at Van Lare based upon increased sludge throughput and reduced fuel consumption.
NTIS
Oxygen; Sewage Treatment; Sludge; Incinerators; Hearths

19990041734 Los Alamos National Lab., NM USA
Midtropospheric influences on boundary layer evolution in the Mexico City basin
Bossert, J. E.; Stalker, J. R.; Langley, D. L.; Dec. 31, 1998; 6p; In English; 8th; Conference on mountain meteorology
Report No.(s): DE99-001222; LA-UR-98-2442; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Mexico City lies in a horseshoe-shaped basin at 2250 m AGL. These authors have simulated the effects of thermally-forced local to regional-scale circulation patterns on the ozone distribution within the basin. On most of the case days studied a relationship could be found between the spatial and temporal evolution of wind patterns and ozone concentration, particularly in the south-

western part of the basin. In this paper, the authors focus upon defining the relationship between the vertical structure of the atmosphere, by examining stability and wind shear, and the near surface pollution. This work was prompted by the need to better understand the role of midtropospheric flow in contributing to, or alleviating, the pollution problem in the basin. The role of vertical exchange processes in this locale has so far been only peripherally explored. From this investigation the authors hope to assess the importance of upper level winds in contributing to ventilation of pollutants out of the basin above the mountaintop level, in flushing the polluted airmass out of the basin, and in the development of basin-wide recirculation patterns. The results of preliminary data analyses are described.
NTIS
Atmospheric Boundary Layer; Mexico; Structural Basins

19990041859 New York Univ., Dept. of Environmental Medicine, New York, NY USA
Radon source apportionment in the home, dosimetry and risk modeling ***Final Report, 1993--1997***
Harley, N. H.; Aug. 04, 1998; 56p; In English
Report No.(s): DE99-001280; DOE/ER/60547-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This research covered the following 3 topics in 4 years: (1) the source apportionment of Rn-222 in the home; (2) the internal bronchial dosimetry of inhaled Rn-222 decay products; and (3) the lung cancer risk from inhalation of the short lived decay products of Rn-222. A 4th year of support was appended to this grant with a switch in research effort to determine a method for long term measurement of the particle size distribution of the short lived decay products in homes.
NTIS
Radiation Damage; Radiation Dosage; Radon Isotopes; Indoor Air Pollution; Buildings; Particle Size Distribution

19990041916 Southern Research Inst., Birmingham, AL USA
Advanced Fine Particulate Control and Implications Toward Solving Multiple Pollutant Control Problems in Coal-Fired Boilers
Gooch, J. P.; Sedman, C. B.; 1998; 26p; In English; Combined Utility Air Pollutant, 25-29 Aug. 1997, Washington, DC, USA; Sponsored by Environmental Protection Agency, USA
Report No.(s): PB99-129793; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The paper discusses advanced fine particulate control and implications toward solving multiple pollutant control problems in coal-fired boilers. Recent advances in fine particulate matter (PM) control, including wet electrostatic precipitation (ESP) and combined ESP/fabric filtration, have demonstrated advanced control of fine particles. These and other improvements in fine particle control offer intriguing routes to solving other emissions problems facing the utility industry. These include sulfates, nitrates, and metals, both solid and vapor, most of which may contribute to plume opacity and the formation of secondary particles in the atmosphere. Current and future advances in fine particle control are discussed, and their integration with other gas cleaning technology to alleviate opacity problems and reduce secondary particle formation is proposed for future development.
NTIS
Particulates; Pollution Control; Boilers; Coal; Combustion; Air Pollution

19990041917 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA
Development of Multipollutant Emission Control Technology for Stoker Boilers
Sedman, C. B.; 1998; 22p; In English; Stoker Boiler, 19-20 Aug. 1998, Dayton, OH, USA
Report No.(s): PB99-129819; EPA/600/A-99/005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The paper discusses the development of multipollutant emission control technology for stoker boilers. Effort to develop a compact multipollutant control system for coal-fired boilers include: (1) particle removal combining electrostatics and fabric filtration, (2) combined acid gas and metal vapor control using a compact, vertical-pipe reactor with new lime-based sorbents, and (3) promoted oxidation and absorption of nitrogen oxides (NOx). An array of government and private partnerships have been formed to develop such a process step independently. Plans to combine process steps include a number of field pilot evaluations, followed by a 200 MBtu/hr (60 MWt) stoker demonstration in Ohio.
NTIS
Technology Assessment; Boilers; Coal; Combustion; Air Pollution

19990041918 OMNI Environmental Services, Inc., Beaverton, OR USA
Air Emissions from Residential Heating: The Wood Heating Option Put into Environmental Perspective
Houck, J. E.; Tiegs, P. E.; McCrillis, R. C.; Keithley, C.; Crouch, J.; 1998; 16p; In English; Emissions Inventory: Living in a Global Environment, 8-10 Dec. 1998, New Orleans, USA; Sponsored by Air and Waste Management Association, USA

Report No.(s): PB99-129934; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper compares the national scale (rather than local) air quality impacts of the various residential space heating options. Specifically, it compares the relative contributions of the space heating options to fine particle emissions, greenhouse gas emissions, and acid precipitation impacts. The major space heating energy options are natural gas, fuel oil, kerosene, liquiefied petroleum gas (LPG), electricity, coal, and wood. Residential wood combustion (RWC) meets 9% of the Nation's space heating energy needs and utilizes a renewable resource. Wood is burned regularly in about 30 million homes. Residential wood combustion is often perceived as environmentally dirty due to emissions from older wood burners.

NTIS

Pollution Control; Particulates; Combustion; Burners; Wood; Air Pollution; Particle Emission; Exhaust Emission

19990042067 NASA Goddard Inst. for Space Studies, New York, NY USA

Frequency and Angular Variations of Land Surface Microwave Emissivities: Can we Estimate SSM/T and AMSU Emissivities from SSM/I Emissivities?

Prigent, Catherine, NASA Goddard Inst. for Space Studies, USA; Wigneron, Jean-Pierre, NASA Goddard Inst. for Space Studies, USA; Rossow, William B., NASA Goddard Inst. for Space Studies, USA; Pardo-Carrion, Juan R., NASA Goddard Inst. for Space Studies, USA; IEEE Transactions on Geoscience and Remote Sensing; 1999; Volume 20; 21p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To retrieve temperature and humidity profiles from SSM/T and AMSU, it is important to quantify the contribution of the Earth surface emission. So far, no global estimates of the land surface emissivities are available at SSM/T and AMSU frequencies and scanning conditions. The land surface emissivities have been previously calculated for the globe from the SSM/I conical scanner between 19 and 85 GHz. to analyze the feasibility of deriving SSM/T and AMSU land surface emissivities from SSM/I emissivities, the spectral and angular variations of the emissivities are studied, with the help of ground-based measurements, models and satellite estimates. Up to 100 GHz, for snow and ice free areas, the SSM/T and AMSU emissivities can be derived with useful accuracy from the SSM/I emissivities- The emissivities can be linearly interpolated in frequency. Based on ground-based emissivity measurements of various surface types, a simple model is proposed to estimate SSM/T and AMSU emissivities for all zenith angles knowing only the emissivities for the vertical and horizontal polarizations at 53 deg zenith angle. The method is tested on the SSM/T-2 91.655 GHz channels. The mean difference between the SSM/T-2 and SSM/I-derived emissivities is less than or equal to 0.01 for all zenith angles with an r.m.s. difference of approx. = 0.02. Above 100 GHz, preliminary results are presented at 150 GHz, based on SSM/T-2 observations and are compared with the very few estimations available in the literature.

Author

Frequencies; Angular Distribution; Remote Sensing; Microwave Emission; Emissivity; Earth Surface; Atmospheric Temperature

19990042154 NASA Ames Research Center, Moffett Field, CA USA

Nitrogen Oxides and Ozones from B-747 Measurements (NOXAR) during POLINAT 2 and SONEX: Overview and Case-Studies on Continental and Marine Convection

Jeker, Dominique, Eidgenoessische Technische Hochschule, Switzerland; Pfister, Lenny, NASA Ames Research Center, USA; Brunner, Dominik, Royal Netherlands Meteorological Inst., Netherlands; Boccippio, Dennis J., NASA Marshall Space Flight Center, USA; Pickering, Kenneth E., Maryland Univ., USA; Thompson, Anne M., NASA Goddard Space Flight Center, USA; Wernli, Heini, Eidgenoessische Technische Hochschule, Switzerland; Selkirk, Rennie B., NASA Ames Research Center, USA; Kondo, Yutaka, Nagoya Univ., Japan; Koike, Matoke, Nagoya Univ., Japan; Zhao, Yongjing, Nagoya Univ., Japan; Staehelin, Johannes, Eidgenoessische Technische Hochschule, Switzerland; [1999]; 104p; In English; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In the framework of the project POLINAT 2 (Pollution in the North Atlantic Flight Corridor) we measured NO(x) (NO and NO2) and ozone on 98 flights through the North Atlantic Flight Corridor (NAFC) with a fully automated system permanently installed aboard an in-service Swissair B-747 airliner in the period of August to November 1997. The averaged NO, concentrations both in the NAFC and at the U.S. east coast were similar to that measured in autumn 1995 with the same system. The patchy occurrence of NO(x), enhancements up to 3000 pptv over several hundred kilometers (plumes), predominately found over the U.S. east coast lead to a log-normal NO(x) probability density function. In three case-studies we examine the origins of such plumes by combining back-trajectories with brightness temperature enhanced (IR) satellite imagery, with lightning observations from the U.S. National Lightning Detection Network (NLDN) or with the Optical Transient Detector (OTD) satellite. For frontal activity above the continental U.S., we demonstrate that the location of NO(x) plumes can be well explained with maps of convective influence. For another case we show that the number of lightning flashes in a cluster of marine thunderstorms is proportional to the NO(x) concentrations observed several hundred kilometers downwind of the anvil outflows and suggest that lightning was the dominant source. From the fact that in autumn the NO, maximum was found several hundred kilometers off the U.S. east coast,

it can be inferred that thunderstorms triggered over the warm Gulf Stream current are an important source for the regional upper tropospheric NO(x) budget in autumn.
Author
Augmentation; Detection; Marine Meteorology; Nitrogen Oxides; Normal Density Functions; Ozone; Plumes; Troposphere; Nitrogen Dioxide

19990042165 NASA Goddard Space Flight Center, Greenbelt, MD USA
GISS Analysis of Surface Temperature Changes
Hansen, J., NASA Goddard Space Flight Center, USA; Ruedy, R., NASA Goddard Space Flight Center, USA; Glascoe, J., NASA Goddard Space Flight Center, USA; Sato, M., NASA Goddard Space Flight Center, USA; [1999]; 30p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the current GISS analysis of surface temperature change based primarily on meteorological station measurements. The global surface temperature in 1998 was the warmest in the period of instrumental data. The rate of temperature change is higher in the past 25 years than at any previous time in the period of instrumental data. The warmth of 1998 is too large and pervasive to be fully accounted for by the recent El Nino, suggesting that global temperature may have moved to a higher level, analogous to the increase that occurred in the late 1970s. The warming in the USA over the past 50 years is smaller than in most of the world, and over that period there is a slight cooling trend in the Eastern USA and the neighboring Atlantic ocean. The spatial and temporal patterns of the temperature change suggest that more than one mechanism is involved in this regional cooling.
Author
Surface Temperature; Weather Stations; Climate Change; Spatial Distribution; Temperature Measurement; Temperature Dependence

19990042206 FROM
LLNL NESHAPs project 1997 annual report
Gallegos, G. M.; Jun. 01, 1998; 73p; In English
Report No.(s): DE98-058709; UCRL-ID-113867-98; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

NESHAP limits the emission of radionuclides to the ambient air from DOE facilities to levels resulting in an annual effective dose equivalent (EDE) of 10 mrem (100 ((mu)Sv) to any member of the public The EDEs for the Lawrence Livermore National Laboratory (LLNL) site- wide maximally exposed members of the public from 1997 operations were Livermore site. The EDEs were generally calculated using the EPA-approved CAP88-PC air-dispersion/dose-assessment model. Site-specific meteorological data, stack flow data, and emissions estimates based on radionuclide inventory data or continuous-monitoring systems data were the specific input to CAP88-PC for each modeled source.
NTIS
Dosage; Radioactive Isotopes; Particulates; Effluents; Air Pollution

19990042313 NASA Langley Research Center, Hampton, VA USA
Western Pacific Tropospheric Ozone and Potential Vorticity: Implications for Asian Pollution
Browell, Edward V., NASA Langley Research Center, USA; Newell, Reginald E., Massachusetts Inst. of Tech., USA; Davis, Douglas D., Georgia Inst. of Tech., USA; Liu, Shaw C., Georgia Inst. of Tech., USA; Geophysical Research Letters; Nov. 15, 1997; ISSN 0094-8534; Volume 24, No. 22, pp. 2733-2736; In English
Report No.(s): Paper-97GL02799; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Tropospheric ozone (03) cross sections measured with lidar from a DC-8 aircraft over the western Pacific correspond closely with potential vorticity (PV). Both are transported from the middle latitude stratosphere, although this is not the only source of 03, and both have sinks in the tropical boundary layer. 03 and PV are good indicators of photochemical and transport process interactions. In summer, some Asian pollution, raised by convection to the upper troposphere, passes southward into the tropics and to the Southern Hemisphere. In winter, subsidence keeps the pollution at low altitudes where it moves over the ocean towards the Inter-Tropical Convergence Zone (ITCZ), with photochemical destruction and secondary pollutant generation occurring en route. Convection raises this modified air to the upper troposphere, where some re may enter the stratosphere. Thus winter Asian pollution may at have a smaller direct influence on the global atmosphere than it would if injected at other longitudes and seasons.
Author
Asia; Boundary Layers; Ozone; Photochemical Reactions; Southern Hemisphere; Summer; Tropical Regions; Troposphere; Winter; Vorticity; Atmospheric Circulation; Atmospheric Composition

19990042319 Norwegian Defence Research Establishment, Kjeller, Norway

PCBs On Air Filters-Preliminary Investigations ***PCB PA Luftfiltre: Preliminere Undersokelser***

Hartvig, Sven Kristian, Norwegian Defence Research Establishment, Norway; Oct. 12, 1998; 26p; In Norwegian

Contract(s)/Grant(s): FFITOX Proj. 720/138.2

Report No.(s): FFI/RAPPORT-98/05135; ISBN 82-464-0296-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Preliminary data from the PCB analysis of a set of archived air filters is presented. Since 1956 filter samples have been collected daily at several different locations in Norway for monitoring of particle bound radioactivity. The glassmicrofibre filters (Whatman GF/A) were soxhlet extracted for 4 hours using n-heptane as the solvent. GC/ECD analysis showed quantifiable amounts of the seven tested PCBs (PCB- 28, 52, 101, 118, 153, 138 and 180) using 3.5 filters (equivalent to approximately 1650 m(exp 3) air sampled). Also a range of other compounds were detected, but they were not identified. The results indicate that to arrive at a monthly average concentrations, sampling of 1/8 of each filter is sufficient.

Author

Air Filters; Polychlorinated Biphenyls; Sampling

19990042399 NASA Goddard Space Flight Center, Greenbelt, MD USA

Atmospheric Transport and Photochemistry of Ozone Over Central Southern Africa During the Southern Africa Fire-Atmosphere Research Initiative

Tyson, P. D., Witwatersrand Univ., South Africa; Garstang, M., Virginia Univ., USA; Thompson, A. M., NASA Goddard Space Flight Center, USA; DAbreton, P., Witwatersrand Univ., South Africa; Diab, R. D., Natal Univ., South Africa; Browell, E. V., NASA Langley Research Center, USA; Journal of Geophysical Research; May 20, 1997; ISSN 0148-0228; Volume 102, No. D9, pp. 10,623-10,635; In English; Sponsored in part by the Foundation for Research Development and Dept. of Environment and Tourism

Contract(s)/Grant(s): NSF ATM-92-07924; NSF ATM-94-24433

Report No.(s): Paper-97JD00170; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Vertically integrated back and forward trajectories for the 300-200, 700-500 and surface-800 hPa levels are calculated using Pretoria as point of origin for the Southern Africa Fire-Atmosphere Research Initiative (SAFARI) period September-October 1992. The transport fields are then combined to show both horizontal and vertical transport of air to and from Pretoria at the different levels. Air transport patterns in the vertical are linked to the occurrence of absolutely stable layers which are also evident in the 16 ozonesonde profiles recorded at Pretoria during SAFARI. The coherence of the stratification based on dynamical and ozone analysis permits the use of mean ozone profiles with air volume fluxes to interpret the ozone in terms of photochemistry and transport within stable layers. Extensive recirculation across the meridional plane at Pretoria implies that advection of ozone is slow and that photochemistry is responsible for the observed vertical structure over central southern Africa in September and October 1992. Requisite ozone formation rates are supported by model analysis of ozone and ozone precursors measured from SAFARI and Transport and Atmospheric Research Chemistry near the Equator-Atlantic aircraft.

Author

Atmospheric Circulation; Ozone; Photochemical Reactions; Vertical Distribution; Fires; Troposphere; Atmospheric Models; Atmospheric Composition

19990042400 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ozone Depletion Potential of CH3Br

Sander, Stanley P., Jet Propulsion Lab., California Inst. of Tech., USA; Ko, Malcolm K. W., Atmospheric and Environmental Research, Inc., USA; Sze, Nien Dak, Atmospheric and Environmental Research, Inc., USA; Scott, Courtney, Atmospheric and Environmental Research, Inc., USA; Rodriquez, Jose M., Atmospheric and Environmental Research, Inc., USA; Weisenstein, Debra K., Atmospheric and Environmental Research, Inc., USA; Journal of Geophysical Research; Nov. 20, 1998; ISSN 0148-0227; Volume 103, No. D21, pp. 28,187-28,195; In English; Sponsored in part by the Methyl Bromide Global Coalition

Contract(s)/Grant(s): NAS5-97039

Report No.(s): Paper-98JD02537; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The ozone depletion potential (ODP) of methyl bromide (CH3Br) can be determined by combining the model-calculated bromine efficiency factor (BEF) for CH3Br and its atmospheric lifetime. This paper examines how changes in several key kinetic data affect BEF. The key reactions highlighted in this study include the reaction of BrO + H02, the absorption cross section of HOBr, the absorption cross section and the photolysis products of BrON02, and the heterogeneous conversion of BrON02 to HOBR and HN03 on aerosol particles. by combining the calculated BEF with the latest estimate of 0.7 year for the atmospheric lifetime of CH3Br, the likely value of ODP for CH3Br is 0.39. The model-calculated concentration of HBr (approximately 0.3 pptv) in the lower stratosphere is substantially smaller than the reported measured value of about I pptv. Recent publications sug-

gested models can reproduce the measured value if one assumes a yield for HBr from the reaction of BrO + OH or from the reaction of BrO + H02. Although the DeAlore et al. evaluation concluded any substantial yield of HBr from BrO + HO2 is unlikely, for completeness, we calculate the effects of these assumed yields on BEF for CH3Br. Our calculations show that the effects are minimal: practically no impact for an assumed 1.3% yield of HBr from BrO + OH and 10% smaller for an assumed 0.6% yield from BrO + H02.
Author
Bromine; Methyl Compounds; Ozone Depletion; Stratosphere; Bromine Compounds

19990042435 Oak Ridge National Lab., Carbon Dioxide Information Analysis Center, TN USA
Surface water and atmospheric underway carbon data obtained during the World Ocean Circulation Experiment Indian Ocean survey cruises (R/V Knorr, December 1998--January 1996)
Kozyr, A.; Allison, L.; Nov. 30, 1997; 69p; In English
Report No.(s): DE98-003680; ORNL/CDIAC-103; NDP-064; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This data documentation presents the results of the surface water and atmospheric underway measurements of mole fraction of carbon dioxide (xCO2), sea surface salinity, and sea surface temperature, obtained during the World Ocean Circulation Experiment (WOCE) Indian Ocean survey cruises (December 1994--January 1996). Discrete and underway carbon measurements were made by members of the CO2 survey team. The survey team is a part of the Joint Global Ocean Flux Study supported by the US Department of Energy to make carbon-related measurements on the WOCE global survey cruises. Approximately 200,000 surface seawater and 50,000 marine air xCO2 measurements were recorded.
NTIS
Carbon; Surface Water; Atmospheric Chemistry; Ocean Surface; Ocean Currents; Sea Water

19990042437 Department of Energy, Office of Energy Research, Washington, DC USA
Investigation of the effect of natural phenomena and industrial activity on stratospheric ozone trends *Final Report, Sep. 1993--Jun. 1998*
McElroy, M. B.; Schneider, H. R.; Dec. 31, 1998; 4p; In English
Report No.(s): DE99-001019; DOE/ER/61708-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The long term goal of this work is to separate the effects of natural variability and anthropogenic emissions on the chemical composition of the atmosphere. In particular, the authors are concerned with the variability of ozone in the stratosphere and the supply of ozone from the stratosphere to the upper troposphere. During the first phase of this project the authors developed an interactive two-dimensional (2D) model of the dynamics, radiation, and chemistry of the stratosphere. The most important features of the model are the use of the full primitive equations in two dimensions, small horizontal mixing in the tropical regions and small mechanical damping in the lower stratosphere. As a result, transport in the tropics and the mass exchange between the tropics and midlatitude are controlled advectively.
NTIS
Stratosphere; Ozone; Trends

46
GEOPHYSICS

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

19990041463 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Time-domain solutions for nonlinear elastic 1-D plane wave propagation
Korneev, V. A.; Jun. 30, 1998; 27p; In English
Report No.(s): DE98-058246; LBL-37411; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Time-domain solutions are obtained for 1-D nonlinear elastic wave propagation problems using a five-constant nonlinear theory. The assumption of weak attenuation was used throughout the development. The strongest nonlinear effects are obtained for the case of single compressional wave propagation, for single compressional or shear wave propagation through a longitudinally pre- stressed elastic material, and for shear wave propagation in a shear pre- stressed elastic material. Estimates of the size of these effects indicate that nonlinear phenomena are likely to be observable in real seismic data. The results may be useful for

the measurement of nonlinear constants in elastic materials, for explaining the frequency content of seismograms, and for monitoring strain fields in the earth's crust.
NTIS
Time Domain Analysis; Nonlinearity; Elastic Waves; Wave Propagation

19990041465 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Nonlinear interaction of plane elastic waves
Korneev, V. A.; Nihei, K. T.; Myer, L. R.; Jun. 30, 1998; 46p; In English
Report No.(s): DE98-058257; LBNL-41914; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The paper presents basic first order results of nonlinear elastic theory by Murnaghan for elastic wave propagation in isotropic solids. The authors especially address the problem of resonant scattering of two collimated beams and present analytical solutions for amplitudes of all possible types of resonant interactions for elastic plane waves. For estimation of nonlinear scattered waves they use measured elastic parameters for sandstone. The most profound nonlinear effect is expected for interactions of two SH waves generating compressional P wave at sum frequency. Estimations show that nonlinear phenomena is likely to be observed in seismic data. Basic equations of nonlinear five-constant theory by Murnaghan are also presented.
NTIS
Wave Interaction; Elastic Waves; Isotropy

19990041466 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Seismic imaging of the shallow subsurface with high frequency seismic measurements
Kaelin, B.; Jul. 31, 1998; 131p; In English
Report No.(s): DE98-058259; LBNL-42058; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Elastic wave propagation in highly heterogeneous media is investigated and theoretical calculations and field measurements are presented. In the first part the dynamic composite elastic medium (DYCEM) theory is derived for one-dimensional stratified media. A self-consistent method using the scattering functions of the individual layers is formulated, which allows the calculation of phase velocity, attenuation and waveform. In the second part the DYCEM theory has been generalized for three-dimensional inclusions. The specific case of spherical inclusions is calculated with the exact scattering functions and compared with several low frequency approximations. In the third part log and VSP data of partially water saturated tuffs in the Yucca Mountain region of Nevada are analyzed. The anomalous slow seismic velocities can be explained by combining self-consistent theories for pores and cracks. The fourth part analyzes an air injection experiment in a shallow fractured limestone, which has shown large effects on the amplitude, but small effects on the travel time of the transmitted seismic waves. The large amplitude decrease during the experiment is mainly due to the impedance contrast between the small velocities of gas-water mixtures inside the fracture and the formation. The slow velocities inside the fracture allow an estimation of aperture and gas concentration profiles.
NTIS
Seismic Waves; Imaging Techniques; High Frequencies; Heterogeneity; Elastic Media

19990041578 NASA Langley Research Center, Hampton, VA USA
Kinetic Requirements for the Measurement of Mesospheric Water Vapor at 6.8 (microns) under Non-LTE Conditions
Zhou, Daniel K., Utah State Univ., USA; Mlynczak, Martin G., NASA Langley Research Center, USA; Lopez-Puertas, Manuel, Instituto de Astrofisica de Andalucia, Spain; Russell, James M., III, Hampton Univ., USA; Geophysical Research Letters; Jan. 01, 1999; ISSN 0094-8276; Volume 26, No. 1, pp. 63-66; In English
Contract(s)/Grant(s): NAS1-20467; ESP96-0623; ESP97-1798
Report No.(s): Paper-1998GL900232; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present accuracy requirements for specific kinetic parameters used to calculate the populations and vibrational temperatures of the H2O(010) and H2O(020) states in the terrestrial mesosphere. The requirements are based on rigorous simulations of the retrieval of mesospheric water vapor profiles from measurements of water vapor infrared emission made by limb scanning instruments on orbiting satellites. Major improvements in the rate constants that describe vibration-to- vibration exchange between the H2O(010) and 02(1) states are required in addition to improved specification of the rate of quenching of O2(1) by atomic oxygen (0). It is also necessary to more accurately determine the yield of vibrationally excited O2(l) resulting from ozone photolysis. A contemporary measurement of the rate of quenching of H2O(010) by N2 and O2 is also desirable. These rates are either highly uncertain or have never before been measured at atmospheric temperatures. The suggested improvements are neces-

sary for the interpretation of water vapor emission measurements at 6.8 microns to be made from a new spaceflight experiment in less than 2 years. The approach to retrieving water vapor under non-LTE conditions is also presented.
Author
Local Thermodynamic Equilibrium; Mesosphere; Oxygen Atoms; Ozone; Photolysis; Water Vapor; Oxygen; Photochemical Reactions

19990041815 Colorado Univ., Dept. of Geological Sciences, Boulder, CO USA
[Activities of Dept. of Geological Sciences, Colorado University] ***Final Report, Period ending 30 Sep. 1997***
Bilham, Roger, Colorado Univ., USA; 1997; 14p; In English
Contract(s)/Grant(s): NAG5-3072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Using remotely sensed data and GPS observations we completed a study of neotectonic processes responsible for landscape changes in an area of active extensional deformation and volcanism. The findings from this study describe the extensional processes operating in the region of the Afar triple junction and the northern Ethiopian rift.
Derived from text
Tectonics; Research; Volcanology; Topography; Deformation

19990041878 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Utilization of UARS Data in Validation of Photochemical and Dynamical Mechanisms in Stratospheric Models ***Final Report***
Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Rodriquez, J. M., Atmospheric and Environmental Research, Inc., USA; Hu, W., Atmospheric and Environmental Research, Inc., USA; Danilin, M. Y., Atmospheric and Environmental Research, Inc., USA; Shia, R.-L., Atmospheric and Environmental Research, Inc., USA; November 1998; 134p; In English
Contract(s)/Grant(s): NAS5-32844
Report No.(s): NASA/CR-1998-209228; NAS 1.26:209228; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The proposed work utilized Upper Atmosphere Research Satellite (UARS) measurements of short-lived and long-lived species, in conjunction with existing photochemical ”box” models, trajectory models, and two-dimensional global models, to elucidate outstanding questions in our understanding of photochemical and dynamical mechanisms in the stratosphere. Particular emphasis was given to arriving at the best possible understanding of the chemical and dynamical contributions to the stratospheric ozone budget. Such understanding will increase confidence in the simulations carried out by assessment models.
Author
Data Processing; Photochemical Reactions; Dynamical Systems; Stratosphere; Two Dimensional Models; Proving

19990041881 National Inst. of Polar Research, Tokyo, Japan
JARE Data Reports No. 230 (Ionosphere 60). HF Field Strength Data Measured at Syowa Station, Antarctica from January to December, 1995
Inamori, Koji, Communications Research Lab., Japan; Ichinose, Masaru, Communications Research Lab., Japan; March 1998; ISSN 0075-3343; In English; Copyright; Avail: Issuing Activity (National Inst. of Polar Research 9-10, Kaga 1-chome, Itabashi-ku, Tokyo 173-8515), Hardcopy, Microfiche
The field strength of JJY (standard frequency radio waves) transmitted from Japan has been measured at Syowa Station, Antarctica, since i 958. The receiver detects only the upper sideband component of the signal in order to avoid the co-channel interference. This report summarizes the results of field strength measurements of JJY 8 MHz for the interval from January to December, 1995.
Derived from text
Electromagnetic Interference; Field Strength; Radio Waves; Receivers

19990042052 NASA Lewis Research Center, Cleveland, OH USA
Geospace Magnetospheric Dynamics Mission
Russell, C. T., California Univ., USA; Kluever, C., Missouri Univ., USA; Burch, J. L., Southwest Research Inst., USA; Fennell, J. F., Aerospace Corp., USA; Hack, K., NASA Lewis Research Center, USA; Hillard, G. B., NASA Lewis Research Center, USA; Kurth, W. S., Iowa Univ., USA; Lopez, R. E., Maryland Univ., USA; Luhmann, J. G., California Univ., USA; Martin, J. B., NASA Goddard Space Flight Center, USA; Hanson, J. E.; Science Closure and Enabling Technologies for Constellation Class Missions; 1998, pp. 58-62; In English
Contract(s)/Grant(s): NAG5-3380; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Geospace Magnetospheric Dynamics (GMD) mission is designed to provide very closely spaced, multipoint measurements in the thin current sheets of the magnetosphere to determine the relation between small scale processes and the global dynamics of the magnetosphere. Its trajectory is specifically designed to optimize the time spent in the current layers and to minimize radiation damage to the spacecraft. Observations are concentrated in the region 8 to 40 R(sub E) The mission consists of three phases. After a launch into geostationary transfer orbit the orbits are circularized to probe the region between geostationary orbit and the magnetopause; next the orbit is elongated keeping perigee at the magnetopause while keeping the line of apsides down the tail. Finally, once apogee reaches 40 R(sub E) the inclination is changed so that the orbit will match the profile of the noon-midnight meridian of the magnetosphere. This mission consists of 4 solar electrically propelled vehicles, each with a single NSTAR thruster utilizing 100 kg of Xe to tour the magnetosphere in the course of a 4.4 year mission, the same thrusters that have been successfully tested on the Deep Space-1 mission.
Author
Radiation Damage; Magnetopause; Ion Propulsion; Current Sheets; Apsides; Earth Magnetosphere

19990042055 Utah State Univ., Space Dynamics Lab., Logan, UT USA
Evidence of non-LTE Effects in Mesospheric Water Vapor from Spectrally-Resolved Emissions Observed by CIRRIS-1A
Zhou, D. K., Utah State Univ., USA; Mlynczak, M. G., NASA Langley Research Center, USA; Lopez-Puertas, M., Instituto de Astrofisica de Andalucia, Spain; Zaragoza, G., Oxford Univ., UK; Geophysical Research Letters; Jan. 01, 1999; ISSN 0094-8276; Volume 26, Nol. 1, pp. 67-70; In English
Contract(s)/Grant(s): NAS1-20467; ESP-96-0623; ESP-97-1798
Report No.(s): Paper-1998GL900233; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Evidence of non-LTE effects in mesospheric water vapor as determined by infrared spectral emission measurements taken from the space shuttle is reported. A cryogenic Michelson interferometer in the CIRRIS-1A shuttle payload yielded high quality, atmospheric infrared spectra. These measurements demonstrate the enhanced daytime emissions of H2O (020-010) which are the result of non-LTE processes and in agreement with non-LTE models. The radiance ratios of H2O (010 to 000) and (020 to 010) Q(1) transitions during daytime are compared with non-LTE model calculations to assess the vibration-to-vibration exchange rate between H2O and O2 in the mesosphere. An exchange rate of 1.2 x 10(exp -12)cc/s is derived.
Author
Water Vapor; Mesosphere; Spectral Emission; Local Thermodynamic Equilibrium; Infrared Spectra

19990042082 NASA Goddard Space Flight Center, Greenbelt, MD USA
Seasonal and Interannual Variabilities in Tropical Tropospheric Ozone
Ziemke, J. R., Software Corp. of America, USA; Chandra, S., NASA Goddard Space Flight Center, USA; [1999]; 44p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents a detailed characterization of seasonal and interannual variability in tropical tropospheric column ozone (TCO). TCO time series are derived from 20 years (1979-1998) of total ozone mapping spectrometer (TOMS) data using the convective cloud differential (CCD) method. Our study identifies three regions in the tropics with distinctly different zonal characteristics related to seasonal and interannual variability. These three regions are the eastern Pacific, Atlantic, and western Pacific. Results show that in both the eastern and western Pacific seasonal-cycle variability of northern hemisphere (NH) TCO exhibits maximum amount during NH spring whereas largest amount in southern hemisphere (SH) TCO occurs during SH spring. In the Atlantic, maximum TCO in both hemispheres occurs in SH spring. These seasonal cycles are shown to be comparable to seasonal cycles present in ground-based ozonesonde measurements. Interannual variability in the Atlantic region indicates a quasi-biennial oscillation (QBO) signal that is out of phase with the QBO present in stratospheric column ozone (SCO). This is consistent with high pollution and high concentrations of mid-to-upper tropospheric O3-producing precursors in this region. The out of phase relation suggests a UV modulation of tropospheric photochemistry caused by the QBO in stratospheric O3. During El Nino events there is anomalously low TCO in the eastern Pacific and high values in the western Pacific, indicating the effects of convectively-driven transport of low-value boundary layer O3 (reducing TCO) and O3 precursors including H2O and OH. A simplified technique is proposed to derive high-resolution maps of TCO in the tropics even in the absence of tropopause-level clouds. This promising approach requires only total ozone gridded measurements and utilizes the small variability observed in TCO near the dateline. This technique has an advantage compared to the CCD method because the latter requires high-resolution footprint measurements of both reflectivity and total ozone in the presence of tropopause-level cloud tops.
Author
Annual Variations; Atmospheric Composition; Cycles; Ozone; Oscillations; Troposphere; Variability

19990042166 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA

Global MHD Simulation of Mesoscale Structures at the Magnetospheric Boundary ***Final Report, 1 May 1995 - 31 Dec. 1998***

Berchem, Jean, California Univ., USA; 1998; 6p; In English

Contract(s)/Grant(s): NAG5-4685; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research carried out for this protocol was focused on the study of mesoscales structures at the magnetospheric boundary. We investigated three areas: (1) the structure of the magnetospheric boundary for steady solar wind conditions; (2) the dynamics of the dayside magnetospheric boundary and (3) the dynamics of the distant tail magnetospheric boundary. Our approach was to use high resolution three-dimensional global magnetohydrodynamic (MHD) simulations of the interaction of the solar wind with the Earth's magnetosphere. We first considered simple variations of the interplanetary conditions to obtain generic cases that helped us in establishing the basic cause and effect relationships for steady solar wind conditions. Subsequently, we used actual solar wind plasma and magnetic field parameters measured by an upstream spacecraft as input to the simulations and compared the simulation results with sequences of events observed by another or several other spacecraft located downstream the bow shock. In particular we compared results with observations made when spacecraft crossed the magnetospheric boundary.

Derived from text

Magnetohydrodynamics; Simulation; Mesoscale Phenomena; Magnetic Fields; Boundaries; Research; Solar Wind

19990042194 Princeton Univ., Plasma Physics Lab., NJ USA

Kinetic Alfven waves and plasma transport at the magnetopause

Johnson, J. R.; Cheng, C. Z.; Dec. 31, 1997; 14p; In English

Report No.(s): DE97-052374; PPPL-3232; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Large amplitude compressional type waves, with frequencies ranging from 10--500 mHz, are nearly always found in the magnetosheath near the magnetopause where there are large gradients in density, pressure and magnetic field. As compressional waves propagation to the magnetopause, there gradients efficiently couple them with shear/kinetic Alfven waves near the Alfven field-line resonance location ((omega) = k(sub (parallel)) v(sub A)). The authors present a solution of the kinetic-MHD wave equations for this process using a realistic equilibrium profile including full ion Larmor radius effects and wave-particle resonance interactions for electrons and ions to model the dissipation. For northward IMF a KAW propagates backward to the magnetosheath. For southward IMF the wave remains in the magnetopause but can propagate through the k(sub (parallel)) = 0 location. The quasi-linear theory predicts that KAWs produce plasma transport with a diffusion coefficient D(sub (perpendicular)) (approximately) 10(exp 9) m(exp 2)/s and plasma convection on the order of 1 km/s. However, for southward IMF additional transport can occur because magnetic islands form at the k(sub (parallel)) = 0 location. Due to the broadband nature of the observed waves these islands can overlap leading to stochastic transport which is much larger than that due to quasilinear effects.

NTIS

Kinetic Equations; Wave Equations; Plasma Waves; Magnetopause

19990042280 NASA Marshall Space Flight Center, Huntsville, AL USA

UVI Auroral Observations During the January 10, 1997 Magnetic Cloud Event

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; May 1997; 1p; In English, May 1997, Baltimore, MD, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Solar wind IMF and plasma conditions surrounding the January 10-11 magnetic cloud event provided very interesting observations relating to magnetospheric and ionospheric processes. Prior to the arrival of the magnetic cloud a shock front followed by abrupt swings in the IMF orientation were observed by the Wind spacecraft at about 100 Re upstream. The Polar Ultraviolet Imager (UVI) near apogee over the northern hemisphere recorded the encounter of the shock with the magnetosphere. Enhancement of dayside precipitation around noon MLT and progression of the enhancement along dawn and dusk flanks of the oval culminating in a very localized pseudo onset near midnight MLT were observed. During the following mainly northward IMF the polar cap region was the site of multiple sunward aligned arcs and curled arc structures that persisted until the IMF turned rapidly southward. While the IMF remained southward the polar cap cleared of arc structures and expanded, and the auroral oval became very thin. No substorms were observed for at least 25 minutes after the following northward turning contrary to what might be expected on the basis of recent reports of substorm initiation by northward turning of the IMF. These observations and others during the magnetic cloud event provide a clear case study of the effect of the solar wind on dayside precipitation, thickness of

the boundary layer, magnetosphere-polar cap magnetic topology and sources of the polar cap precipitation, and triggering of substorms. These issues will be discussed along with the presentation of the UVI auroral observations and solar wind measurements. Author

Auroras; Magnetic Clouds; Plasma Interactions; Solar Wind; Boundary Layers; Magnetic Storms

19990042281 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Ultraviolet Imaging of the Aurora From Space

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Chua, D., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Lummerheim, D., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Toward Solar Max 2000, 11 Feb. 1998, Yosemite National Park, CA, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Global observation of the aurora by the Ultraviolet Imager (UVI) on the Polar spacecraft has provided both the benefit of placing ground and space-based observations in the context of auroral activity as well as the ability to make quantitative measurements of important parameters that characterize energy transfer to the ionosphere. The UVI images have provided simultaneously the timing of substorm onsets, the location of auroral boundaries, the polar cap area, and changes in the intensity of auroral activity at all local times. Increased accuracy in the measurement of energy flux and characteristic energy of the precipitating electrons in conjunction with auroral precipitation models are now available at high time resolution over many hours through the use of narrow-band far ultraviolet filters on the UVI. We will discuss how ultraviolet imaging of the aurora from space has provided fresh insight into processes such as substorm energy loading and deposition, substorm triggering, and solar wind control of substorm dynamics.

Author

Auroras; Far Ultraviolet Radiation; Ultraviolet Filters; Imaging Techniques; High Resolution; Electron Precipitation; Energy Transfer

19990042283 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Auroral Energy Deposition Compared with Magnetic Indices

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; 1997; 1p; In English, 8-12 Dec. 1997, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Measurement of the global rate of energy deposition in the ionosphere via auroral particle precipitation is one of the primary goals of the Polar UVI program and is an important component of the ISTP program. The instantaneous rate of energy deposition for the entire month of January 1997 has been calculated by applying models to the UVI images and is presented by Fillingim et al. in this session. Magnetic indices, such as KP, AE, and Dst, which are sensitive to variations in magnetospheric current systems have been constructed from ground magnetometer measurements and employed as measures of activity. The systematic study of global energy deposition raises the possibility of constructing a global magnetospheric activity index explicitly based on particle precipitation to supplement magnetic indices derived from ground magnetometer measurements. The relationship between global magnetic activity as measured by these indices and the rate of total global energy loss due to precipitation is not known at present. We study the correlation of the traditional magnetic index of KP for the month of January 1997 with the energy deposition derived from the UVI images. We address the question of whether the energy deposition through particle precipitation generally matches the KP and AE indices, or the more exciting, but distinct, possibility that this particle-derived index may provide an somewhat independent measure of global magnetospheric activity that could supplement traditional magnetically-based activity indices.

Author

Energy Dissipation; Auroras; Energy Transfer; Magnetic Variations

19990042412 NASA Marshall Space Flight Center, Huntsville, AL USA

Compensation for Spherical Geometric and Absorption Effects on Lower Thermospheric Emission Intensities Derived from High Earth Orbit Images

Swift, W., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Richards, P. G., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Brittnacher, M., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; 1997; 1p; In English, 8-12 Dec.

1997, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Remote sensing of the atmosphere from high earth orbit is very attractive due to the large field of view obtained and a true global perspective. This viewpoint is complicated by earth curvature effects so that slant path enhancement and absorption effects, small from low earth orbit, become dominant even at small nadir view angles. The effect is further complicated by the large range of local times and solar zenith angles in a single image leading to a modulation of the image intensity by a significant portion of the diurnal height variation of the absorbing layer. The latter effect is significant in particular for mesospheric, stratospheric and auroral emissions due to their depth in the atmosphere. As a particular case, the emissions from atomic oxygen (130.4 and 135.6 nm) and molecular nitrogen (two LBH bands, LBHS from 140 to 160 nm and LBHL from 160 to 180 nm) as viewed from the Ultraviolet Imager (UVI) are examined. The LBH emissions are of particular interest since LBHS has significant 02 absorption while LBHL does not, In the case of auroral emissions this differential absorption, well examined in the nadir, gives information about the height of the emission and therefore the energy of the precipitating particles. Using simulations of the viewing geometry and images from the UVI we examine these effects and obtain correction factors to adjust to the nadir case with a significant improvement of the derived characteristic energy. There is a surprisingly large effect on the images from the 02 diurnal layer height changes. An empirical compensation to the nadir case is explored based on the local nadir and local zenith angles for each portion of the image. These compensations are demonstrated as applied to the above emissions in both auroral and dayglow images and compared to models. The extension of these findings to other instruments, emissions and spectral regions is examined.
Author

Earth Orbits; Thermosphere; Auroras; Remote Sensing; Field of View; Molecular Gases

47
METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990041153 Futuretech Corp., Greenbelt, MD USA

Millimeter-Wave Imaging Radiometer (MIR) Data Processing and Development of Water Vapor Retrieval Algorithms
Final Report, 1 Oct. 1994 - 30 Sep. 1998

Chang, L. Aron, Futuretech Corp., USA; October 1998; 49p; In English
Contract(s)/Grant(s): NAS5-32705
Report No.(s): NASA/CR-1998-209227; NAS 1.26:209227; Rept-98FTC0001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes the final report of the Millimeter-wave Imaging Radiometer (MIR) Data Processing and Development of Water Vapor Retrieval Algorithms. Volumes of radiometric data have been collected using airborne MIR measurements during a series of field experiments since May 1992. Calibrated brightness temperature data in MIR channels are now available for studies of various hydrological parameters of the atmosphere and Earth's surface. Water vapor retrieval algorithms using multichannel MIR data input are developed for the profiling of atmospheric humidity. The retrieval algorithms are also extended to do three-dimensional mapping of moisture field using continuous observation provided by airborne sensor MIR or spaceborne sensor SSM/T-2. Validation studies for water vapor retrieval are carried out through the intercomparison of collocated and concurrent measurements using different instruments including lidars and radiosondes. The developed MIR water vapor retrieval algorithm is capable of humidity profiling under meteorological conditions ranging from clear column to moderately cloudy sky. Simulative water vapor retrieval studies using extended microwave channels near 183 and 557 GHz strong absorption lines indicate feasibility of humidity profiling to layers in the upper troposphere and improve the overall vertical resolution through the atmosphere.
Author

Water Vapor; Moisture Content; Clouds (Meteorology); Radiometers; Millimeter Waves; Algorithms; Calibrating; Data Processing

19990041440 Atmospheric and Environmental Research, Inc., Cambridge, MA USA

The Simulation of the Polar Barriers in a 2-D CTM by Adjusting the Eddy Diffusion Coefficients using UARS CH4 Data

Shia, Run-Lie, Atmospheric and Environmental Research, Inc., USA; Randel, William J., National Center for Atmospheric Research, USA; Ko, Malcolm K. W., Atmospheric and Environmental Research, Inc., USA; Rodriguez, Jose, Atmospheric and Environmental Research, Inc., USA; Scott, Courtney, Atmospheric and Environmental Research, Inc., USA; 1998; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A model for simulating the transport of chemicals in the atmosphere is discussed in this paper. An approach for adjusting Kyy through minimizing a cost function which measures the difference between the CH4 gradients from model simulations and UARS observations is discussed, and is deemed feasible. The choice of the cost function is critical for the success of the adjustment. A specific function is discussed: adding the polar barriers to the AER 2-Dimensional Chemistry Transport Model improves the simulation of long lived species. It also introduces moderate changes to the prediction of the HIgh speed civil Transport (HSCT) ozone depletion. The effects of adding the polar barriers are mainly located in the polar area. This paper is in outline format, with some graphics, which show comparisons of the distribution of CH4 from different sources.
CASI
Ozone Depletion; Turbulent Diffusion; Atmospheric Models; Atmospheric Chemistry; Atmospheric Turbulence; Atmospheric Circulation; Circulation Distribution; Polar Regions

19990041441 Alabama Univ., Dept. of Atmospheric Sciences, Huntsville, AL USA
Global Retrieval of Cloud Particle Size and Optical Thickness Using ISCCP Data ***Final Report***
Welch, Ronald M., Alabama Univ., USA; Han, Qingyuan, Alabama Univ., USA; [1998]; 3p; In English
Contract(s)/Grant(s): NAG8-3922; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary thrust of this investigation is to develop an algorithm to retrieve cloud particle sizes using ISCCP data. The research under this grant has been successful in obtaining initial results of global distribution of ice-particle sizes. Further research about possible problems caused by nonsphericity of ice particle sizes is currently underway. An algorithm of retrieving ice-cloud particle sizes using ISCCP CX data has been developed. The first survey of ice-particle size in a near-global scale has been completed. Comparison with in situ measurements of ice crystal sizes during FIRE I shows good agreement. The initial results show that the global mean size of ice crystals (De) is about 60 micron. This result is consistent with the range of in situ measurements all over the world if definitions of effective particle size are unified (see next section). The survey also shows that there is no distinct difference of ice-particle sizes between continental and maritime ice-clouds. There are many different definitions of effective particle size used in ice-cloud research. Simple comparisons between values of in situ measurement and satellite remote sensing are misleading and may lead to incorrect conclusions. We reviewed different definitions of effective particle sizes used in the literature and compared their relative magnitudes.
Derived from text
Particle Size Distribution; Optical Thickness; Algorithms; Ice Clouds

19990041449 NASA Goddard Space Flight Center, Greenbelt, MD USA
Direct Detection Doppler Lidar for Spaceborne Wind Measurement
Korb, C. Laurence, NASA Goddard Space Flight Center, USA; Flesia, Cristina, Geneva Univ., Switzerland; 1999; 2p; In English; Advanced Technologies in Optical Communication and Sensing, 17-18 Mar. 1999, Tokyo, Japan; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aerosol and molecular based versions of the double-edge technique can be used for direct detection Doppler lidar spaceborne wind measurement. The edge technique utilizes the edge of a high spectral resolution filter for high accuracy wind measurement using direct detection lidar. The signal is split between an edge filter channel and a broadband energy monitor channel. The energy monitor channel is used for signal normalization. The edge measurement is made as a differential frequency measurement between the outgoing laser signal and the atmospheric backscattered return for each pulse. As a result the measurement is insensitive to laser and edge filter frequency jitter and drift at a level less than a few parts in 10(exp 10). We have developed double edge versions of the edge technique for aerosol and molecular-based lidar measurement of the wind. Aerosol-based wind measurements have been made at Goddard Space Flight Center and molecular-based wind measurements at the University of Geneva. We have demonstrated atmospheric measurements using these techniques for altitudes from 1 to more than 10 km. Measurement accuracies of better than 1.25 m/s have been obtained with integration times from 5 to 30 seconds. The measurements can be scaled to space and agree, within a factor of two, with satellite-based simulations of performance based on Poisson statistics. The theory of the double edge aerosol technique is described by a generalized formulation which substantially extends the capabilities of the edge technique. It uses two edges with opposite slopes located about the laser frequency at approximately the half-width of each edge filter. This doubles the signal change for a given Doppler shift and yields a factor of 1.6 improvement in the measurement accuracy compared to the single edge technique. The use of two high resolution edge filters substantially reduces the effects of Rayleigh scattering on the measurement, as much as order of magnitude, and allows the signal to noise ratio to be substantially improved in areas of low aerosol backscatter. We describe a method that allows the Rayleigh and aerosol components of the signal to be independently determined using the two edge channels and an energy monitor channel. The effects of Rayleigh scattering may then subtracted from the measurement and we show that the correction process does not significantly increase the measurement noise for Rayleigh to aerosol ratios up to 10. We show that for small Doppler shifts a measurement accuracy of 0.4 m/s can be

obtained for 5000 detected photon, 1.2 m/s for 1000 detected photons, and 3.7 m/s for 50 detected photons for a Rayleigh to aerosol ratio of 5. Methods for increasing the dynamic range of the aerosol-based system to more than +/- 100 m/s are given.
Author
Aerosols; Doppler Radar; Optical Radar; Wind Measurement; Remote Sensors; Satellite-Borne Instruments

19990041600 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
National Weather Service: Sulphur Mountain Radar Performance
Oct. 1998; 38p; In English
Report No.(s): PB99-136707; GAO/AIMD-99-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In December 1994, the National Weather Service (NWS) began operating a Next Generation Weather Radar (NEXRAD) located on Sulphur Mountain in Ventura County, California. The radar was recently the focus of a study by the Rose Institute of Claremont McKenna College. Our objectives were to determine whether the Sulphur Mountain NEXRAD (1) can provide timely and accurate information for warning of flash floods and (2) is intended to provide low-level data necessary to predict wind shear for Los Angeles International Airport.
NTIS
Congressional Reports; Meteorological Services; Meteorological Radar; California

19990041790 Radian International, LLC, Austin, TX USA
Observation of the Atmospheric Boundary Layer in the Western and Central Gulf of Mexico ***Annual Report***
Dec. 1998; 50p; In English
Report No.(s): PB99-134066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For the Gulf of Mexico, present data sets poorly represent how temperature, winds, and mixing height vary vertically over the atmospheric boundary layer and free troposphere. Under this project, the MMS shall obtain field observations describing the vertical structure of the marine boundary layer over the Western and Central Gulf of Mexico for ongoing and future applications. The agency will accomplish this goal by establishing two (2) boundary layer profiler systems on offshore platforms for approximately three (3) years of data collection. This project will provide a valuable source of information to the National Weather Service (NWS) operations as the boundary layer observations are collected in real time and distributed.
NTIS
Meteorological Services; Data Acquisition; Gulf of Mexico; Atmospheric Boundary Layer

19990041940 NASA Goddard Space Flight Center, Greenbelt, MD USA
Comparison of measurements by the NASA/GSFC scanning Raman lidar and the DOE/ARM CART Raman lidar
Whiteman, David, NASA Goddard Space Flight Center, USA; Turner, David, Pacific Northwest National Lab., USA; Evans, Keith, Maryland Univ. Baltimore County, USA; Demoz, Belay, Maryland Univ. Baltimore County, USA; Melfi, Harvey, Maryland Univ. Baltimore County, USA; Schwemmer, Geary, NASA Goddard Space Flight Center, USA; Cadirola, Martin, Maryland Univ. Baltimore County, USA; Ferrare, Richard, NASA Langley Research Center, USA; Goldsmith, John, Sandia National Labs., USA; Wise, Stacy, Maryland Univ. Baltimore County, USA; Apr. 30, 1998; 6p; In English; 19th; Laser Radar, USA
Report No.(s): DE98-052865; SAND-98-8561C; CONF-980722; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Latent heat transfer through evaporation and condensation of water vapor is the most important energy transport mechanism in the atmosphere. In addition, water vapor is the most active greenhouse gas. Any global warning scenario must take accurate account of the spatial and temporal variation of water vapor in order to account for both of these effects. Due to the great importance of water vapor in atmospheric radiation studies, specific intensive operations periods (IOPs) have been hosted by the Department of Energy's Atmospheric Radiation Measurements (ARM) program. One of the goals of these IOPs has been to determine the quality of and explain any discrepancies among a wide variety of water vapor measuring instruments. Raman lidar systems developed by NASA/Goddard Space Flight Center and DOE/Sandia National Laboratories have participated in the two Water Vapor IOPs (WVIOPs) held at the Southern Great Plains (SGP) Cloud and Radiation Testbed Site (CART) site during 1996 (WVIOP1) and 1997 (WVIOP2). Detailed comparisons of these two systems is ongoing but this effort has already resulted in numerous improvements in design and data analysis for both lidar systems.
NTIS
Optical Radar; Atmospheric Radiation; Evaporation; Heat Transfer; Laboratories; Measuring Instruments; Water Vapor; Performance Tests

19990042023 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Polar Vortex Conditions during the 1995-96 Artic Winter: Meteorology and MLS Ozone

Manney, G. L., Jet Propulsion Lab., California Inst. of Tech., USA; Santee, M. L., Jet Propulsion Lab., California Inst. of Tech., USA; Froidevaux, L., Jet Propulsion Lab., California Inst. of Tech., USA; Waters, J. W., Jet Propulsion Lab., California Inst. of Tech., USA; Zurek, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; Nov. 01, 1996; ISSN 0094-8534; Volume 23, No. 22, pp. 3203-3206; In English; Original contains color illustrations

Report No.(s): Paper 96GL02453; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The 1995-96 northern hemisphere (NH) 205 winter stratosphere was colder than in any of the previous 17 winters, with lower stratospheric temperatures continuously below the type 1 (primarily HN03) polar stratospheric cloud (PSC) threshold for over 2 1/2 months. Upper tropospheric ridges in late Feb and early Mar 1996 led to the lowest observed NH lower stratospheric temperatures, and the latest observed NH temperatures below the type 2 (water ice) PSC threshold. Consistent with the unusual cold and chemical processing on PSCS, Upper Atmosphere Research Satellite (UARS) MLS observed a greater decrease in lower stratospheric ozone (03) in 1995-96 than in any of the previous 4 NH winters. 03 decreased throughout the vortex over an altitude range nearly as large as that typical of the southern hemisphere (SH). The decrease between late Dec 1995 and early Mar 1996 was about 2/3 of that over the equivalent SH period. As in other NH winters, temperatures in 1996 rose above the PSC threshold before the spring equinox, ending chemical processing in the NH vortex much earlier than is usual in the SH. A downward trend in column 03 above 100 hPa during Jan and Feb 1996 appears to be related to the lower stratospheric 03 depletion.

Author

Depletion; Meteorology; Northern Hemisphere; Ozone; Stratosphere; Winter; Atmospheric Composition

19990042210 ENVIRON International Corp., Novato, CA USA

Meteorology of the Northeastern Gulf of Mexico ***Interim Report***

Yocke, M. A.; Emery, C. A.; Roberts, P.; Barnett, A.; Oct. 1998; 90p; In English

Report No.(s): PB99-134132; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

There is renewed interest in oil and gas extraction activities in the Northeastern Gulf of Mexico (NEGOM). The National Environmental Policy Act mandates multidisciplinary environmental assessments of Outer Continental Shelf activities to address spill concerns. The objectives of this study include the following: to collect wind data from all available sources spanning the NEGOM, and estimate the temporal/frequency contents and spatial scales of variation from these measurements; to collect humidity, air and sea-surface temperature measurements throughout the NEGOM from these same institutions, prepare maps of the mean and variance fields, and estimate the temporal and spatial scales of variation; to calculate mean and variance fields of surface wind stress and heat flux over the NEGOM and prepare maps of these quantities, to estimate wind curl and vertical vorticity means and variability with and without effects of sea breezes and to use these data to the maximum extent possible to study winter cyclogensis and cold frontal passage in the NEGOM; to assess how frontal passage and the modification of air masses affect the local fiels of temperature, humidity, pressure and other relevant meterological parameters; to estimate the transport of water and latent heat across water-land boundaries or coastlines and the properties of the atmospheric boundary layer, and to evaluate the temporal and spatial variation scales analyzed as functions of atmospheric and climatological forcing; and to develop an 'expert' software system to allow the users of the NEGOM meteorological data base simple access and display capabilities.

NTIS

Meteorology; Meteorological Parameters; Wind Measurement; Climatology; Data Bases; Environment Management; Variability

19990042211 Los Alamos National Lab., NM USA

Numerical investigation into effects of complex terrain on spatial and temporal variability of precipitation

Stalker, J. R.; Bossert, J. E.; Reisner, J. M.; Dec. 31, 1998; 4p; In English; Conference on mountain meteorology

Report No.(s): DE99-001224; LA-UR-98-2441; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This study is part of an ongoing research effort at Los Alamos to understand the hydrologic cycle at regional scales by coupling atmospheric, land surface, river channel, and groundwater models. In this study the authors examine how local variation of heights of the two mountain ranges representative of those that surround the Rio Grande Valley affects precipitation. The lack of observational data to adequately assess precipitation variability in complex terrain, and the lack of previous work has prompted this modeling study. Thus, it becomes imperative to understand how the local terrain affects snow accumulations and rainfall during winter and summer seasons respectively so as to manage this valuable resource in this semi-arid region. While terrain is three dimensional, simplifying the problem to two dimensions can provide some valuable insight into topographic effects that may exist at various transects across the Rio Grande Valley. The authors induce these topographic effects by introducing variations in heights

of the mountains and the width of the valley using an analytical function for the topography. The Regional Atmospheric Modeling System (RAMS) is used to examine these effects.
NTIS
Terrain; Temporal Distribution; Spatial Distribution; Variability; Precipitation (Meteorology); Annual Variations

19990042398 NASA Langley Research Center, Hampton, VA USA
0.Measurements of H216O Linestrengths and Air-Induced Broadenings and Shifts in the 815-nm Spectral Region
Ponsardin, Patrick L., Science Applications International Corp., USA; Browell, Edward V., NASA Langley Research Center, USA; Journal of Molecular Spectroscoy; 1997; ISSN 0022-2852; Volume 185, pp. 58-70; In English
Report No.(s): MS-977354; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The linestrengths for 40 absorption lines of H2 16-O water vapor that were located between 813 and 820 nm were measured; most of these lines were selected for their potential usefulness in laser remote measurements of atmospheric humidity using the differential absorption lidar technique. The air-induced pressure-broadening coefficients were also measured for 32 of these lines and the air-induced pressure shift coefficients were measured for 29 lines. These spectroscopic parameters were derived from spectra obtained with an AlGaAs diode laser and two long-path absorption cells. Collisional narrowing effects were observed and were accurately described by a Galatry profile. Comparisons were made with previous experimental work or theoretical calculations as available.
Author
Differential Absorption Lidar; Line Spectra; Remote Sensing; Water Vapor; Atmospheric Moisture; Moisture Content

48
OCEANOGRAPHY

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

19990041869 Texas A&M Univ., LATEX Program Office, College Station, TX USA
Texas-Louisiana Shelf Circulation and Transport Processes Study: Synthesis Report, Volume 1, Technical Report
Nowlin, W. D.; Jochens, A. E.; Reid, R. O.; DiMarco, S. F.; Sep. 1998; 500p; In English
Report No.(s): PB99-136228; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

The Minerals Management Service funded the Louisiana-Texas Shelf Physical Oceanography Program (LATEX). Study Unit A of LATEX, the Texas-Louisiana Shelf Circulation and Transport Processes Study, was conducted by the Texas A&M University System from 1 October 1991 through 30 September 1998, with field operations undertaken during the period April 1992 through December 1995. During field operations, data were collected from current meters, meteorological buoys, drifting buoys, and hydrographic and Acoustic Doppler Current Profiler surveys over the continental shelf off Texas and Louisiana. Historical and current data from other programs in the region were collected. This report includes data products prepared by the LATEX study unit(s) and presents a new synthesis of shelf circulation.
NTIS
Water Currents; Continental Shelves; Hydrography; Buoys; Oceanographic Parameters

19990041870 Texas A&M Univ., LATEX Program Office, College Station, TX USA
Texas-Louisiana Shelf Circulation and Transport Processes Study: Synthesis Report, Volume 2, Appendices *Final Report, Apr. 1992 - Dec. 1995*
Nowlin, W. D.; Jochens, A. E.; Reid, R. O.; DiMarco, S. F.; Sep. 1998; 296p; In English
Report No.(s): PB99-136236; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The Minerals Management Service funded the Louisiana-Texas Shelf Physical Oceanography Program (LATEX). Study Unit A of LATEX, the Texas-Louisiana Shelf Circulation and Transport Processes Study, was conducted by the Teas A&M University System from 1 October 1991 through 30 September 1998, with field operations undertaken during the period April 1992 through December 1995. During field operations, data were collected from current meters, meteorological buoys, drifting buoys, and hydrographic and Acoustic Doppler Current Profiler surveys over the continental shelf off Texas and Louisiana. Historical and current data from other programs in the region were collected. This report includes data products prepared by the LATEX study unit(s) and presents a new synthesis of shelf circulation.
NTIS
Continental Shelves; Ocean Dynamics; Minerals; Oceanographic Parameters

19990042208 Science Applications International Corp., Raleigh, NC USA
DeSoto Canyon Eddy Intrusion Study. Annual Report. Year 2 ***Final Report, 1 Jul. 1997 - 30 Jun. 1998***
Nov. 1998; 24p; In English
Report No.(s): PB99-134074; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes progress in accomplishing the principal objectives of the DeSoto Canyon Eddy Intrusion Study during the second program year, July 1, 1997 through June 30, 1998. The study objectives are to: document and analyze by means of in-situ current measurements, hydrographic data, and satellite images the Loop Current intrusions and interactions with the northeastern Gulf of Mexico (NEGM) slope; document and examine the dynamical processes of momentum, mass, and vertical vorticity exchanges that occur during Loop Current-slope interactions and other driving forces; estimate the frequency of Loop Current and secondary eddy interactions with the NEGM slope, and conduct and assessment of the vertical and horizontal current shears, exchanges of vorticity, momentum, and mass fields associated with these eddy-slope interactions; and elucidate the role of the DeSoto Canyon in Loop Current and eddy interactions and as a route of mass and momentum exchange between the shelf and deep water of the NEGM.
NTIS
Hydrography; Time Series Analysis; Gulf of Mexico; Canyons

51
LIFE SCIENCES (GENERAL)

19990041707 Kansas State Univ., Div. of Biology, Manhattan, KS USA
Effects of Microgravity on Embryonic Quail Eye Development ***Final Report***
Barrett, Joyce E., Kansas State Univ., USA; Wells, Diane C., Kansas State Univ., USA; Paulsen, Avelina Q., Kansas State Univ., USA; Conrad, Gary W., Kansas State Univ., USA; [1997]; 24p; In English
Contract(s)/Grant(s): NAG2-1005; NAGw-2328; NIH-EY-00952; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Immunohistochemical methods were used to stain neurofilament protein in corneal nerves of Embryonic Day 16 (E16) quail eyes that had been fixed in 4% paraformaldehyde at room temperature for several months. Fixation was according to the methods used by the Mir 21/NASA 2 Avian Developmental Biology Flight Experiments for quail embryos incubated on the Mir Space Station. After fixation, corneas were pretreated to improve immunohistochemical visualization of neurofilaments. A sequential combination of three pretreatments [microwave heating in saline G, followed by extraction with sodium dodecyl sulfate (SDS) at 37 C, followed by digestion with hyaluronidase at 37 C], produced increased antibody staining of corneal nerve neurofilament proteins, compared with corneas subjected to no prior pretreatments. Darker nerve staining and increased numbers of fine branches were observed, together with lower background staining after such pretreatments. In contrast, use of any single pretreatment or pair of pretreatments resulted in only slight and inconsistent enhancement of nerve staining. Only the sequential combination of all three pretreatments resulted in consistently better nerve staining.
Author
Microgravity; Embryos; Eye (Anatomy); Pretreatment; Cornea; Augmentation; Antigens; Antibodies

19990041841 Marine Biological Lab., Woods Hole, MA USA
Genetic Regulatory Networks in Embryogenesis and Evolution
The Biological Bulletin; December 1998; Volume 195, pp. 361-386; In English, 11-14 Jun. 1997, Woods Hole, MA, USA; Sponsored by Marine Biological Lab., USA
Contract(s)/Grant(s): NCC2-896; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The article introduces a series of papers that were originally presented at a workshop titled Genetic Regulatory Network in Embryogenesis and Evaluation. Contents include the following: evolution of cleavage programs in relationship to axial specification and body plan evolution, changes in cell lineage specification elucidate evolutionary relations in spiralia, axial patterning in the leech: developmental mechanisms and evolutionary implications, hox genes in arthropod development and evolution, heterochronic genes in development and evolution, a common theme for LIM homeobox gene function across phylogeny, and mechanisms of specification in ascidian embryos.
CASI
Concentration; Genetics; Reproduction (Biology); Hydrogen Compounds; Embryology

19990042045 Pacific Northwest National Lab., Richland, WA USA

Collective Dose as a Performance Measure for Occupational Radiation Protection Programs: Issues and Recommendations

Strom, D. J.; Harty, R.; Hickey, E. E.; Martin, J. B.; Peffers, M. S.; Jul. 31, 1998; 60p; In English

Report No.(s): DE98-057943; PNNL-11934; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Collective dose is one of the performance measures used at many US Department of Energy (DOE) contractor facilities to quantitatively assess the objectives of the radiation protection program. It can also be used as a management tool to improve the program for keeping worker doses as low as reasonably achievable (ALARA). Collective dose is used here to mean the sum of all total effective dose equivalent values for all workers in a specified group over a specified time. It is often used as a surrogate estimate of radiological risk. In principle, improvements in radiation protection programs and procedures will result in reduction of collective dose, all other things being equal. Within the DOE, most frequently, a single collective dose number, which may or may not be adjusted for workload and other factors, is used as a performance measure for a contractor. The purpose of this report is to evaluate the use of collective dose as a performance measure for ALARA programs at DOE sites.

NTIS

Radiation Protection; Personnel; Radiation Dosage

19990042097 NASA Ames Research Center, Moffett Field, CA USA

Effects of Weightlessness on Vestibular Development: Summary of Research on NIH.R1

Fritzsch, Bernd, Creighton Univ., USA; Bruce, L. L., Creighton Univ., USA; Jun. 01, 1998; 5p; In English

Contract(s)/Grant(s): NCC2-861; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In our original application we proposed to investigate the effects of gravity on the formation of connections between the gravity receptors of the ear and the brain in rat pups raised in space beginning at an age before these connections are made until near the time of birth, when they are to some extent functional. We used the neuronal tracer, Dil, which could be applied to tissue obtained immediately after landing of the space shuttle, thus minimizing changes due to the earth's gravity. We hoped to determine whether the vestibular system develops in two phases, as do other sensory systems (such as the visual system). In these other systems the first phase of development is controlled genetically and the second phase is controlled by environmental stimulation. Our data collected strongly supports the idea that the vestibular system has these same two phases of development. The tissue obtained from the NIH.R1 experiment was of exceptionally high quality for our analysis. Therefore, we expanded our investigation into the ultrastructural effects of microgravity on vestibular development. For the sake of clarity we will subdivide our summary into two categories: (1) analysis of the branching pattern of axons between the vestibular nerve and the gravistatic receptors of the ear in flight and control animals, and (2) analysis of the branching pattern of axons between the vestibular nerve and the brain in flight and control animals.

Derived from text

Vestibules; Experimentation; Spaceborne Experiments; Exobiology; Spacecraft Environments; Weightlessness; Controlled Atmospheres

19990042278 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Increased Cyclic AMP Concentration on Muscle Protein Synthesis and B-Adrenergic Receptor Expression in Chicken Skeletal Muscle Cells in Culture

Young, R. B., NASA Marshall Space Flight Center, USA; Vaughn, J. R., NASA Marshall Space Flight Center, USA; Bridge, K. Y., NASA Marshall Space Flight Center, USA; Smith, C. K., Lilly Research Labs., USA; 1998; 1p; In English; 1998 Congress on In Vitro Biology, 30 May - 4 Jun. 1998, Las Vegas, NV, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Analogies of epinephrine are known to cause hypertrophy of skeletal muscle when fed to animals. These compounds presumably exert their physiological action through interaction with the P-adrenergic receptor. Since the intracellular signal generated by the Beta-adrenergic receptor is cyclic AMP (cAMP), experiments were initiated in cell culture to determine if artificial elevation of cAMP by treatment with forskolin would alter muscle protein metabolism and P-adrenergic receptor expression. Chicken skeletal muscle cells after 7 days in culture were treated with 0.2-30 micrometers forskolin for a total of three days. At the end of the treatment period, both the concentration of cAMP and the quantity of myosin heavy chain (MHC) were measured. Concentration of cAMP in forskolin-treated cells increased up to 10-fold in a dose dependent manner. In contrast, the quantity of MHC was increased approximately 50% above control cells at 0.2 micrometers forskolin, but exhibited a gradual decline at higher levels of forskolin so that the quantity of MHC in cells treated with 30 micrometers forskolin was not significantly different from con-

trols. Curiously, the intracellular concentration of cAMP which elicited the maximum increase in the quantity of MHC was only 40% higher than cAMP concentration in control cells.
Author
Cells (Biology); Epinephrine; Musculoskeletal System; Protein Synthesis; Cyclic Amp; Muscles; Adrenergics; Protein Metabolism

19990042343 Los Alamos National Lab., NM USA
Advanced biomolecular materials based on membrane-protein/polymer complexation
Smith, G. S.; Nowak, A.; Safinya, C.; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-001256; LA-UR-98-2355; 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 goal of this project was to apply neutron reflectometry and atomic force microscopy to the study of lipid membranes containing proteins. Standard sample preparation techniques were used to produce thin films of these materials appropriate for these techniques. However, these films were not stable, and a new sample preparation technique was required. Toward this goal, the authors have developed a new capability to produce large, freely suspended films of lipid multi-bilayers appropriate for these studies. This system includes a controlled temperature/humidity oven in which the films 5-cm x 5-cm are remotely drawn. The first neutron scattering experiments were then performed using this oven.
NTIS
Molecular Structure; Membrane Structures; Proteins

19990042361 Lawrence Livermore National Lab., Livermore, CA USA
Automatic Generation of Warehouse Mediators Using an Ontology Engine
Critchlow, T.; Mar. 04, 1998; 11p; In English; International workshop on knowledge representation meets databases
Report No.(s): DE98-058754; UCRL-JC-129930; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Data Foundry research project at LLNL is investigating data warehousing in highly dynamic scientific environments. Specifically, we are developing a data warehouse to aid structural biologists in genetics research. Upon completion, this warehouse will present a uniform view of data obtained from several heterogeneous data sources containing distinct but related data from various genetics domains. Our warehouse uses a mediated data warehouse architecture in which only some data is represented explicitly in the warehouse; remote access is required to obtain the non-materialized data. Mediators are used to convert data from the data source representation to the warehouse representation and make it available to the warehouse. The major challenge we face is reducing the impact of source schema changes on warehouse availability and reliability: based upon previous efforts, we anticipate one source schema modification every 2-4 weeks once all of the desired sources have been integrated. Incorporating these modifications into the mediators using brute force results in an unacceptable amount of warehouse down-time. We believe that extensive use of a carefully designed ontology will allow us to overcome this problem, while providing a useful knowledge base for other applications. In addition to automatically generating the transformation between the data sources and the warehouse, the ontology will be used to guide automatic schema evolution, and provide a high level interface to the warehouse. This paper focuses on the use of the ontology to automatically generate mediators, because reducing the effect of source changes is a critical step in providing reliable access to heterogeneous data sources.
NTIS
Genetics; Biological Evolution; Evolution (Development); Research and Development

19990042427 Department of Energy, Washington, DC USA
Similarity landscapes: An improved method for scientific visualization of information from protein and DNA database searches
Dogget, N.; Myers, G.; Wills, C. J.; Dec. 31, 1998; 6p; In English
Report No.(s): DE99-001172; LA-UR-98-2619; 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 authors have used computer simulations and examination of a variety of databases to answer questions about a wide range of evolutionary questions. The authors have found that there is a clear distinction in the evolution of HIV-1 and HIV-2, with the former and more virulent virus evolving more rapidly at a functional level. The authors have discovered highly non-random patterns in the evolution of HIV-1 that can be attributed to a variety of selective pressures. In the course of examination of microsatellite DNA (short repeat regions) in microorganisms, the authors have found clear differences between prokaryotes and eukaryotes in their distribution, differences that can be tied to different selective pressures. They have developed a new method (topiary pruning) for enhancing the phylogenetic information contained in DNA sequences. Most recently, the

authors have discovered effects in complex rainforest ecosystems that indicate strong frequency-dependent interactions between host species and their parasites, leading to the maintenance of ecosystem variability.
NTIS
Scientific Visualization; Proteins; Deoxyribonucleic Acid; Data Bases

52
AEROSPACE MEDICINE

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

19990041438 Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA
Targeting HER-2/neu Overexpression by Suicide Ribozyme In Breast Cancer ***Final Report, 1 Sep. 1996 - 31 Aug. 1998***
Hung, Mien-Chie; Sep. 1998; 53p; In English
Contract(s)/Grant(s): DAMD17-96-1-6253
Report No.(s): AD-A362035; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Breast cancer represents a major cause of death for women in the United States. Overexpression of HER-2/neu oncogene was found in approximately 30% of breast tumor tissues and shown to be a marker indicating poor prognosis for breast cancer patients. HER-2/neu overexpression in cancer cells is also known to enhance cancer metastasis and to induce chemoresistance to certain anti-cancer drugs and repression of HER-2/neu expression reduces malignancy of the cancer cells. Therefore, HER-2/neu overexpression serves as an excellent target for development of breast cancer therapy. Ribozymes have been successfully used to control gene expression. We have designed a novel suicide ribozyme that will allow a gene of interest (such as a toxin gene) to be expressed specifically in the HER-2/neu-overexpressing breast cancer cells, and therefore, will kill only the HER-2/neu-overexpressing cells. This final report describes the progress in the following specific aims: 1) Design of the suicide ribozyme and proof of concept in vitro; 2) Proof of concept in vivo: a reporter gene regulated by the suicide ribozyme will be expressed only in cells overexpressing HER-2/neu mRNA. 3) Application of concept in vivo: a toxin gene regulated by the suicide ribozyme will preferentially inhibit the growth of breast cancer cells that overexpress HER-2/neu. During the last funding period (9/1/97 - 8131198), we have tested our suicide ribozymes in breast cancer cell lines that express either high or low level of HER-2/neu mRNA. Although we have not obtained the optimal suicide ribozyme that would consistently show a preferential expression in HER-2/neu overexpressors, our alternative approach using a HER-2/neu antisense iron responsive element has yielded an encouraging result which may lead to a potential gene therapy treatment a against HER-2/neu-overexpressin breast cancer cells.
DTIC
Cancer; Death; Physiological Effects

19990041598 NASA Langley Research Center, Hampton,VA USA
Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 492
May 31, 1999; 29p; In English
Report No.(s): NASA/SP-1999-7011/SUPPL492; NAS 1.21:7011/SUPPL492; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.
Derived from text
Aerospace Medicine; Bibliographies; Data Bases; Indexes (Documentation)

19990041836 Civil Aeromedical Inst., Oklahoma City, OK USA
Urinary Genotyping for DQA1 and PM Loci using PCR-Based Amplification: Effects of Volume, Storage Temperature, Preservatives, and Aging on DNA Extraction and Typing ***Final Report***
Vu, Nicole T., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; April 1999; 14p; In English
Contract(s)/Grant(s): FAA-AM-B-97-TOX-202; FAA-AM-B-98-TOX-202

Report No.(s): DOT/FAA/AM-99/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Urine is often the sample of choice for drug screening in aviation/general forensic toxicology and in workplace drug testing. In some instances, the origin of the submitted samples may be challenged because of the medicolegal and socioeconomic consequences of a positive drug test. Methods for individualization of biosamples have reached a new boundary with the application of the polymerase chain reaction (PCR) in DNA profiling, but a successful characterization of the urine specimens depends on the quantity and quality of DNA present in the samples. Therefore, the present study investigated the influence of storage conditions, sample volumes, concentration modes, extraction procedures, and chemical preservations on the quantity of DNA recovered, as well as the success rate of PCR-based urinary genotyping for DQA1 and PM loci. Urine specimens from male and female volunteers were divided and stored at various temperatures for up to 30 days. The results suggested that sample purification by dialfiltration, using 3,000-100,000 molecular weight cut-off filters, did not enhance DNA recovery and typing rate compared with simple centrifugation procedures. Extraction of urinary DNA by the organic method and by the resin method gave comparable typing results. Larger sample volume yielded higher amount of DNA, but the typing rates were not affected for sample volumes between 1 to 5 ml. The quantifiable amounts of DNA present were found to be greater in female (14-200 ng/ml) than in male (4-60 ng/ml) samples and decreased with the elapsed time under both room temperature (RT) and frozen storage. Typing of the male samples also demonstrated that RT storage samples produced significantly higher success rates than that of frozen samples, while there was only marginal difference in the DNA typing rates among the conditions tested using female samples. Successful assignment of DQA1+PM genotype was achieved for all sampling of fresh urine, independent of gender, starting sample volume, or concentration method. Preservation by 0.25% sodium azide was acceptable for sample storage at 4 C during a period of 30 days. For longer storage duration, freezing at -70 C may be more appropriate. Thus, the applicability of the DQA1 +PM typing was clearly demonstrated for individualization of the urine

Author

Urology; Urine; Sampling; Temperature Effects; Purification; Centrifuging; Preserving

19990041847 Civil Aeromedical Inst., Oklahoma City, OK USA

Refractive Surgery in the Civil Airman Population by Class of Medical Certificate and by Aviation Occupation ***Final Report***

Nakagawara, Van B., Civil Aeromedical Inst., USA; Wood, Kathryn J., Civil Aeromedical Inst., USA; Montgomery, Ronald W., Civil Aeromedical Inst., USA; February 1999; 12p; In English

Contract(s)/Grant(s): FAA-AM-B-98-TOX-203

Report No.(s): DOT/FAA/AM-99/6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Refractive surgical procedures performed in the USA have increased in recent years and continued growth is projected in the near future. These procedures have been associated with numerous side-effects, including glare, reduced contrast sensitivity, and fluctuating visual acuity. The quality of vision after refractive surgery may be unacceptable in a cockpit environment. This report reviews the aeromedical certification experience with the refractive surgery population.

Author

Aerospace Medicine; Data Bases; Eye (Anatomy); Surgery

19990041967 Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

Predoctoral Training in Breast Cancer Detection and Training ***Annual Report, 1 Aug. 1997 - 31 Jul. 1998***

Leigh, John S., Jr; Aug. 1998; 14p; In English

Contract(s)/Grant(s): DAMD17-94-J-4027

Report No.(s): AD-A361568; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our training program in breast cancer detection and treatment continues to provide an excellent opportunity to train research fellows who demonstrate an interest in pursuing clinical and technical work relating to breast cancer. Through the dual mentorship system that we have adopted, each of the four current trainees is assigned to both a clinical specialist and a theoretical or research specialist. These complementary yet distinct professional perspectives constitute an invaluable resource throughout the program. Trainees also attend related seminars and conferences as part of their training. Trainee research encompasses a broad range of theoretical disciplines genetics, biochemistry, electrical engineering, computer science, physiology, and tumor biology as well as clinical disciplines such as radiology, oncology, pathology, and radiation therapy. The University of Pennsylvania has developed a broadly-based graduate study program designed to apply theory to clinical practice in developing technology and procedures for the detection and treatment of disease. Throughout this year our work focused primarily upon improving methods of detecting breast cancer through magnetic resonance imaging of tissue, with significant attention paid to the characteristics of the

disease at various stages. We have also strived to build upon current general knowledge of the metabolic and genetic parameters of the disease.
DTIC
Clinical Medicine; Diagnosis; Diseases; Biochemistry; Cancer; Computer Assisted Instruction; Education

19990041976 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Visualizing Early-Stage Breast Cancer Tumors in a Mammographic Environment Through a 3-Dimensional Mathematical Model
Bassham, Christopher B.; Mar. 1999; 112p; In English
Report No.(s): AD-A361639; AFIT/GOA/ENS/99M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In response to the insidious and deadly nature of breast cancer and the less-than-perfect detection ability of mammography, we develop a mathematical model as a foundation to the long-term goal of improving early breast cancer detection. by using modeling and simulation to construct an accurate breast cancer tumor model, we hope to solve the problems associated with mammogram misdiagnosis and, perhaps as a by-product, lend insight to tumor development dynamics. The final tumor model, written in MATLAB, provides realistic tumor growth and 2-dimensional visualization of 3-dimensional structures. Earlier modeling attempts capture slices of the tumor in the 2-dimensional growth spaces. The final 3-dimensional model closely mimics the characteristics of theoretical breast cancer development within the female breast by establishing an algorithm that reliably represents the ideal tumor model. The possible impact of this model and its progeny is earlier detection of breast cancer, which leads to an increased chance of survival for those afflicted with the disease.
DTIC
Mammary Glands; Cancer; Diseases

19990042034 Texas Univ. Health Science Center, Houston, TX USA
Application of Rotating Wall Vessel (RWV) Cell Culture for Pancreas Islet Cell Transplantation ***Final Report***
Rutzky, Lynne P., Texas Univ. Health Science Center, USA; Jun. 30, 1998; 5p; In English
Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Type I insulin-dependent diabetes mellitus (IDDM) remains a major cause of morbidity and mortality in both pediatric and adult populations, despite significant advances in medical management. While insulin therapy treats symptoms of acute diabetes, it fails to prevent chronic complications such as microvascular disease, blindness, neuropathy, and chronic renal failure. Strict control of blood glucose concentrations delays but does not prevent the onset and progression of secondary complications. Although, whole pancreas transplantation restores physiological blood glucose levels, a continuous process of allograft rejection causes vascular and exocrine-related complications. Recent advances in methods for isolation and purification of pancreatic islets make transplantation of islet allografts an attractive alternative to whole pancreas transplantation. However, immunosuppressive drugs are necessary to prevent rejection of islet allografts and many of these drugs are known to be toxic to the islets. Since autotransplants of isolated islets following total pancreatectomy survive and function in vivo, it is apparent that a major obstacle to successful clinical islet transplantation is the immunogenicity of the islet allografts.
Derived from text
Pancreas; Transplantation; Insulin; Diabetes Mellitus; Carbohydrate Metabolism; Enzyme Activity

19990042132 Istituto Superiore di Sanita, Rome, Italy
Biomarkers for Environmental and Occupational Exposure to Aromatic Mutagens and Carinogens from Emissions of Oil Shale Petrochemistry: Report of the EC PEO Programme, Project CIPA-CT92-3016 ***Biomarcatori di Esposizione Ambientale ed Occupazionale a Mutageni e Cancerogeni Nella Lavorazione Degli Scisti Bituminosi: Rapporto del Programma Comunitario PECO, Progetto CIPA-CT92-3016***
Carere, Angelo, Editor, Istituto Superiore di Sanita, Italy; Crebelli, Riccardo, Editor, Istituto Superiore di Sanita, Italy; 1998; ISSN 0394-9311; In English
Report No.(s): ISTISAN-98/1; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viale Regina Elena, 299-00161 Rome, Italy), Hardcopy, Microfiche

Oil shale processing for energy supply and further refining for petrochemistry is an important field of industry in Baltic countries. Estonia possesses the largest oil shale mines and oil shale processing plants of the world. Large scale oil shale extraction and processing lead to extensive environmental pollution and to the release of high levels of aromatic carcinogenic substances

in processing plants. In the framework of the ”PECO” programme, during 1993-1996, the European Commission funded a research project on biomarkers of environmental and occupational exposure in oil shale petrochemistry. The project gave the opportunity to develop and calibrate several biomarkers of exposure to aromatic carcinogens. The results obtained highlighted the role of blood benzene and urinary trans, trans-muconic acid and 1-hydroxypyrene as sensitive biomarkers of occupational exposure to benzene and polycyclic aromatic hydrocarbons. A novel promising approach was developed for the analysis of benzene adducts in haemoglobin. This methodology, as well as the P-32-postlabelling analysis of bulky adducts in DNA of blood cells of oil shale workers, showed high sensitivity and potential utility in human biomonitoring. Molecular cytogenetic methods based on in situ hybridization showed an exposure-related clastogenic, and possibly aneugenic, effect in oil shale workers, demonstrating the potential advantage of novel molecular approaches in the cytogenetic surveillance of carcinogen exposure.
Author
Carcinogens; Deoxyribonucleic Acid; Environment Pollution; Extraction; Personnel; Polycyclic Aromatic Hydrocarbons; Shale Oil

19990042145 Los Alamos National Lab., NM USA
TeleMed: Wide-area, secure, collaborative object computing with Java and CORBA for healthcare
Forslund, D. W.; George, J. E.; Gavrilov, E. M.; Dec. 31, 1998; 5p; In English; IEEE international symposium on high performance distributed computing
Report No.(s): DE99-001250; LA-UR-98-2490; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Distributed computing is becoming commonplace in a variety of industries with healthcare being a particularly important one for society. The authors describe the development and deployment of TeleMed in a few healthcare domains. TeleMed is a 100% Java distributed application build on CORBA and OMG standards enabling the collaboration on the treatment of chronically ill patients in a secure manner over the Internet. These standards enable other systems to work interoperably with TeleMed and provide transparent access to high performance distributed computing to the healthcare domain. The goal of wide scale integration of electronic medical records is a grand-challenge scale problem of global proportions with far-reaching social benefits.
NTIS
Java (Programming Language); Security; Distributed Processing; Clinical Medicine

19990042215 Baylor Coll. of Medicine, Houston, TX USA
Applying a Neural Network to Prostate Cancer Survival Data
Kattan, Michael W., Baylor Coll. of Medicine, USA; Ishida, Haku, Baylor Coll. of Medicine, USA; Scardino, Peter T., Baylor Coll. of Medicine, USA; Beck, J. Robert, Baylor Coll. of Medicine, USA; Intelligent Data Analysis in Medicine and Pharmacology; 1997, pp. 295-306; In English
Contract(s)/Grant(s): NCC9-36; NCI-CA-58204; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Prediction of treatment efficacy for prostate cancer therapies has proven difficult and requires modeling of survival-type data. One reason for the difficulty may be infrequent use of flexible modeling techniques, such as artificial neural networks (ANN). The purpose of this study is to illustrate the use of an ANN to model prostate cancer survival data and compare the ANN to the traditional statistical method, Cox proportional hazards regression. Clinical data and disease follow-up for 983 men were modeled by both an ANN and a Cox model. Repeated sampling of 200 training and testing subsets were supplied td each technique. The concordance index c was calculated for each testing dataset. As further validation, ANN and Cox models were applied to a totally separate dataset. The ANN outperformed the Cox model in internal validation datasets (ANN c = 0.76, Cox c = 0.74) and on the external validation dataset (ANN c = 0.77, Cox c = 0.74). ANNs were more discriminating than Cox models for predicting cancer recurrence. Calibration of the ANN remains a problem. Once solved, it is expected that an ANN will make the most accurate predictions of prostate cancer recurrence and improve treatment decision making.
Author
Statistical Analysis; Mathematical Models; Neural Nets; Cancer; Prostate Gland

53
BEHAVIORAL SCIENCES

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

19990041609 Institute for Experimental Psychiatry Research Foundation, Merion Station, PA USA
Crew Alertness Management on the Flight Deck: Cognitive and Vigilance Performance, ***1 Feb. 1989 - 31 Oct. 1998***
Dinges, David F., Institute for Experimental Psychiatry Research Foundation, USA; 1998; 10p; In English
Contract(s)/Grant(s): NCC2--599; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project had three broad goals: (1) to identify environmental and organismic risks to performance of long-haul cockpit crews; (2) to assess how cognitive and psychomotor vigilance performance, and subjective measures of alertness, were affected by work-rest schedules typical of long-haul cockpit crews; and (3) to determine the alertness-promoting effectiveness of behavioral and technological countermeasures to fatigue on the flight deck. During the course of the research, a number of studies were completed in cooperation with the NASA Ames Fatigue Countermeasures Program. The publications emerging from this project are listed in a bibliography in the appendix. Progress toward these goals will be summarized below according to the period in which it was accomplished.
Derived from text
Psychomotor Performance; Work-Rest Cycle; Fatigue (Biology); Flight Crews; Pilot Performance; Flight Fatigue; Alertness; Circadian Rhythms; Aerospace Medicine

19990041920 American Transit Association, Trucking Research Inst., Washington, DC USA
Eye-Activity Measures of Fatigue and Napping as a Fatigue Countermeasure ***Final Report, Sep. 1997 - Feb. 1998***
Jan. 1999; 164p; In English
Report No.(s): PB99-134900; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This study investigated the potential use of an eye tracking system for detecting reduced driver alertness, and the impact of prophylactic napping on driver performance and alertness. The study used traditional behavioral and physiological measures of alertness. In addition, an unobtrusive eye tracker attached to the simulator structure was used to measure eye and eyelid behavior. The results showed clear time-of-day (TOD) and time-on-task (TOT) effects for the following eye closure measures: Partial closures during fixations, speed or slow eyelid closure (SEC), blink duration, and blink frequency.
NTIS
Sleep; Alertness; Fatigue (Biology); Eye Movements; Physiology

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19990041615 Earth Technology, Inc., San Antonio, TX USA
Level II Ergonomic Analyses, Dover AFB, DE ***Final Report, Feb. 1996***
Marcotte, Andrew; Joyce, Marilyn; Miller, Nancy; Feb. 1999; 228p; In English
Contract(s)/Grant(s): F41624-95-D-9016
Report No.(s): AD-A361102; IERA-RS-BR-TR-1999-0002; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The results of ten ergonomic evaluations conducted in the EMS ISO Dock, the EMS Structural Maintenance Shop, and the APS Special Handling Shop at Dover AFB are described. The evaluations were performed as part of an Air Mobility Command-sponsored effort to identify, evaluate, and control hazards for work-related musculoskeletal disorders. The report identifies key risk factors associated with various jobs in each shop, the underlying cause of the hazard, control options to reduce or eliminate the hazard, and the expected impacts of each control measure.
DTIC
Musculoskeletal System; Occupational Diseases

19990041745 Army Aeromedical Research Lab., Fort Rucker, AL USA
An Evaluation of Air Warrior Concept Aviator Ensembles With and Without Microclimate Cooling ***Final Report***
Katz, Lawrence C.; Wildzunas, Robert M.; Cadarete, Bruce S.; Mar. 1999; 25p; In English
Contract(s)/Grant(s): Proj-3O162787A879
Report No.(s): AD-A361991; USAARL-99-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Program Manager, U.S. Army Aircrew Integrated Systems (PM-ACIS) requested that the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, Alabama, assess the physiological and psychological effects of heat stress exposure for aviators wearing encumbered chemical defense level-4 mission oriented protective posture (MOPP4) ensembles. This project was conducted under a joint agreement between USAARL and the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts. The methodology for assessing heat stress in an environmentally controlled helicopter simulator was established in previous studies conducted at USAARL (Reardon et al., 1996; Reardon et al., 1997; Reardon et al., 1998).

DTIC
Aircraft Pilots; Microclimatology; Heat Tolerance; Cooling

19990041828 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA
Human Factors Analysis and Modeling of U.S. Navy Afloat Electrical Shock Mishaps
Sciretta, M. S.; Mar. 1999; 116p; In English
Report No.(s): AD-A361999; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Electrical shock mishaps account for 33 percent of all personnel injuries occurring onboard U.S. Navy surface combatants from 1995 to 1997. Clearly this indicates a need to identify the root causes and to develop intervention strategies for preventing electrical shock. Electrical shock root caUSAl factors are identified through the evaluation of Special Case Mishap Reports maintained by the Naval Safety Center. Analysis indicates that over 85 percent of electrical shock mishaps are human factors related. Scenario analysis coupled with categorical data analysis is used to identify human factors patterns that are present in electrical shock mishaps. This human factors approach finds that the failure of two primary human factors related interventions identified in the safety literature, improper tagout of equipment and misuse of personal protective equipment, account for 37 percent of the mishaps. A stochastic model of electrical shock mishaps, including human factors related and non-human factors related mishaps, is constructed to develop an overall impression of the status quo. This model is then used to forecast the impact of correcting the identified failed interventions on future expected mishap frequencies and associated costs.

DTIC
Human Factors Engineering; Accident Investigation; Forecasting

19990041938 Institute for Human Factors TNO, Soesterberg, Netherlands
Ergonomic Evaluation of the Fennek ***Final Report Ergonomische Evaluatie van de Fennek***
Oudenhujzen, A. J. K., Institute for Human Factors TNO, Netherlands; Nov. 26, 1998; In English
Contract(s)/Grant(s): A96/KL/301; TNO Proj. 789.1
Report No.(s): TD98-0276; TNO-TM-98-A064; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A prototype of the Fennek, a new patrol vehicle for the Royal Dutch Army, is being tested. TNO Human Factors Research Institute (HFRI) investigated ergonomics of the vehicle as a part of tactical tests that are being performed by the Royal Dutch Army and the German Army, This report is the second in a series about the ergonomics of the Fennek. The first report described an analysis that was performed on a digital mockup of the Fennek using digital 3D human modelling systems, called the digital analysis. This report describes the results of a field trial and compares the results of the field trial land the digital analysis. The Fennek crew gave their ergonomic judgement about the Fennek during the field trial making use of an ergonomic checklist. During the field trial attention was given to: how to enter/exit the Fennek; use of controls and displays; steering wheel and pedals; the crew seats; free space; outside- and inside view; stowage room; noise: ventilation and climate control systems; safety. The results of the overall testing activities are used to improve the design of the Fennek. The improvement of the Fennek is an ongoing process. The results as described in this report are based on tests on the TVM 2. It is possible that certain mentioned ergonomic problems are already solved. The following conclusions can be derived from the study: The crew of the Fennek has a positive general judgement about the ergonomics of the Fennek. They would like to see improvements to several items. These items are: (1) the outside view: the Fennek crew complained about insufficient outside view. The crew will be hampered in performing their task due to the limited amount of available outside view; (2) the controls and displays: various remarks were made concerning the controls and displays; 3 the climate control and ventilation systems: the climate control and ventilation systems did not function sufficiently and will be worse in more severe climates; (4) a high noise level: the high noise level affects the inter cabin communication in the Fennek; (5) the space in the Fennek: various remarks were made concerning the available space in the Fennek. Conclusions for the compari-

son between the field trial and the digital analysis. Various differences were found between the overlapping results of both mentioned studies. It is concluded that each of the methods used have their specific advantages and disadvantages. The digital analysis will find its application in early studies, when a full-scale mockup is not available. The application of the digital techniques does reduce the need for full-scale mockups or prototypes early in the design process. Task related aspects, such as the outside view, cannot completely be evaluated with digital human modelling techniques. Recommendations: (1) it is recommended to search methods for improvement of the crew outside view; (2) it is recommended to investigate the dangers of the crews exposure to excessive heat load; (3) the use of an intercom system in the Fannek, combined with headsets is recommended; (4) it is recommended to perform a more extensive study on the controls, the displays and the available space in the Fennek.This will be the sabject of the third phase of this project; (5) it is recommended to establish anthropometric selection criteria for the Fennek's crew. This will be the subject of the third phase of the project.
Author
Evaluation; Prototypes; Performance Tests; Armed Forces; Human Factors Engineering; Digital Techniques; Digital Systems; Motor Vehicles

19990042032 Georgia Inst. of Tech., School of Textile and Fiber Engineering, Atlanta, GA USA
The Design and Development of a Regenerative Separatory Column Using Calixarenes as a Polymeric Backbone for the Purification of Water from Urine ***Final Report***
Polk, M., Georgia Inst. of Tech., USA; 1999; 6p; In English
Contract(s)/Grant(s): NGT10-52603; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The objective of this research project is to design calixarenes, cup-shaped molecules, with the specific binding sites to the sodium chloride and nitrogen containing components of urine, such as urea and uric acid, in urine. The following partition of the research accomplishes this objective: (1) functionalization of calixarene, (2) development of a calixarene based medium for the separatory process, (3) design of the column regeneration protocol. Work was also accomplished in the area of temperature sensitive paint (TSP). Research was undertaken to design a TSP with insulating propertites. An important part of this research project is to discover the thermal conductivity of polymers for TSP.
Derived from text
Sodium Chlorides; Water; Urine; Nitrogen; Purification; Thermal Conductivity; Paints

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

19990041386 Geophysical Observatory, Helsinki, Finland
Annals of the Finnish Academy of Science, Volume 22, Mathematics ***Annales Academia Scientiarum Fennicae, Volumen 22, Mathematica***
Lehto, Olli, Editor, Helsinki Univ., Finland; 1997; ISSN 1239-629X; In English; See also 19990041387 through 19990041400; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche
Articles addressing various topics in Mathematics are presented. Subject areas include conformal, quasiconformal and quasiregular mappings, analytic functions, Riemann Surfaces, univalent and multivalent functions, entire functions, Kleinian groups, Hausdorff measures and fractals.
CASI
Euclidean Geometry; Analytic Functions; Topology; Journals; Mathematics

19990041584 Sandia National Labs., Albuquerque, NM USA
Experiences developing ALEGRA: A C++ coupled physics framework
Budge, K. G.; Peery, J. S.; Dec. 31, 1998; 10p; In English; Hirschegg '98: 26. international workshop on gross properties of nuclei and nuclear excitations: Nuclear astrophysics
Report No.(s): DE99-000590; SAND-98-2134C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
ALEGRA is a coupled physics framework originally written to simulate inertial confinement fusion (ICF) experiments being conducted at the PBFA-II facility at Sandia National Laboratories. It has since grown into a large software development project supporting a number of computational programs at Sandia. As the project has grown, so has the development team, from the origi-

nal two authors to a group of over fifteen programmers crossing several departments. In addition, ALEGRA now runs on a wide variety of platforms, from large PCs to the ASCI Teraflops massively parallel supercomputer. The authors discuss the reasons for ALEGRA's success, which include the intelligent use of object-oriented techniques and the choice of C++ as the programming language. They argue that the intelligent use of development tools, such as build tools (e.g. make), compiler, debugging environment (e.g. dbx), version control system (e.g. cvs), and bug management software (e.g. ClearDDTS), is nearly as important as the choice of language and paradigm.
NTIS
C++ (Programming Language); Computer Systems Programs

19990041709 Los Alamos National Lab., NM USA
Parallel implicit Monte Carlo in C++
Urbatsch, T. J.; Evans, T. M.; Dec. 31, 1998; 9p; In English; ISCOPE '98: international symposium on computing in object oriented parallel environments
Report No.(s): DE99-000753; LA-UR-98-2135; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors are developing a parallel C++ Implicit Monte Carlo code in the Draco framework. As a background and motivation for the parallelization strategy, they first present three basic parallelization schemes. They use three hypothetical examples, mimicking the memory constraints of the real world, to examine characteristics of the basic schemes. Next, they present a two-step scheme proposed by Lawrence Livermore National Laboratory (LLNL). The two-step parallelization scheme they develop is based upon LLNL's two-step scheme. The two-step scheme appears to have greater potential compared to the basic schemes and LLNL's two-step scheme. Lastly, they explain the code design and describe how the functionality of C++ and the Draco framework assist the development of a parallel code.
NTIS
Monte Carlo Method; C++ (Programming Language); Parallel Processing (Computers)

19990041952 NASA Lewis Research Center, Cleveland, OH USA
A Solution to the Fundamental Linear Fractional Order Differential Equation
Hartley, Tom T., Akron Univ., USA; Lorenzo, Carl F., NASA Lewis Research Center, USA; December 1998; 20p; In English
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TP-1998-208693; E-11408; NAS 1.60:208693; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper provides a solution to the fundamental linear fractional order differential equation, namely, (sub c)d(sup q, sub t) + ax(t) = bu(t). The impulse response solution is shown to be a series, named the F-function, which generalizes the normal exponential function. The F-function provides the basis for a qth order "fractional pole". Complex plane behavior is elucidated and a simple example, the inductor terminated semi- infinite lossy line, is used to demonstrate the theory.
Author
Differential Equations; Linear Equations

19990042440 Department of Energy, Office of Energy Research, Washington, DC USA
Composite centered schemes for multidimensional conservation laws
Liska, R.; Wendroff, B.; May 08, 1998; 12p; In English
Report No.(s): DE99-000831; LA-UR-98-2216; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The oscillations of a centered second order finite difference scheme and the excessive diffusion of a first order centered scheme can be overcome by global composition of the two, that is by performing cycles consisting of several time steps of the second order method followed by one step of the diffusive method. The authors show the effectiveness of this approach on some test problems in two and three dimensions.
NTIS
Conservation Laws; Finite Difference Theory

60
COMPUTER OPERATIONS AND HARDWARE

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

19990041512 SRI International Corp., Artificial Intelligence Center, Menlo Park, CA USA
The Open Agent Architecture(TM)
Cheyer, Adam, SRI International Corp., USA; Martin David, SRI International Corp., USA; Moran, Douglas, SRI International Corp., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 239-262; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation provides an overview of the motivations, implementation, and application of SRI's Open Agent Architecture (OAA), a new framework for constructing dynamic, distributed systems.
Author
Software Engineering; Internets; Dynamical Systems; Human-Computer Interface

19990042066 GenCorp Aerojet, AzUSA, CA USA
Earth Observing System(EOS). Advanced Microwave Sounding Unit-A: Firmware Test Report
Schwantje, R., GenCorp Aerojet, USA; Oct. 29, 1998; 176p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209223; NAS 1.26:209223; Rept-10974A; CDRL-217; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document is the Firmware Test Report for the firmware to be used in the Earth Observing System (EOS) Advanced Microwave Sounding Unit-A (AMSU-A) instrument. It describes the firmware results of the Formal Qualification Test (FQT)/Demonstrations conducted on Mar. 21, 1997, Apr. 8, 1998, and July 14, 1998, for the EOS/AMSU-A instrument.
Author
Performance Tests; Firmware

19990042079 Los Alamos National Lab., NM USA
Reconfigurable computer array: The bridge between high speed sensors and low speed computing
Robinson, S. H.; Caffrey, M. P.; Dunham, M. E.; Jun. 16, 1998; 11p; In English; International workshop on field programmable logic and applications
Report No.(s): DE99-001233; LA-UR-98-2510; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A universal limitation of RF and imaging front-end sensors is that they easily produce data at a higher rate than any general-purpose computer can continuously handle. Therefore, Los Alamos National Laboratory has developed a custom Reconfigurable Computing Array board to support a large variety of processing applications including wideband RF signals, LIDAR and multi-dimensional imaging. The boards design exploits three key features to achieve its performance. First, there are large banks of fast memory dedicated to each reconfigurable processor and also shared between pairs of processors. Second, there are dedicated data paths between processors, and from a processor to flexible I/O interfaces. Third, the design provides the ability to link multiple boards into a serial and/or parallel structure.
NTIS
Arrays; Microprocessors; Optical Radar

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19990041147 NASA Goddard Space Flight Center, Greenbelt, MD USA
Spacecraft Onboard Software Maintenance: An Effective Approach which Reduces Costs and Increases Science Return
Shell, Elaine M., NASA Goddard Space Flight Center, USA; Lue, Yvonne, Computer Sciences Corp., USA; Chu, Martha I., Johns Hopkins Univ., USA; Jan. 20, 1999; 9p; In English; 3rd; Reducing Cost of Aircraft Ground Systems and Operations, 1999, Taiwan, Province of China; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Flight software (FSW) is a mission critical element of spacecraft functionality and performance. When ground operations personnel interface to a spacecraft, they are dealing almost entirely with onboard software. This software, even more than ground/flight communications systems, is expected to perform perfectly at all times during all phases of on-orbit mission life. Due to the fact that FSW can be reconfigured and reprogrammed to accommodate new spacecraft conditions, the on-orbit FSW maintenance team is usually significantly responsible for the long-term success of a science mission. Failure of FSW can result in very expensive operations work-around costs and lost science opportunities. There are three basic approaches to staffing on-orbit software maintenance, namely: (1) using the original developers, (2) using mission operations personnel, or (3) assembling a Center of Excellence for multi-spacecraft on-orbit FSW support. This paper explains a National Aeronautics and Space Administration, Goddard Space Flight Center (NASA/GSFC) experience related to the roles of on-orbit FSW maintenance personnel. It identifies the advantages and disadvantages of each of the three approaches to staffing the FSW roles, and demonstrates how a cost efficient on-orbit FSW Maintenance Center of Excellence can be established and maintained with significant return on the investment.
Author
Applications Programs (Computers); Costs; Spacecraft Maintenance; Flight Control; Computer Programs

19990041148 Aerojet-General Corp., AzUSA, CA USA
Earth Observing System (EOS) Advanced Microwave Sounding Unit: A (EOS/AMSU-A) Firmware Version Description Document *Final Report*
Cisneros, A., Aerojet-General Corp., USA; Dec. 07, 1998; 14p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209213; NAS 1.26:209213; Rept-10976A; CDRL-306-8b; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final submittal of the Earth Observing System/Advanced Microwave Sounding Unit-A Firmware Version Description Document. Its purpose is to provide a precise description of the particular version of the firmware being released. This description also defines the version of the requirements and design applicable to this version.
Author
Advanced Microwave Sounding Unit; Earth Observing System (EOS); Firmware; Documentation

19990041151 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Revision of the NASA Team Sea Ice Algorithm
Markus, T., NASA Goddard Space Flight Center, USA; Cavalieri, Donald J., NASA Goddard Space Flight Center, USA; 1998; 45p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a recent paper, two operational algorithms to derive ice concentration from satellite multichannel passive microwave sensors have been compared. Although the results of these, known as the NASA Team algorithm and the Bootstrap algorithm, have been validated and are generally in good agreement, there are areas where the ice concentrations differ, by up to 30%. These differences can be explained by shortcomings in one or the other algorithm. Here, we present an algorithm which, in addition to the 19 and 37 GHz channels used by both the Bootstrap and NASA Team algorithms, makes use of the 85 GHz channels as well. Atmospheric effects particularly at 85 GHz are reduced by using a forward atmospheric radiative transfer model. Comparisons with the NASA Team and Bootstrap algorithm show that the individual shortcomings of these algorithms are not apparent in this new approach. The results further show better quantitative agreement with ice concentrations derived from NOAA AVHRR infrared data.
Author
Algorithms; Sea Ice; Satellite Instruments; Infrared Radiation; Atmospheric Models

19990041500 NASA Langley Research Center, Hampton, VA USA

Intelligent Agents and Their Potential for Future Design and Synthesis Environment

Noor, Ahmed K., Compiler, Virginia Univ., USA; Malone, John B., Compiler, NASA Langley Research Center, USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999; 295p; In English, 16-17 Sep. 1998, Hampton, VA, USA; Sponsored by NASA, USA; See also 19990041501 through 19990041514

Contract(s)/Grant(s): RTOP 282-10-01-42

Report No.(s): NASA/CP-1999-208986; L-17802; NAS 1.55:208986; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This document contains the proceedings of the Workshop on Intelligent Agents and Their Potential for Future Design and Synthesis Environment, held at NASA Langley Research Center, Hampton, VA, September 16-17, 1998. The workshop was jointly sponsored by the University of Virginia's Center for Advanced Computational Technology and NASA. Workshop attendees came from NASA, industry and universities. The objectives of the workshop were to assess the status of intelligent agents technology and to identify the potential of software agents for use in future design and synthesis environment. The presentations covered the current status of agent technology and several applications of intelligent software agents. Certain materials and products are identified in this publication in order to specify adequately the materials and products that were investigated in the research effort. In no case does such identification imply recommendation or endorsement of products by NASA, nor does it imply that the materials and products are the only ones or the best ones available for this purpose. In many cases equivalent materials and products are available and would probably produce equivalent results.

Author

Conferences; Software Engineering; Systems Engineering; Self Organizing Systems; Adaptive Control

19990041501 Virginia Univ., Center for Advanced Computational Technology, Hampton, VA USA

Overview of Intelligent Software Agents

Noor, Ahmed K., Virginia Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 1-20; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation introduces the concept of the intelligent software agent. The agent is defined as hardware, software, or human which independently perform tasks on the part of their contracting party (or user) for which specialized knowledge is needed or which consist of many time-intensive steps. The software agent acts on behalf of people, takes initiatives, and makes suggestions. Some of the characteristics of the software agent are: reactive, autonomous, proactive, adaptive, inferentially capable, mobile communicative, and collaborative. The development of agent technology is strongly influenced by Artificial Intelligence, control theory and cybernetics, and cognitive psychology. Intelligent agents can further be described in terms of the space, defined by the three dimensions of agency, intelligence and mobility. Three categories are used in developing agent applications: languages, ontologies and support computing technologies. Software agents are classified by three schemes. The first one is based on the attributes exhibited by the agent. The second uses three criteria: Intelligence, mobility, and number of agents. The third classification is based on the particular applications for which the agent is used. The evolution and use of intelligent software agents in a variety of disciplines is described. These disciplines are : (1) Human computer interfaces, (2) Learning technology, (3) information retrieval and filtering. (4) Computer assisted design and Computer Assisted Engineering systems. Some future directions for the development and use of intelligent agents are suggested.

CASI

Artificial Intelligence; Cognitive Psychology; Cybernetics; Computer Systems Design; Cognition; Knowledge Based Systems; Control Theory

19990041502 George Mason Univ., Center for Information Systems Integration and Evolution, Fairfax, VA USA

The Role of Intelligent Agents in Advanced Information Systems

Kerschberg, Larry, George Mason Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 21-38; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this presentation we review the current ongoing research within George Mason University's (GMU) Center for Information Systems Integration and Evolution (CISE). We define characteristics of advanced information systems, discuss a family of agents for such systems, and show how GMU's Domain modeling tools and techniques can be used to define a product line Architecture for configuring NASA missions. These concepts can be used to define Advanced Engineering Environments such as those envisioned for NASA's new initiative for intelligent design and synthesis environments.

Derived from text

Information Systems; Systems Integration; Artificial Intelligence; Information Retrieval; Information Management; Knowledge Based Systems; Systems Engineering

19990041503 Memphis Univ., Conscious Software Research Group, Memphis, TN USA

"Conscious" Software Agents

Franklin, Stanley, Memphis Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 39-61; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The concept or a conscious software agent is developed from the notions of autonomous and cognitive agents. An autonomous agent is a system which is situated within and as a part of an environment, that senses that environment and acts on it, over time in pursuit of its own agenda, so as to effect what it senses in the future. A cognitive agent is an agent which has most of these features: Multiple senses, attention, multiple drives, conceptualization, memory-beliefs, learning, emotions, action selection multiple coordinated actions. Important to the concept of the conscious software agent, is the idea of Global workspace theory. The single most important contribution of global workspace theory is the idea of broadcasting the contents of consciousness in order to recruit relevant processors to help deal with whatever is new or problematic in the current situation. Anything else can be dealt with subconsciously. The Conscious Mattie (CMattie) is the first implementation of the Global workspace theory. The CMattie will carry out tasks autonomously and correspond in natural language with seminar organizers and participants via email. The different modules and mechanisms of CMattie are described as well as the architecture.

CASI

Architecture (Computers); Autonomy; Consciousness; Adaptive Control; Artificial Intelligence; Computer Programs; Electronic Mail

19990041506 International Business Machines Corp., Knowledge Management and Intelligent Agent Services, Research Triangle Park, NC USA

Some Standards Activity in Agent-Based Learning and Virtual Consultation for Manufacturing

Aparicio, Manuel, IV, International Business Machines Corp., USA; Huang, Yen-Min, International Business Machines Corp., USA; Fleming, James, International Business Machines Corp., USA; Singh, Munindar, North Carolina State Univ., USA; Arliey, Dan, Massachusetts Inst. of Tech., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 105-128; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation represents several interests in intelligent agents. First, it will introduce one of IBM's primary commercial initiatives in intelligent agents. The market is still emerging and is a hard market, but agent technology is providing real value. IBM provides such technology through our Knowledge Management and Intelligent Agent Services. Second, we are providing the agent technology within the SMART consortium, focused on advanced manufacturing, particularly for lower MES and the make-side of supply-chains. Third, we are active in several international, multi-organizational agent organizations. FIPA is becoming the de facto and de jur standards body for agents, while the Agent Society is a trade organization and excellent Web site for more information. Following these interests, the presentation agenda will introduce each. Agent-based learning will be a primary theme, not only because of our work, but because all the other presentations so far have mentioned agent learning, which I would like to emphasize. First, our services work this year has concentrated on MemoryAgent, which includes the core learning technology as well as a collaborative model for organizational knowledge management. At a deeper technical level, I will also introduce a list of requirements for agent-based learning. In the SMART consortium, we have applied MemoryAgent to semiotic sequences and activity-resource assignment, and are now looking at collaborative planning. For interoperation of MemoryAgent with other agents, we are working with other members of FIPA on human-interaction, user personalization, and learning services. Author

Artificial Intelligence; Machine Learning; Cybernetics; Automatic Control

19990041507 NASA Ames Research Center, Moffett Field, CA USA

Intelligent Agents for Design and Synthesis Environments: My Summary

Norvig, Peter, NASA Ames Research Center, USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 129-138; In English; See also 19990041500; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This presentation gives a summary of intelligent agents for design synthesis environments. We'll start with the conclusions, and work backwards to justify them. First, an important assumption is that agents (whatever they are) are good for software engineering. This is especially true for software that operates in an uncertain, changing environment. The "real world" of physical artifacts is like that: uncertain in what we can measure, changing in that things are always breaking down, and we must interact with non-software entities. The second point is that software engineering techniques can contribute to good design. There may have been a time when we wanted to build simple artifacts containing little or no software. But modern aircraft and spacecraft are complex, and rely on a great deal of software. So better software engineering leads to better designed artifacts, especially when we are designing a series of related artifacts and can amortize the costs of software development. The third point is that agents

are especially useful for design tasks, above and beyond their general usefulness for software engineering, and the usefulness of software engineering to design.
Author
Software Engineering; Software Development Tools; Computer Systems Design

19990041508 Worcester Polytechnic Inst., Artificial Intelligence in Design Group, MA USA
Improving Design With Agents, or, Improving Agents by Design
Brown, David C., Worcester Polytechnic Inst., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 139-167; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation addresses multi-agent implementation of the design and synthesis environment. The multi-agent will need to learn. The nature of the design problem affects the use of agents for constructing an environment for the design of future systems.
CASI
Design Analysis; Systems Engineering; Machine Learning; Artificial Intelligence; Adaptive Control; Cybernetics

19990041509 Lockheed Martin Missiles and Space, Palo Alto, CA USA
Developing CORBA-Based Information Agents
Dabke, Padmanabh, Lockheed Martin Missiles and Space, USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 169-187; In English; See also 19990041500
Contract(s)/Grant(s): MDA972-95-D-0003; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Current Simulation Based Design (SBD) program objective is to create a domain independent information infrastructure for collaborative development of complex engineering products. SBD adopts a component based approach towards enterprise integration. In this approach, legacy systems are encapsulated as components which are software objects with well defined interfaces for remote communication. Using these legacy systems components, the tools are provided to assist users to create Common Object Request Broker Agreement (CORBA) based components. SBD provides uniform and integrated access to components and provides ”glueware” services in the workflow automation, event management, that link enterprise components. The SBD design contains three levels. The two outside layers are an interface level base service. The third layer contains information agents which provide a well defined information management function which can interpret a task specific communication.
CASI
Information Management; Product Development; Software Reuse; Systems Engineering; Systems Analysis

19990041510 Delaware Univ., Dept. of Computer and Information Sciences, Newark, DE USA
Coordinating Intelligent Agents
Decker, Keith S., Delaware Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 189-214; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The research program is involved in developing intelligent software agents, which can operate in environments where there is uncertainty and deadlines. The research program is divided into three areas: (1) How to formally represent and reason about these sorts of problems; (2) we actually build software and tools for building agents; (3) understanding, modeling and imitating the human organizational structure, in the context of software agents. An important problem is that of coordinating computational actions. The problem of coordinating activities falls into three general areas: (1) choosing alternatives, (2) ordering and (3) locating actions in time with respect to the order. This problem is compounded by the fact that no one agent will have a complete view of the problem being solved. The representation of the coordination problem is accomplished using Task Analysis and Environment Modeling System (TAEMS), which is a language used to formally define what the task structure is. After the representation of the task, the Generalized Partial Global Planning (GPGP) approach provides a planner or plan retriever to create task structures that attempt to achieve agent goals, and a scheduler that attempts to maximize utility via the choice and temporal location of basic actions in the task structure.
CASI
Computer Programs; Coordination; Real Time Operation; Scheduling; Systems Engineering; System Identification

19990041511 South Carolina Univ., Center for Information Technology, Columbia, SC USA
Multiagent-Oriented Programming
Huhns, Michael N., South Carolina Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 215-238; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation describes a new approach to the production of robust software. The approach is motivated by explaining why the two major goals of software engineering-correct software and reUSAble software-are not being addressed by the current state of software practice. A methodology based on active, cooperative, and persistent software components, i.e., agents, and how the methodology enables robust and reUSAble software to be produced is described. Requirements are derived for the structure and behavior of the agents, and a methodology is described that satisfies the requirements. The presentation concludes with examples of the use of the methodology and ruminations about a new computational paradigm.
Author
Computer Programming; Software Engineering; Artificial Intelligence; Software Reliability

19990041592 California Univ., Lawrence Berkeley Lab., Earth Sciences Div., Berkeley, CA USA
ITOUGH2 V3.2 verification and validation report
Finsterle, S.; Jun. 30, 1998; 59p; In English
Report No.(s): DE98-058304; LBNL-42002; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes the Verification and Validation (V and V) test cases performed to qualify ITOUGH2 V3.2. ITOUGH2 V3.2 was installed in a directory approximately/itough2v3.2 on a SUN ULTRA 1 workstation under UNIX Solaris 2. Instructions for installing ITOUGH2 can be found in file read.me and the user's manual. This report is structured as follows: for each functional requirement, the corresponding design is described, which may include the mathematical model implemented in ITOUGH2 V3.2, if appropriate. Next, the author discusses the test case or sequence of test cases performed to validate each requirement, followed by a description of the test results and their compliance with the acceptance criteria. ITOUGH2 simulates fluid flow in fractures.
NTIS
Proving; Computer Programs

19990041710 Los Alamos National Lab., NM USA
Factorizing monolithic applications
Hall, J. H.; Ankeny, L. A.; Clancy, S. P.; Dec. 31, 1998; 9p; In English; ISCOPE '98: international symposium on computing in object oriented parallel environments
Report No.(s): DE99-000752; LA-UR-98-2141; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Blanca project is part of the US Department of Energy's (DOE) Accelerated Strategic Computing Initiative (ASCI), which focuses on Science- Based Stockpile Stewardship through the large-scale simulation of multi-physics, multi-dimensional problems. Blanca is the only Los Alamos National Laboratory (LANL)-based ASCI project that is written entirely in C++. Tecolote, a new framework used in developing Blanca physics codes, provides an infrastructure for gluing together any number of components; this framework is then used to create applications that encompass a wide variety of physics models, numerical solution options, and underlying data storage schemes. The advantage of this approach is that only the essential components for the given model need be activated at runtime. Tecolote has been designed for code re-use and to isolate the computer science mechanics from the physics aspects as much as possible -- to the underlying physics equations that govern the computational physics. This paper describes the advantages of component architectures and contrasts the Tecolote framework with Microsoft's OLE and Apple's OpenDoc. An actual factorization of a traditional monolithic application into its basic components is also described.
NTIS
Factorization; Architecture (Computers)

19990041743 Naval Postgraduate School, Monterey, CA USA
Implementation of a Portable PSDL EDitor for the Heterogeneous Systems Integrator
Duranlioglu, Ilker; Mar. 1999; 305p; In English
Report No.(s): AD-A361985; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
The Computer Aided Prototyping System (CAPS) is an integrated set of tools that is used for rapid prototyping of real time systems. Prototype System Description Language (PSDL) is the prototyping language that captures the requirements and produces executable prototypes. Prototypes can be created by using specially designed PSDL Editor, which can automatically generate PSDL code from data flow graphs. The Heterogeneous Systems Integrator (HSI) is an extension to CAPS, designed to automate the process of integrating complex distributed systems, where the subsystems can reside on different locations, be implemented in different hardware, operating systems and programming languages. It is envisioned that the HSI will be a distributed system itself. Users at remote sites need not install the entire HSI system, but only the User Interface for entering the PSDL specification of the target systems. This research is the first step in the evolution of HSI. The focus is to create a portable user interface, which can be used in any environment (hardware and operating system). We have designed and implemented a platform independent llSI user interface using the Java programming language. The functionalities of CAPS Release 2.0 PSDL Editor are mainly

preserved in this implementation with a few added features. The new editor shows significant improvement in performance and user friendliness over the previous
DTIC
Computer Programs; Prototypes; Complex Systems; Computer Techniques; Information Flow

19990041816 Naval Postgraduate School, Monterey, CA USA
Exploring the Human Computer Interface and Photic Driving
Peterman, Robert B.; Mar. 1999; 107p; In English
Report No.(s): AD-A362006; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The application of a stroboscopic light within a certain frequency range may cause a subject's brain waves to follow or become entrained to the same frequency as the flashing light. This phenomenon is known as photic driving. The objective of this study is to determine if computer monitors can be used as the presentation medium for photic driving, and to investigate whether any measurable cognitive changes can be caused through this photic driving. In the software design, two Java applets were written which caused the flashing of the screen in both a regular, set frequency and at a random frequency. A webpage was developed as a container for a subset of the Kit of Factor-Referenced Cognitive Tests. An empirical study was performed utilizing a light/sound machine, the Java applets as well as the cognitive tests. Twenty-five subjects were divided into three sample groups and their performance during all phases of the study were recorded and analyzed. Analyses of the results indicate that no direct correlation between photic driving and test score can be proved. Subjects' comments following their participation indicate however that there were some significant effects caused by the photic driving that were not reflected in the test scores.
DTIC
Software Engineering; Human-Computer Interface; Java (Programming Language)

19990041823 Ohio Univ., Dept. of Electrical and Computer Engineering, Athens, OH USA
Automate Information Extraction from Scan Data ***Final Report, 1 Nov. 1997 - 1 Nov. 1998***
Nurre, Joseph H.; Nov. 18, 1998; 43p; In English
Contract(s)/Grant(s): SPO100-95-D-1014
Report No.(s): AD-A362095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The DDFU-T2-P5 Short Term Project is a continuation of the DDFU-T2-P3 Short Term Project. The goal of the two projects is the automated extraction of apparel measurements from scan data. The development of algorithms for three dimensional data analysis and processing proceeded to a new phase. The algorithms were field tested at the Marine Corps Recruit Depot in San Diego (MCRD-SD), in cooperation with the Cal Poly-Pomona Demo and the USMC. This required that robustness be added to the algorithms, where necessary. A new suite of software tools was also developed to manage the scan data. Furthermore, Ohio University provided technical support and man-power for the body scanning experiment. A CD is included with this report that presents the project's results in a PowerPoint presentation. Source code, for methods developed or refined, were released to Cyberware Inc.
DTIC
Software Engineering; Dimensional Analysis; Extraction; Refining; Pattern Recognition

19990041831 Metrica, Inc., San Antonio, TX USA
CBT Data /Knowledge Acquisition: Using Knowledge Objects to Prototype Courseware
Muraida, Daniel J.; Grimes, Gary R.; Wilen, Saul B.; Jan. 1998; 7p; In English; Prepared in collaboration with International Horizons Unlimited, San Antonio, TX and Medical Horizons Unlimited, San Antonio, TX.
Report No.(s): AD-A362149; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One of the major factors underlying the considerable initial costs of CBT development is the time required of specialists: Programmers, instructional designers, authors, and subject matter experts (SMEs). The SME occupies a pivotal role in the success or failure of any instructional design project. Ideally the SME can save the developers vital production time when he or she provides them annotated or structured documentation that shows how concepts and skills fit together in a given piece of curriculum. Although knowledge acquisition has long been recognized as a linchpin process in the development of courseware, the process for collecting the vital content data has been based primarily on unstructured interviews and focus groups which often result in unclearly specified or misspecified requirements. The following is an approach to knowledge acquisition that will reduce the time required of an SME, while making that time spent more focused and useful for the production process. Knowledge acquisition as conceptualized here is based on instructional design research that has successfully used an object-oriented view of the design process. The subject matter knowledge of an SME is viewed as structured content that can be organized into a pedagogical structure, that will translate into instructional delivery decisions. Knowledge acquisition is further viewed as an early step in an iterative

instructional design process that minimizes risk for the designers as well as the client. We find that a courseware engineering model that emphasizes rapid prototyping is most compatible with our views of the instructional design process as inherently iterative.
DTIC
Knowledge Based Systems; Object-Oriented Programming

19990041876 Los Alamos National Lab., NM USA
Computational study of routing algorithms for realistic transportation networks
Jacob, R.; Marathe, M. V.; Nagel, K.; Dec. 31, 1998; 21p; In English; 2nd; Workshop on algorithmic engineering
Report No.(s): DE99-001071; LA-UR-98-2249; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors carry out an experimental analysis of a number of shortest path (routing) algorithms investigated in the context of the TRANSIMS (Transportation Analysis and Simulation System) project. The main focus of the paper is to study how various heuristic and exact solutions, associated data structures affected the computational performance of the software developed especially for realistic transportation networks. For this purpose the authors have used Dallas Fort-Worth road network with very high degree of resolution. The following general results are obtained: (1) they discuss and experimentally analyze various one-one shortest path algorithms, which include classical exact algorithms studied in the literature as well as heuristic solutions that are designed to take into account the geometric structure of the input instances; (2) they describe a number of extensions to the basic shortest path algorithm. These extensions were primarily motivated by practical problems arising in TRANSIMS and ITS (Intelligent Transportation Systems) related technologies. Extensions discussed include--(i) time dependent networks, (ii) multi-modal networks, (iii) networks with public transportation and associated schedules. Computational results are provided to empirically compare the efficiency of various algorithms. The studies indicate that a modified Dijkstra's algorithm is computationally fast and an excellent candidate for use in various transportation planning applications as well as ITS related technologies.
NTIS
Algorithms; Transportation Networks; Computer Programs

19990041935 NASA Ames Research Center, Moffett Field, CA USA
The Science of Computing: Expert Systems
Denning, Peter J., NASA Ames Research Center, USA; American Scientist; January-February 1986; Volume 74, No. 1, pp. 18-20; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The creative urge of human beings is coupled with tremendous reverence for logic. The idea that the ability to reason logically--to be rational--is closely tied to intelligence was clear in the writings of Plato. The search for greater understanding of human intelligence led to the development of mathematical logic, the study of methods of proving the truth of statements by manipulating the symbols in which they are written without regard to the meanings of those symbols. by the nineteenth century a search was under way for a universal system of logic, one capable of proving anything provable in any other system.
Derived from text
Intelligence; Creativity; Expert Systems; Artificial Intelligence

19990041955 NASA Marshall Space Flight Center, Huntsville, AL USA
Variable Structure PID Control to Prevent Integrator Windup
Hall, C. E., NASA Marshall Space Flight Center, USA; Hodel, A. S., Auburn Univ., USA; Hung, J. Y., Auburn Univ., USA; 1999; 5p; In English; System Theory (SSST 99), 21-23 Mar. 1999, Auburn, AL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

PID controllers are frequently used to control systems requiring zero steady-state error while maintaining requirements for settling time and robustness (gain/phase margins). PID controllers suffer significant loss of performance due to short-term integrator wind-up when used in systems with actuator saturation. We examine several existing and proposed methods for the prevention of integrator wind-up in both continuous and discrete time implementations.
Derived from text
Controllers; Integrators; Control Theory; Feedback Control; Feedforward Control

19990041968 Naval Postgraduate School, Monterey, CA USA
Methodology and Design of Adaptive Agent-Based Simulation Architectures for Bamboo or Visual C++
Boyd, Mark A.; Gagnon, Todd A.; Mar. 1999; 109p; In English
Report No.(s): AD-A361593; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Zero-sum budgeting, downsizing, and increased mission requirements make it more challenging for U.S. Navy leaders to understand the short and long-term consequences of their decisions. An enterprise model of the Navy could provide decision-mak-

ers with a tool to study how their decisions might affect the Navy's ability to conduct worldwide operations. Agent- based simulation technology provides a flexible platform to model the complex relationships between the Navy's many components. Agent-based modeling uses software agents to define each relevant entity of the system. These agents have the ability to interact with their environment and learn or adapt their behaviors while trying to achieve their goals. The aggregate of these interactions results in identifiable behavior patterns known as emergent behaviors. This thesis looks at two methods of designing the underlying architecture for a simple agent-based simulation. A classic predator-prey relationship is modeled using a Windows/C++ implementation and a dynamically extensible Bamboo implementation. While the Windows/C++ implementation is straightforward, it requires definition of all agents before run-time. Bamboo is more challenging to implement, but allows the introduction of agents "on-the-fly", and can easily be extended for distributed implementation. Both appear to be viable implementation architectures for an enterprise model of the Navy.
DTIC
Computer Programs; Models; Systems Simulation

19990042102 Lockheed Martin Corp., Syracuse, NY USA
Embedded and Real-Time Application of High-Performance Scalable Computing ***Final Report, Sep. 1995 - Sep. 1998***
Hamlet, Ronald E.; Feb. 1999; 55p; In English
Contract(s)/Grant(s): ARPA ORDER-D354; Proj-D002
Report No.(s): AD-A361839; AFRL-IF-RS-TR-1999-31; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Pre and Post Doppler Space-Time Adaptive Processing (STAP) architectures were considered for target implementations based on embedded High Performance Scalable Computing (HPSC) architectures leveraging commercially available processing technology from Analog Devices Super Harvard Architecture (SHARC) Digital Signal Processor (DSP). Algorithm partitioning and mapping was performed that demonstrated initial feasibility and then a sizing study was performed for a theoretical implementation. Further modeling and simulation studies utilized a discrete event simulator to perform detailed timing analysis and three different mappings of the Recursive Modified Gram Schmidt with Error Feedback (RMGSEF) algorithm in order to obtain insight into processor communication utilization and data latency. This effort culminated in a real time Radar demonstration of the RMGSEF algorithm that was implemented using parallel SHARC processors based on the High Performance Scalable Computer (HPSC) to perform the QR Decomposition (QRD). The demonstration Radar System incorporated 18 antenna elements over three pulse repetition intervals resulting in 34 degrees of freedom with performance of less than 15 ms of latency and a 42KHz sample rate. Further studies concentrated on alternative STAP solutions based on evolving Motorola PowerPC's and Field Programmable Gate Arrays (FPGAs).
DTIC
Embedding; Real Time Operation; Doppler Radar; Parallel Processing (Computers); Architecture (Computers)

19990042185 Stanford Univ., Stanford, CA USA
HOOTS II Second Workshop on Higher-Order Operational Techniques in Semantics. Volume 10 ***Final Report, 30 Sep. 1997 - 30 Sep. 1998***
Gordon, Andrew; Pitts, Andrew; Talcott, Carolyn; Dec. 12, 1997; 311p; In English
Contract(s)/Grant(s): N00014-98-1-0201
Report No.(s): AD-A361649; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This issue of ENTCS is an unrefereed conference record of talks presented at the Second Workshop on Higher Order Operational Techniques in Semantics held at Stanford University, December 8-11, 1997. The meeting was organized by A. Gordon, A. Pitts and C. Talcott with generous sponsorship from Harlequin Ltd, NSF and ONR. The study of operational techniques for higher-order languages has much research activity going on in distinct communities, including the concurrency, functional programming and type theory communities. The purpose of the workshop was to bring researchers from these communities together to discuss current trends in the theory of operational semantics, its application to higher-order languages and its connection with more established semantic techniques.
DTIC
Computer Programming; High Level Languages; Semantics

19990042187 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Analysis of USAF Battlelabs' Communication Infrastructure Over Various Protocols
Favorito, Rocky A.; McIllece, David M.; Mar. 1999; 139p; In English
Report No.(s): AD-A361644; AFIT/GCS/ENG/99M-04; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

As a result of the doctrines exposed in the Air Force's "Global Engagement: A Vision for the 21st Century Air Force," the concept of a "Battlelab" was devised to support and develop the key warfighting capabilities needed in the next century. Although geographically separated, these labs must have the capability to exchange information with each other in a "Virtual Battlelab Environment" (VBE). Although many types of data will be exchanged, only variable-bit-rate (VBR) video and distributed interactive simulation (DIS) traffic are modeled in the VBE. The research described in this thesis utilizes a systems engineering approach to investigate the performance of wide-area networking technologies and recommend a connectivity solution. Three networking protocols were considered: Native ATM, IP over ATM, and LAN Emulation. In addition, three analyses were performed: performance-weighted, evenly-weighted, and cost-weighted. Native ATM was the recommended solution for the performance-weighted analysis. IP over ATM was recommended for the cost-weighted and evenly-weighted analyses, although by only slight margins over LANE. Finally, the merit of a systems engineering approach to assist in tradeoff and decision making analyses was also demonstrated.
DTIC
Systems Engineering; Distributed Interactive Simulation; Local Area Networks

19990042214 Alabama Univ., Research Inst., Huntsville, AL USA
Experimental Internet Environment Software Development ***Final Report, 14 Jun. 1996 - 31 Mar. 1997***
Maddux, Gary A., Alabama Univ., USA; September 1998; 10p; In English
Contract(s)/Grant(s): NAS8-38609
Report No.(s): NASA/CR-1999-208191; NAS 1.26:208191; TR-5-34474; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Geographically distributed project teams need an Internet based collaborative work environment or "Intranet." The Virtual Research Center (VRC) is an experimental Intranet server that combines several services such as desktop conferencing, file archives, on-line publishing, and security. Using the World Wide Web (WWW) as a shared space paradigm, the Graphical User Interface (GUI) presents users with images of a lunar colony. Each project has a wing of the colony and each wing has a conference room, library, laboratory, and mail station. In FY95, the VRC development team proved the feasibility of this shared space concept by building a prototype using a Netscape commerce server and several public domain programs. Successful demonstrations of the prototype resulted in approval for a second phase. Phase 2, documented by this report, will produce a seamlessly integrated environment by introducing new technologies such as Java and Adobe Web Links to replace less efficient interface software.
Derived from text
Internets; On-Line Systems; World Wide Web; Graphical User Interface; Java (Programming Language)

19990042307 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
A Model of Joint Software Reviews
Kingston, Gina, Defence Science and Technology Organisation, Australia; October 1998; 44p; In English
Report No.(s): DSTO-TR-0735; DODA-AR-010-661; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury South Austrialia), Hardcopy, Microfiche

Joint software reviews, involving the developer and the acquirer, play an important role in Defence's acquisition of software-intensive systems. However, academic and commerical work on software reviews has focused on intra-organizational peer reviews and software inspections. This report argues that the principles which have been derived for inspections cannot be blindly applied to joint software reviews. This paper proposes a model of joint reviews, which draws on software engineering, decision and negotiation theory, and models of inspection. The model suggests that the structure and goals of the review group may significantly affect the outcome of the review. The model has also been used to suggest changes to Defence's software review process and to plan a series of studies on joint software reviews. These studies will provide additional and updated recommendations on how Defence should structure their software reviews for maximum efficiency and effectiveness.
Author
Computer Programming; Inspection; Models

19990042315 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Insirius: Intelligent Interface in Natural Language to the Sirius System ***Insirius: Interface Inteligente em Linguagem Natural Para o Sistema Sirius***
Rodrigues, Flavia Beatriz Vasconcellos, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 96p; In Portuguese
Report No.(s): INPE-6833-TDI/646; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This dissertation describes the development of a natural language intelligent interface for the bibliographical research and retrieval system, the SIRIUS, for the library of the Instituto Nacional de Pesquisas Epacias (INPE.) The interface translates a query

formulated in natural language into a command accepted by the SIRIUS system. This occurs when the interface understands the query. The idiom used by the interface is Portuguese from Brazil in its written form. The interface parses the user's sentence for syntax and semantics. There is a knowledge base which can be increased with the interactions with the user. A dialog with the user will be established whenever the interface does not understand the sentence. The purpose of this dialog is to capture the intention of the user. The thesis uses some Artificial Intelligence and Computational Linguistics concepts. It also uses frames and production rules to represent the knowledge within the prototype system.
Author (revised)
Artificial Intelligence; Libraries; Query Languages; Knowledge Based Systems; Information Retrieval; Human-Computer Interface; Natural Language Processing

19990042320 NASA Goddard Space Flight Center, Greenbelt, MD USA
Incorporating Manual and Autonomous Code Generation
McComas, David, NASA Goddard Space Flight Center, USA; Embedded Systems Programming; Sep. 1998; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Code can be generated manually or using code-generated software tools, but how do you interpret the two? This article looks at a design methodology that combines object-oriented design with autonomic code generation for attitude control flight software. Recent improvements in space flight computers are allowing software engineers to spend more time engineering the applications software. The application developed was the attitude control flight software for an astronomical satellite called the Microwave Anisotropy Probe (MAP). The MAP flight system is being designed, developed, and integrated at NASA's Goddard Space Flight Center. The MAP controls engineers are using Integrated Systems Inc.'s MATRIXx for their controls analysis. In addition to providing a graphical analysis for an environment, MATRIXx includes an autonomic code generation facility called AutoCode. This article examines the forces that shaped the final design and describes three highlights of the design process: (1) Defining the manual to autonomic code interface; (2) Applying object-oriented design to the manual flight code; (3) Implementing the object-oriented design in C.
Derived from text
Applications Programs (Computers); Object-Oriented Programming; Software Development Tools; Autocoders; Computer Systems Design; Satellite Attitude Control

62
COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990041498 Florida Univ., Dept. of Computer and Information Sciences, Gainesville, FL USA
An Agent-Based Approach to Extending the Native Active Capability of Relational Data Base Systems ***Final Report, Sep. 1997 - 1998***
Chakravarthy, S.; Li, L.; Feb. 1999; 30p; In English
Contract(s)/Grant(s): F30602-97-C-0306; AF Proj. R472
Report No.(s): AD-A362008; AFRL-IF-RS-TR-1999-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Event-condition-action (or ECA) rules are used to capture active capability. While a number of research prototvpes of active database systems have been built, ECA rule capability in Relational DBMSs is still very limited. In this report, we address the problem of turning a traditional database management system into a full-fledged active database system without changing the underlying system. The advantages of this approach are: transparency; ability to add active capability without changing the client programs; retain relational DBMS's underlying functionality; and persistence of ECA rules using the native database functionality. This report describes how complete active database semantics can be supported on an existing SQL Server (Sybase, in our case) by adding a mediator, termed ECA Agent, between the SQL Server and the clients. ECA rules are fully supported through the ECA agent without changing applications or the SQL Server. Composite events are detected in the ECA Agent and actions are invoked in the SQL Server. Events are persisted in the native database system. ECA Agent is designed to connect to SQL Server by using Sybase connectivity products. The architecture, design, and implementation details are presented.
DTIC
Data Base Management Systems; Data Systems; Relational Data Bases; Knowledge Based Systems; Computer Programs

19990041505 Maryland Univ. Baltimore County, Dept. of Computer Science and Electrical Engineering, Catonsville, MD USA
MultiAgent Systems, WWW and Networked Scientific Computing
Joshi, Anupam, Maryland Univ. Baltimore County, USA; Rice, John R., Purdue Univ., USA; Houstis, Elias N., Purdue Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 83-104; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation is about the multidisciplinary problem solving environments. A problem solving environment (PSE) is a computer system that provides all computational facilities needed to solve a target class of problems. A multidisciplinary problem solving environment is a framework and a software kernel for combining PSE's for tailored multidisciplinary applications. Or an MPSE is a software system solving a problem viewed by the user as complex, composite, and consisting of a number of smaller, distinct subproblems, each of which is solved by a relatively independent software bearing the features of a PSE.
CASI
Kernel Functions; Problem Solving; Systems Engineering; Computer Systems Programs; Computer Programming

19990041513 Maryland Univ., Computer Science Dept., College Park, MD USA
KR for the World Wide Web
Hendler, James, Maryland Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 263-287; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

One of the most exciting changes in computing in the past decade has been the introduction of the world wide web and the internationally expanding internet, making enormous amounts of information available to users regardless of location. This access, however, has created information management problems beyond the capabilities of most systems. AI systems, combining intelligent agent technologies with large knowledge bases, have long been proposed as a leading contender for dealing with searching, managing, and filtering this wealth of knowledge. In this talk, we look at some work aimed at bridging the gap between Al and databases, and the use of this research in support of world wide web applications. In particular, we describe the SHOE language, an ontology mark-up language for web documents. We show how SHOE is being used to support an emerging community-wide web management and search tool for researchers in microbiological epidemiology (particularly concerning documents on "transmissible spongiform encephalopathies," such as the well-known "mad cow disease"). Also described is the Parka-DB system, a combination of AI and database technologies which allows for collection of SHOE data into knowledge bases that can be browsed or queried by users.
Author
World Wide Web; Hierarchies; Knowledge Representation; Information Management; Artificial Intelligence

19990041514 Massachusetts Inst. of Tech., Media Lab., Cambridge, MA USA
Why Surf Alone? Exploring the Web With Reconnaissance Agents
Lieberman, Henry, Massachusetts Inst. of Tech., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 289-301; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation discusses Letizia, an autonomous interface agent for web browsing. Letizia attempts to try to anticipate what is behind the link returned from a search or a browse action. Letizia attempts to infer user intent from the browsing behavior. Using other clues, such as link selection, dwell time, mailing, downloading, Letizia attempts to discern the user intent.
CASI
World Wide Web; Searching; Information Retrieval; Precision; Self Organizing Systems

19990041599 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Bureau of the Public Debt: Areas for Improvement in Computer Controls
Oct. 1998; 18p; In English
Report No.(s): PB99-136731; GAO/AIMD-99-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses general and application controls that support key automated financial systems maintained and operated by BPD. These systems process investments and redemptions of Treasury securities, generate interest payments, account for the resulting debt, and provide financial reports to the public and the federal government.
NTIS
Congressional Reports; Automatic Control; Computer Systems Programs

19990041665 Los Alamos National Lab., NM USA

Dependence driven execution for multiprogrammed multiprocessor

Vajracharya, S.; Grunwald, D.; Dec. 31, 1998; 10p; In English; International super computing, USA

Report No.(s): DE99-000612; LA-UR-98-1350; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Barrier synchronizations can be very expensive on multiprogramming environment because no process can go past a barrier until all the processes have arrived. If a process participating at a barrier is swapped out by the operating system, the rest of participating processes end up waiting for the swapped-out process. This paper presents a compile-time/run-time system that uses a dependence-driven execution to overlap the execution of computations separated by barriers so that the processes do not spend most of the time idling at the synchronization point.

NTIS

Multiprocessing (Computers); Multiprogramming

19990041772 Lawrence Livermore National Lab., Livermore, CA USA

Expanding symmetric multiprocessor capability through gang scheduling

Jette, M. A.; Mar. 01, 1998; 19p; In English; Parallel processing symposium/parallel and distributed processing

Report No.(s): DE98-057706; UCRL-JC-129927; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Symmetric Multiprocessor (SMP) systems normally provide both space-sharing and time-sharing to insure high system utilization and good responsiveness. However the prevailing lack of concurrent scheduling for parallel programs precludes SMP use in addressing many large-scale problems. Tightly synchronized communications are impractical and normal time-sharing reduces the benefit of cache memory. Evidence gathered at Lawrence Livermore National Laboratory (LLNL) indicates that gang scheduling can increase the capability of SMP systems and parallel program performance without adverse impact upon system utilization or responsiveness.

NTIS

Multiprocessing (Computers); Scheduling

19990041787 Lawrence Livermore National Lab., Livermore, CA USA

Zephyr: A secure Internet process to streamline engineering

Jordan, C. W.; Niven, W. A.; Cavitt, R. E.; May 12, 1998; 47p; In English; Commerce at light speed (CALS) expo international 21st century commerce 1998

Report No.(s): DE98-058325; UCRL-JC-130755; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lawrence Livermore National Laboratory (LLNL) is implementing an Internet- based process pilot called 'Zephyr' to streamline engineering and commerce using the Internet. Major benefits have accrued by using Zephyr in facilitating industrial collaboration, speeding the engineering development cycle, reducing procurement time, and lowering overall costs. Programs at LLNL are potentializing the efficiencies introduced since implementing Zephyr. Zephyr's pilot functionality is undergoing full integration with Business Systems, Finance, and Vendors to support major programs at the Laboratory.

NTIS

Internets; Commerce; Product Development

19990041826 Naval Postgraduate School, Monterey, CA USA

Planning Considerations for Secure Network Protocols

Barlow, Philip R.; Mar. 1999; 151p; In English

Report No.(s): AD-A361958; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An attempt is made to provide the reader with an appreciation for incorporating basic security services within a network protocol (e.g., multicast). Security incorporated within a network design is an increasingly common requirement that users are levying upon network implementations (military and commercial). Network security implementations evoke a myriad of abstractions, technologies and other related issues that can overpower a reader and cloud the topic with details. This thesis is intended to assist readers achieve an overview and background of the varied subject matter network security implementation necessitates. Essential services are introduced and discussed to provide an understanding of what constitutes an adequate and efficient security implementation. Related infrastructure (key distribution/ management) requirements needed to support network security services are examined. The thesis concludes by identifying tactical user network requirements and suggests security issues to be considered in concert with network implementation.

DTIC

Computer Networks; User Requirements; Support Systems; Security

19990041829 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
A Proposed Modeling Protocol for Evaluating Information Attacks ***Final Report, Jan. - Nov. 1997***
Brand, John H., II; Jan. 1999; 37p; In English
Report No.(s): AD-A362101; ARL-TN-112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The essence of an information attack is to alter, either by intrusion into and manipulation of a database or by deception, the scenario under which a target mind or organization evaluates and selects future courses of action. The aim is to influence the actions of the target. The method is alteration of the perceived desirability or expected payoff of specific courses of action. This alteration of the information in possession of the target can be described as alteration of the perceived reality under which the target operates. Probable success by an attacker in altering the target's perceived behavior, given a successful manipulation of the target's information, has, in the past, been subjective. A modeling protocol based on the use of game theory is proposed that may, in certain cases, allow optimization of the scenario, or reality, imposed on the target to force the choice of a desired course of action. It should also allow a quantitative estimate of the likelihood of the target's adopting a given course of action. This tool can be used to estimate friendly susceptibility to information attack.
DTIC
Linear Programming; Game Theory; Intrusion

19990041966 Defense Information Systems Agency, Arlington, VA USA
Communications Assessment Model (CAM): Processes and Products Associated with Modeling, Simulation and Assessment for DoD Networks ***Final Report***
Collins, Daniel L.; Berry, David; Graziano, Thomas; Kennedy, Vincent; Stuber, John; Apr. 13, 1999; 11p; In English
Contract(s)/Grant(s): Proj-011
Report No.(s): AD-A361393; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The CAM process is a communications assessment and modeling tool that evaluates the impact of communications demands on current and evolving theater-level Defense Information Infrastructure/Defense Information Systems Network (DII/DISN) communications networks and systems supporting the CINCs, Joint Staff, and OSD. The CAM process can identify critical communication nodes and links requiring performance improvement and can answer "what-if" questions in the event of node failures. It provides performance analyses on data, voice, and video communications network links during different stages of various scenarios ranging from Major Theater War (MTW) and Small Scale Contingency (SSC) to Non-combatant Evacuation Operations (NEO). The CAM process is tailored to address specific assessment requirements for each network involved in a particular scenario with respect to its adequacy to support hostilities in a CINC' area of responsibility (AOR). The CAM process provides DOD warfighters and planners with knowledge regarding where additional attention is needed to resolve areas of communications deficiencies or imbalances. CAM has been used successfully to assess (1) the adequacy of DII/DISN networks in supporting CINC Operational Plans and Contingency Plans and (2) the impact of emerging technologies, such as the Enhanced Mobile Satellite System and the Global Broadcast Service, on the DII/DISN networks.
DTIC
Satellite Communication; Computer Networks; Communication Networks; Information Systems

19990042338 Los Alamos National Lab., NM USA
Optimizing transformations of stencil operations for parallel object-oriented scientific frameworks on cache-based architectures
Bassetti, F.; Davis, K.; Quinlan, D.; Dec. 31, 1998; 11p; In English; ISCOPE '98: international symposium on computing in object oriented parallel environments
Report No.(s): DE99-001267; LA-UR-98-2404; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High-performance scientific computing relies increasingly on high-level large-scale object-oriented software frameworks to manage both algorithmic complexity and the complexities of parallelism: distributed data management, process management, inter-process communication, and load balancing. This encapsulation of data management, together with the prescribed semantics of a typical fundamental component of such object-oriented frameworks--a parallel or serial array-class library--provides an opportunity for increasingly sophisticated compile-time optimization techniques. This paper describes two optimizing transformations suitable for certain classes of numerical algorithms, one for reducing the cost of inter-processor communication, and one for improving cache utilization; demonstrates and analyzes the resulting performance gains; and indicates how these transformations are being automated.
NTIS
Object-Oriented Programming; Stencil Processes; Architecture (Computers)

19990042364 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Extensible Multi-Agent System for Heterogeneous Database Association Rule Mining and Unification
Marks, Christopher G.; Mar. 1999; 107p; In English
Report No.(s): AD-A361641; AFIT/GCS/ENG/99M-12; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Probabilities, Expert System, Knowledge, and Inference (PESKI) System uses the data mining of association rules to fill incompleteness in the knowledge of an expert system. The rules are mined from transactional data sources and then incorporated using an existing link to PESKI. One method of providing a system that will easily allow new data sources to be added is using an information gathering agent-based system. This research first develops a methodology for designing and creating a multi-agent system. It then applies this methodology to design a platform independent means of data mining data sources of any format. The use of agents allows a format specific agent to be used for every data source. The system performs the data mining, then unifies the association rules to present one list of unique results to the parent application.
DTIC
Information Systems; Expert Systems; Knowledge Based Systems; Probability Theory; Data Bases

63
CYBERNETICS

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

19990041154 Baylor Coll. of Medicine, Houston, TX USA
Experiments to Determine Whether Recursive Partitioning (CART) or an Artificial Neural Network Overcomes Theoretical Limitations of Cox Proportional Hazards Regression
Kattan, Michael W., Baylor Coll. of Medicine, USA; Hess, Kenneth R., Texas Univ., USA; Kattan, Michael W., Baylor Coll. of Medicine, USA; Computers and Biomedical Research; 1998; ISSN 0010-4809; Volume 31, pp. 363-373; In English
Contract(s)/Grant(s): NCC9-36; NCI-CA-58204
Report No.(s): CO981488; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

New computationally intensive tools for medical survival analyses include recursive partitioning (also called CART) and artificial neural networks. A challenge that remains is to better understand the behavior of these techniques in effort to know when they will be effective tools. Theoretically they may overcome limitations of the traditional multivariable survival technique, the Cox proportional hazards regression model. Experiments were designed to test whether the new tools would, in practice, overcome these limitations. Two datasets in which theory suggests CART and the neural network should outperform the Cox model were selected. The first was a published leukemia dataset manipulated to have a strong interaction that CART should detect. The second was a published cirrhosis dataset with pronounced nonlinear effects that a neural network should fit. Repeated sampling of 50 training and testing subsets was applied to each technique. The concordance index C was calculated as a measure of predictive accuracy by each technique on the testing dataset. In the interaction dataset, CART outperformed Cox (P less than 0.05) with a C improvement of 0.1 (95% Cl, 0.08 to 0.12). In the nonlinear dataset, the neural network outperformed the Cox model (P less than 0.05), but by a very slight amount (0.015). As predicted by theory, CART and the neural network were able to overcome limitations of the Cox model. Experiments like these are important to increase our understanding of when one of these new techniques will outperform the standard Cox model. Further research is necessary to predict which technique will do best a priori and to assess the magnitude of superiority.
Author
Experimentation; Data Acquisition; Hazards; Leukemias; Mathematical Models; Neural Nets; Survival

19990041170 Los Alamos National Lab., Div. of Space and Atmospheric Sciences, NM USA
Implementing size-optimal discrete neural networks require analog circuitry
Beiu, V.; Dec. 31, 1998; 5p; In English; 9th; Signal processing
Report No.(s): DE99-000650; LA-UR-98-1702; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper starts by overviewing results dealing with the approximation capabilities of neural networks, as well as bounds on the size of threshold gate circuits. Based on a constructive solution for Kolmogorov's superpositions the authors show that implementing Boolean functions can be done using neurons having an identity transfer function. Because in this case the size of

the network is minimized, it follows that size-optimal solutions for implementing Boolean functions can be obtained using analog circuitry. Conclusions and several comments on the required precision are ending the paper.
NTIS
Neural Nets; Discrete Functions; Circuits

19990041720 Transportation Research Board, IDEA Programs, Washington, DC USA
Robotic System for Underwater Bridge Inspection and Scour Evaluation. Report of Investigation ***Final Report, Jun. 1997 - Nov. 1998***
Devault, J. E.; Hudson, W. B.; Hossain, M.; Nov. 1998; 30p; In English
Report No.(s): PB99-130700; TRB/NCHRP-ID043; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This project developed a prototype robotic system for underwater inspection of bridge substructure and scour evaluation. The primary system consists of two or more identical robots designed to travel along opposite surfaces of submerged structures while connected to one another by a cable and winch system. The system carries a video to areas along the periphery of the structure that transmit images to an operator at the control console. A prototype with control and communications modules and software to support a communication protocol was fabricated. An on-board microprocessor-based control system provided local control of system activities including robot motion, cable tensioning, and sensor operation. However, the system was too heavy for deployment under realistic conditions. Consequently, a second prototype with a different design and reduced was developed that incorporated hydraulic motors on an open frame structure with control electronics housed separately and located above water. The system needs to be evaluated under field conditions.
NTIS
Robotics; Erosion; Robot Dynamics; Robots; Prototypes; Inspection; Bridges (Structures); Fabrication; Deployment

19990041885 Defence Science and Technology Organisation, Melbourne, Australia
Risk-Sensitive Filtering and Parameter Estimation
Ford, Jason, Defence Science and Technology Organisation, Australia; January 1999; In English
Report No.(s): DSTO-TR-0764; DODA-AR-010-820; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria, Australia 3001 UK), Hardcopy, Microfiche
This paper investigates the use of risk-sensitive filtering for state and parameter estimation in systems with model uncertainties. Modelling uncertainties arise from imperfectly known input process and noise characteristics as well as system model errors such as uncertain or time varying parameters of the system description. No new convergence results are given in this paper but simulation examples demonstrate that, in some situations, risk-sensitive filtering and estimation techniques allow for system uncertainties better than optimal techniques such as Kalman filtering.
Author
Risk; Sensitivity; Control Simulation; Optimization; Filtration

19990041975 Naval Research Lab., Washington, DC USA
Tools for Simplifying Proofs of Properties of Timed Automata: The TAME Template, Theories, and Strategies
Archer, Myla; Mar. 26, 1999; 56p; In English
Report No.(s): AD-A361638; NRL/MR/5540--99-8359; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The tool TAME is intended to provide automated support to simplify specifying and reasoning about timed automata using PVS. This report documents the current specification template, standard theories, and PVS strategies upon which TAME is based. The TAME system is now available for limited distribution by contracting the author.
DTIC
Automation; Automata Theory; Proving

19990042147 Los Alamos National Lab., Space and Atmospherics Div., NM USA
2D neural hardware versus 3D biological ones
Beiu, V.; Dec. 31, 1998; 8p; In English; International symposium on neural computation
Report No.(s): DE99-001244; LA-UR-98-2504; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper will present important limitations of hardware neural nets as opposed to biological neural nets (i.e. the real ones). The author starts by discussing neural structures and their biological inspirations, while mentioning the simplifications leading to artificial neural nets. Going further, the focus will be on hardware constraints. The author will present recent results for three different alternatives of implementing neural networks: digital, threshold gate, and analog, while the area and the delay will be related to neurons' fan-in and weights' precision. Based on all of these, it will be shown why hardware implementations cannot

cope with their biological inspiration with respect to their power of computation: the mapping onto silicon lacking the third dimension of biological nets. This translates into reduced fan-in, and leads to reduced precision. The main conclusion is that one is faced with the following alternatives: (1) try to cope with the limitations imposed by silicon, by speeding up the computation of the elementary silicon neurons; (2) investigate solutions which would allow one to use the third dimension, e.g. using optical interconnections.
NTIS
Neural Nets; Hardware

19990042186 Michigan Univ., Ann Arbor, MI USA
Computer-Aided Diagnosis and Feature-Guided Data Reduction Systems in Mammography ***Annual Report, 23 Sep. 1997 - 22 Sep. 1998***
Chan, Heang-Ping; Oct. 1998; 39p; In English
Contract(s)/Grant(s): DAMD17-96-1-6254
Report No.(s): AD-A361648; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goals of this project are: (1) Implement and evaluate a computer-aided diagnosis (CAD) system to assist radiologists in mammographic interpretation. (2) Develop and evaluate a feature-guided data compression technique to facilitate implementation of digital mammography. For the first sub-project, we plan to implement our CAD algorithms for detection and classification of microcalcifications in a high speed workstation, develop user interface for efficient operation of the CAD programs, and perform a pilot clinical trial. For the second sub-project, we plan to evaluate and select the most efficient lossless and lossy data compression techniques that can provide maximum compression ratio without noticeable loss of information for mammography. In the second year of the funding period, we have performed the following studies: (1) completion of the graphical user interface (GUl) development based on a PC which is networked to the CAD system, (2) improvement and implementation of the mass detection program in the CAD system, (3) continue the improvement and implementation of the microcalcification detection program, (4) quantitative evaluation of the data compression methods for mammograms, and (5) design methods and programs for data collection and data analysis for the pilot clinical trial. These studies are the necessary steps to accomplish the goals of this project.
DTIC
Diagnosis; Cancer; Computer Programs

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990041775 Lawrence Livermore National Lab., Livermore, CA USA
Efficient computation of periodic and nonperiodic Green's functions in layered media using the MPIE
Wilton, D. R.; Jackson, D. R.; Champagne, N. J.; Mar. 27, 1998; 7p; In English; 1998 international symposium on electromagnetic theory
Report No.(s): DE98-057733; UCRL-JC-130406; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The mixed potential integral equation (MPIE) formulation is convenient for problems involving layered media because potential quantities involve low order singularities, in comparison to field quantities. For nonperiodic problems, the associated Green's potentials involve spectral integrals of the Sommerfeld type, in the periodic case, discrete sums over sampled values of the same spectra are required. When source and observation points are in the same or in adjacent layers, the convergence of both representations is enhanced by isolating the direct and quasi-static image contributions associated with the nearby layers. In the periodic case, the convergence of direct and image contributions may be rapidly accelerated by means of the Ewadd method.
NTIS
Green"S FUNCTIONS; Integral Equations; Periodic Functions

65
STATISTICS AND PROBABILITY

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

19990041171 Los Alamos National Lab., NM USA
Bayesian stratified sampling to assess corpus utility
Hochberg, J.; Scovel, C.; Thomas, T.; Hall, S.; Dec. 31, 1998; 15p; In English; 6th; Very large corpora
Report No.(s): DE99-000656; LA-UR-98-1922; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a method for asking statistical questions about a large text corpus. The authors exemplify the method by addressing the question, 'What percentage of Federal Register documents are real documents, of possible interest to a text researcher or analyst.' They estimate an answer to this question by evaluating 200 documents selected from a corpus of 45,820 Federal Register documents. Bayesian analysis and stratified sampling are used to reduce the sampling uncertainty of the estimate from over 3,100 documents to fewer than 1,000. A possible application of the method is to establish baseline statistics used to estimate recall rates for information retrieval systems.
NTIS
Bayes Theorem; Sampling; Statistics

19990041175 Los Alamos National Lab., NM USA
Availability growth modeling
Wendelberger, J. R.; Dec. 31, 1998; 11p; In English; Joint statistical meeting
Report No.(s): DE99-001205; LA-UR-98-2678; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In reliability modeling, the term availability is used to represent the fraction of time that a process is operating successfully. Several different definitions have been proposed for different types of availability. One commonly used measure of availability is cumulative availability, which is defined as the ratio of the amount of time that a system is up and running to the total elapsed time. During the startup phase of a process, cumulative availability may be treated as a growth process. A procedure for modeling cumulative availability as a function of time is proposed. Estimates of other measures of availability are derived from the estimated cumulative availability function. The use of empirical Bayes techniques to improve the resulting estimates is also discussed.
NTIS
Availability; Mathematical Models; Systems Analysis

19990041595 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Salisbury, Australia
On-Line Estimation of Allan Variance Parameters
Ford, J.J., Defence Science and Technology Organisation, Australia; Evans, M. E., Defence Science and Technology Organisation, Australia; January 1999; In English
Report No.(s): DSTO-RR-0141; DODA-AR-010-684; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 1500, Salisbury, South Australia, Australia 5108), Hardcopy, Microfiche

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

19990041671 Los Alamos National Lab., NM USA
Geometrically-compatible 3-D Monte Carlo and discrete-ordinates methods
Morel, J. E.; Wareing, T. A.; McGhee, J. M.; Evans, T. M.; Dec. 31, 1998; 12p; In English
Report No.(s): DE99-001120; LA-UR-98-1886; 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 purpose of this project was two-fold. The first purpose was to develop a deterministic discrete-ordinates neutral-particle transport scheme for unstructured tetrahedral spatial meshes, and implement it in a computer code. The second purpose was to modify the MCNP Monte Carlo radiation transport code to use adjoint solutions from the tetrahedral-mesh discrete-ordinates code to reduce the statistical variance of Monte Carlo solutions via a weight-window approach. The first task has resulted in a deterministic transport code that is much more efficient for modeling complex 3-D geometries than any previously

existing deterministic code. The second task has resulted in a powerful new capability for dramatically reducing the cost of difficult 3-D Monte Carlo calculations.
NTIS
Monte Carlo Method; Neutral Particles

19990042273 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Adaptive importance sampling of random walks on continuous state spaces
Baggerly, K.; Cox, D.; Picard, R.; Dec. 31, 1998; 94p; In English
Report No.(s): DE99-000874; LA-UR-98-1214; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors consider adaptive importance sampling for a random walk with scoring in a general state space. Conditions under which exponential convergence occurs to the zero-variance solution are reviewed. These results generalize previous work for finite, discrete state spaces in Kollman (1993) and in Kollman, Baggerly, Cox, and Picard (1996). This paper is intended for nonstatisticians and includes considerable explanatory material.
NTIS
Sampling; Random Walk; Scoring

19990042336 Los Alamos National Lab., NM USA
Development of an integrated system for estimating human error probabilities
Auflick, J. L.; Hahn, H. A.; Morzinski, J. A.; Dec. 31, 1998; 13p; In English
Report No.(s): DE99-001272; LA-UR-98-2649; 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). This project had as its main objective the development of a Human Reliability Analysis (HRA), knowledge-based expert system that would provide probabilistic estimates for potential human errors within various risk assessments, safety analysis reports, and hazard assessments. HRA identifies where human errors are most likely, estimates the error rate for individual tasks, and highlights the most beneficial areas for system improvements. This project accomplished three major tasks. First, several prominent HRA techniques and associated databases were collected and translated into an electronic format. Next, the project started a knowledge engineering phase where the expertise, i.e., the procedural rules and data, were extracted from those techniques and compiled into various modules. Finally, these modules, rules, and data were combined into a nearly complete HRA expert system.
NTIS
Human Performance; Error Analysis; Reliability Analysis; Measure and Integration; Probability Theory

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990041746 Naval Postgraduate School, Monterey, CA USA
Dynamic-Programming Approaches to Single- and Multi-Stage Stochastic Knapsack Problems for Portfolio Optimization
Khoo, Wai G.; Mar. 1999; 72p; In English
Report No.(s): AD-A362005; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This thesis proposes new methods, based on dynamic programming, for solving certain single-stage and multi-stage integer stochastic knapsack problems. These problems model stochastic portfolio optimization problems (SPOPs) which assume deterministic unit weight, and normally distributed unit return with known mean and variance for each item type. Given an initial wealth, the objective is to select a portfolio that maximizes the probability of achieving or exceeding a specified final return threshold; the multi-stage problem allows revisions of the portfolio at regular time intervals. An exact method is developed to solve a single-stage SPOP with independence of returns among item types. For a problem from the literature with 11 item types, this method obtains an optimal solution in a fraction of a second on a laptop computer. An approximation method, based on discretization of possible wealth values, is developed to solve a multi-stage SPOP with inter- and intra-stage independence of returns among item types. Running on a desktop computer, this approximation method solves a 3-stage problem with 6 item types in under 12 minutes. With finer discretization in a 3-stage problem with 8 item types, the solution time is about 46 minutes.
DTIC
Dynamic Programming; Approximation; Integers; Probability Theory

19990041963 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Technology Selection for the Air Force Research Laboratory Air Vehicles Directorate: An Analysis Using Value Focused Thinking

Winthrop, Michael F.; Mar. 1999; 295p; In English

Report No.(s): AD-A361622; AFIT/GOR/ENS/99M-18; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

A technology selection model was developed for the Air Vehicles Directorate of Air Force Research Laboratory. The model was developed and demonstrated to aid in addressing the question of what technologies Air Vehicles' should invest in to remain consistent with Air Force values. Both Value-Focused Thinking and optimization approaches were used to identify the value of Air Vehicles technology, to provide insights to Air Vehicles' decision-makers, to determine where value gaps might exist with the scored alternatives, and to determine how sensitive the model was to changes. As a demonstration of the approach, seven technologies were scored, representing all three of the Air Vehicles' Integrated Concepts. In the process, the support to the war-fighter due to technological change was quantified and analyzed.

DTIC

Operations Research; Research Vehicles

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990041387 Liverpool Univ., Dept. of Mathematical Sciences, UK

The Exponent of Convergence of a Finite Blaschke Product

Jones, Gavin L., Liverpool Univ., UK; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 245-254; In English; See also 19990041386

Contract(s)/Grant(s): EPSRC-GR/K/75453; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

This paper describes the iteration theory of finite blaschke products using the techniques of Fuchsian groups. In particular the Julia set is shown to decompose into points of conical approach and parabolic points. We also use the hyperbolic geometry of the unit disc to describe the construction and properties of conformal measures on the Julia set.

Author

Construction; Convergence; Decomposition; Iteration; Set Theory

19990041388 State Univ. of New York, Mathematics Dept., Stony Brook, NY USA

On Isomorphisms of Bers Fiber Spaces

Zhang, Chao-Hui, State Univ. of New York, USA; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 255-274; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

The main purpose of this paper is to describe all fiber-preserving isomorphhisms among Bers fiber spaces in most general cases. Some extension problems in the theory of Bers fiber spaces are also discussed in this paper.

Author

Isomorphism; Riemann Manifold; Complex Variables; Analytic Functions

19990041389 Technion - Israel Inst. of Tech., Dept. of Mathematics, Haifa, Israel

Estimates for Asymptotically Conformal Mappings

Dynkin, Evsey, Technion - Israel Inst. of Tech., Israel; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 275-304; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Let f be a univalent function in the unit disc D, which admits a quasiconformal extension to the whole plane with a complex dilation mu, absolute value(mu) is less than = chi and chi is less than 1. The following main estimate is established : Absolute value of (f"(z) / f'(z) = or is less than C * [1 - absolute value (z)] exp - aleph *[integral (limits infinity, (1- absolute value z)] of [(omega(z,t)) / (t(exp 2) - aleph)]*dt, absolute value z is less than 1 where omega(z,t) = [1/pi*t2 * integral (limit(absolute value zeta-z is less than and equal to t) of absolute value of [mu *(zeta)](exp 2)] (exp 1/2) is the square mean of mu. The main estimate is sharp and implies many new and old results, concerning the boundary behaviour of asymptotically conformal mappings. Among

these are a new condition for the rectifiability of the image function of T in terms of the Littlewood-Paley quadratic function of mu, and an alternative proof of Astala-Zinsmeister's result on the embedding log f' element of BMOA.
Author
Functions (Mathematics); Conformal Mapping; Invariant Imbeddings; Asymptotic Methods

19990041390 California Inst. of Tech., Dept. of Mathematics, Pasadena, CA USA
On Coefficients, Boundary Size and Hoelder Domains
Makarov, Nikolai, California Inst. of Tech., USA; Pommerenke, Christian, Technische Univ., Germany; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 305-312; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Let phi(z) = for every a(sub n) * z(exp n) map the unit disk onto a bounded plane domain. Then (asterisk) a(sub n) = O[n(exp gamma-1+epsilon)] for every epsilon is greater than 0, where gamma is an unknown absolute constant. We show here that gamma is less than .04886. Suppose now additionally that the boundary of the image domain has Minkowski dimension is less than and = M. It is shown that still no bound better than (asterisk) holds provided that M is is greater than and equal to M(sub c) and M is less than and equal 2 for some critical dimension M(sub c) is less than 2. The proof is based upon the universal integral means spectrum, the connection with Hoelder continuity and the Carleson-Jones modification method.
Author
Coefficients; Domains; Proving; Conformal Mapping; Minkowski Space

19990041391 Umea Univ., Sweden
Thinness in Non-Linear Potential Theory for Non-Isotropic Sobolev Spaces
Sjoedin, Tord, Umea Univ., Sweden; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 313-338; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

We consider the non-isotropic Sobolev spaces H(sub rho,r,p) = H(sub rho,r,p)(R(exp M) X R(exp n) of functions f on R(exp d) = R(exp m) X R(exp n) of the form f = G(exp m sub rho) Tensor product G(exp n sub r) star g. Here G(exp m sub rho) and G(exp n sub r) are Bessel kernels or order rho, and r in R(exp M) and R(exp n) respectively and g belongs to L(exp P)(R(exp d). We develop at least part of a potential theory for H(sub rho, r, p) that is analogous to the well known non-linear L(exp p) - potential theory for the Sobolev spaces H(sub rho,p)(R(exp M). We define thinness in H(sub rho,r,p), prove the Choquet and Kellog properties and give a partial characterization of properties of certain non-linear potentials in terms of thinness.
Author
Nonlinearity; Potential Theory; Sobolev Space; Anisotropy

19990041392 Uppsala Univ., Dept. of Mathematics, Sweden
Entire Functions of Order Less Than or Equal to 1, With Bounds on Both Axes
Domar, Yngve, Uppsala Univ., Sweden; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 339-348; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Results are proved on the existence of a not identically vanishing entire function f of order is less than or equal to 1, and satisfying log absolute value of f(x) is less than or equal to K(x), log absolute value of f(ix) is less than or equal to a absolute value of x, x is an element of R, where k is a given odd function and a a positive constant. Existence is proved if k is an element c square (r) with the absolute value of xk"(x) is less than or equal to 2a pi (exp -1), x is an element of R, or for every a, if k is convex on R+, with k' bounded the second result is used to produce non-trivial translation invariant subspaces of the corresponding weighted l(exp p)(Z).
Author
Convexity; Entire Functions; Complexity

19990041393 Southampton Univ., Faculty of Mathematical Studies, UK
Analyticity of Hausdorff Dimension of Limit Sets of Kleinian Groups
Anderson, James W., Southampton Univ., UK; Rocha, Andre C., Universidade Federal de Pernambuco, Brazil; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 349-364; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

We show that the Hausdorff dimension of the limit set is a real analytic function on the deformation space of a class of convex co-compact Kleinian groups which includes all convex co-compact function groups. This extends a result or Ruelle [20] for quasi-fuchsian groups
Author
Analytic Functions; Convexity; Deformation; Function Space; Riemann Manifold

19990041394 Universidad Complutense, Dept. de Analisis Economico, Madrid, Spain
Geometry of Self-Similar Measures
Moran, Manuel, Universidad Complutense, Spain; Rey, Jose-Manuel, Universidad Complutense, Spain; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 365-386; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Self-similar measures can be obtained by regarding the self-similar set generated by a system of similitudes Psi = {rho (sub i)} i is an element of M as the probability space associated with an infinite process of Bernoulli trials with state space Psi. These measures are concentrated in normal Besicovitch similitudes. In this paper we obtain some geometric-size properties of self-similar measures. We generalize the expression of the Hausdorff and packing dimensions of such measures to the case when M is countable. We give a precise answer to the problem of determining what packing measures are singular with respect to self-similar measures. Both problems are solved by means of a technique which allows us to obtain efficient coverings of balls by cylinder sets. We also show that normal Besicovitch sets have infinite packing measure in their dimension.
Author
Bernoulli Theorem; Fractals; Set Theory; Similarity Theorem

19990041395 Helsinki Univ., Dept. of Mathematics, Helsinki, Finland
Conservative Action and the Horospheric Limit Set
Tukia, Pekka, Helsinki Univ., Finland; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 387-394; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

It has been shown that a discrete Mobius group G of S(exp n) acts conservatively on the horospheric limit set H(G) of G, that is if A is contained in H(GH) has positive measure, then so has A intersects gA for infinetly many g in G. On the other hand, G has a measurable fundamental set outisde H(G). We show that if the definition of the horospheric limit set slightly changed, these results are also valid for any conformal measure mu of G.
Author
Set Theory; Riemann Manifold

19990041396 Hong Kong Univ. of Science and Technology, Dept. of Mathematics, Kowloon, Hong Kong
Uniqueness and Value-Sharing of Meromorphic Functions
Yang, Chung-Chun, Hong Kong Univ. of Science and Technology, Hong Kong; Hua, Xin-Hou, Nanjing Univ., China; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 395-406; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Concerning the uniqueness and sharing values of meromorphic functions, many results about meromorphic functions that share more than or equal to two values have been obtained. In this paper, we shall study meromorphic functions that share only one value, and prove the following result: For M is greater than = 11 and two meromorphic functions(of z and gof z if f(exp n)f-prime and g(exp n) g-prime share the same nonzero and finite value a with the same multiplicities, then f is equivalent of dg or g=c(sub 1)e(exp cz) and f = c(sub 2) e(exp -cz) where d is an (n+1)th root of unity, c,c1, and c2 being constants. As an application, we solve some non-linear differential equations.
Author
Differential Equations; Meromorphic Functions; Distribution Functions

19990041397 Texas Univ., Dept. of Mathematics, Austin, TX USA
Univalence Criteria for Classes of Rectangles and Equiangular Hexagons
Miller-VanWieren, Leila, Texas Univ., USA; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 407-424; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

Let d be a simply connected plane domain and let b be the unit disk. The inner radius of D or, sigma(d is defined by sigma(D)=sup {a:a is greater than or equal to 0, S(sub f) is parallel to D is less than a implies f is univalent in D}. Here S(sub

f) is the Schwarzian derivative of f, hyperbolic density on D and is parallel to S(sub f) is parallel to D = sup(z element D absolute value [S(sub f)(z)] hyperbolic density of bar-D (exp 2) (z). Domains for which the value of sigma (D) is known include disks, angular sectors and regular polygons. All of the mentioned domains except non-convex angular sectors have an interesting property in common, namely that sigma(d) = 2- S(sub h) is parallel to B, where h maps B conformally onto D. Because of the importance of this property, we say that D is a Nehari disk if sigma(D) = 2 -S(sub h) is parallel to B is satisfied. First we use the definition of a Nehari disk to give a new proof of the result on regular n-sided polygons p(sub n) due to D. Calvis. Next we study rectangles and equiangular hexagons. We prove that if R is a rectangle whose ratio of longer over shorter side is bounded from above ba a specific constant (approximately equal to 1.52345...), then R is a Nehari disk and sigma(of R) = 1/2 = sigma(of P(sub 4) and if H is an equiangular hexagon whose sides form the sequence baabaa with b/a is less than or equal to 1.67117..., then H is a Nehari disk and sigma (H)= 8/9 - sigma(P(sub 6)).
Author
Convexity; Hexagons; Polygons; Rectangles; Conformal Mapping; Injection

19990041398 Pennsylvania Coll. of Technology, Integrated Studies Div., Williamsport, PA USA
Two-Point Distortion Theorems for Bounded Univalent Functions
Ma, William, Pennsylvania Coll. of Technology, USA; Minda, David, Cincinnati Univ., USA; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 425-444; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

One-parameter families of sharp two point distortion theorems are established for nonnormalized bounded univalent functions f, that is univalent functions f defined on the unit disk D={z : absolute value of z is less than 1} with f of D contained in D. These theorems provide sharp upper and lower bounds on d of D(f of a, f of b), the hyperbolic distance between f of a and f of b, in terms of d(sub D)a,b) and the ”hyperbolic derivatives” (1-(absolute value of a)(exp 2) (absolute value of f-prime of a) . [1 - (absolute value of a) (exp 2)], (1-(absolute value of b)(exp 2) (absolute value of f-prime of b) . [1 - (absolute value of b) (exp 2)] for arbitrary growth theorems for bounded univalent functions that are due to Pick. The lower bounds are also sufficient conditions to imply that f is univalent in D. As part of establishing these results, a new, sharp coefficient inequality for bounded univalent functions is derived.
Author
Distortion; Inequalities; Injection; Hyperbolic Functions

19990041399 Helsinki Univ., Matematiikan Laitos, Helsinki, Finland
Uniform Domains of Higher Order, Paper 3
Alestalo, Pekka, Helsinki Univ., Finland; Vaeisaelae, Jussi, Helsinki Univ., Finland; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 445-464; In English; See also 19990041386; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

We continue the study of (p,c)- uniform domains. Special emphasis is on (p,c)-NUD sets. The ambient space is assumed to be a Hilbert space.
Author
Domains; Hilbert Space; Conformal Mapping; Homotropy; Invariance; Imbeddings (Mathematics)

19990041400 Technische Univ., Fachbereich Mathematik, Berlin, Germany
Bilipschitz Maps and the Modulus of Rings
Rohde, S., Technische Univ., Germany; Annals of the Finnish Academy of Science; 1997; Volume 22, No. 2, pp. 465-474; In English; See also 19990041386; Sponsored in part by HCM Network; Copyright; Avail: Issuing Activity (Geophysical Observatory, Helsinki, Finland), Hardcopy, Microfiche

We show that a homeomorphism f or euclidean n-space is bilipschitz continuous if and only if there is a constant M such that (the absolute value of M of(f (of A)) = M of (A)) is less than or equal M for all spherical annuli A where M of (A) is the Modulus of A. We also present a local version of this result and give an application concerning absolute continuity on lower dimensional sets.
Author
Annuli; Analytic Geometry; Toruses

19990042383 Florida Univ., Computational NeuroEngineering Lab., Gainesville, FL USA
Local Dynamic Modeling with Self-Organizing Maps and Applications to Nonlinear System Identification and Control
Principe, Jose C., Florida Univ., USA; Wang, Ludong, Florida Univ., USA; Motter, Mark A., Florida Univ., USA; Proceedings

of the IEEE; November 1998; ISSN 0018-9219; Volume 86, No. 11, pp. 2240-2258; In English
Contract(s)/Grant(s): N00014-94-I-0858; NSF ECS-95-10715; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The technique of local linear models is appealing for modeling complex time series due to the weak assumptions required and its intrinsic simplicity. Here, instead of deriving the local models from the data, we propose to estimate them directly from the weights of a self organizing map (SOM), which functions as a dynamic-preserving model of the dynamics. We introduce one modification to the Kohonen learning to ensure good representation of the dynamics and use weighted least squares to ensure continuity among the local models. The proposed scheme is tested using synthetic chaotic time series and real-world data. The practicality of the method is illustrated in the identification and control of the NASA Langley wind Tunnel during aerodynamic tests of model aircraft. Modeling the dynamics with an SOM leads to a predictive multiple model control strategy (PMMC). Comparison of the new controller against the existing controller in test runs shows the superiority of our method. Keywords- Dynamic modeling, local linear models, multiple models, NASA wind tunnel, neural control, self-organizing maps.
Author
Aircraft Models; Dynamic Models; Time Series Analysis; Controllers; Chaos; Self Organizing Systems

19990042408 Geophysical Observatory, Helsinki, Finland
Minimization Problems for Lipschitz Functions Via Viscosity Solutions
Juutinen, Petri, Geophysical Observatory, Finland; 1998; ISSN 1239-6303; 56p; In English
Contract(s)/Grant(s): Proj. 8597
Report No.(s): Rept-115; ISBN 951-41-0846-9; Copyright; Avail: Issuing Activity (Dept. of Mathematics, Helsinki Univ., P.O. Box 4, Helsinki, Finland), Hardcopy, Microfiche

The purpose of this thesis is to find a minimal Lipschitz extension of a continuous function by viscosity solutions. In order to prove this thesis, presentation of certain factual evidence and or proofs are presented throughout the sections of this paper.
CASI
Lipschitz Condition; Partial Differential Equations

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.

19990042279 NASA Marshall Space Flight Center, Huntsville, AL USA
An Investigation of Magneto-Optical Effects
Adams, Mitzi L., NASA Marshall Space Flight Center, USA; Hagyard, Mona J., NASA Marshall Space Flight Center, USA; West, Edward A., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We exhibit the effects of Faraday rotation on the direction of the transverse component of the magnetic field in a simple, symmetric sunspot. A set of 35 polarization filtergrams of NOAA active region 4662 (June 9, 1985) were obtained with the Marshall Space Flight Center (MSFC) vector magnetograph. These filtergrams measured the Stokes I, Q, U, and V intensities averaged over the instrument's filter bandpass (0.0125 nm) for wavelengths from 0.017 nm in the red wing to 0.017 nm in the blue wing of the Lambda525.22 nm spectral line in steps of 0.001 nm. These data were used to derive the azimuth phi of the vector field as a function of wavelength over the field of view of the sunspot. We interpret the observed variations of this azimuth with wavelength as the effects of Faraday rotation and verify this interpretation by comparing these variations with those predicted from magneto-optical theory. In the theoretical calculations we use the line-profile parameters and magnetic field strength derived in previous work by Balasubramaniam and West (Astrophys. J 382, p. 699, 1991).
Author
Magneto-Optics; Magnetic Fields; Faraday Effect; Sunspots; Filtergrams; Magnetic Signatures; Magnetic Flux

71
ACOUSTICS

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

19990041264 California Inst. of Tech., Pasadena, CA USA
Evaluation of Noise Radiation Mechanisms in a Turbulent Jet
Colonius, T., California Inst. of Tech., USA; Mohseni, K., California Inst. of Tech., USA; Freund, J. B., California Univ., USA; Lele, S. K., Stanford Univ., USA; Moin, P., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 159-167; In English; See also 19990041253; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Data from the direct numerical simulation (DNS) of a turbulent, compressible (Mach=1.92) jet has been analyzed to investigate the process of sound generation. The overall goals are to understand how the different scales of turbulence contribute to the acoustic field and to understand the role that linear instability waves play in the noise produced by supersonic turbulent jets. Lighthill's acoustic analogy was used to predict the radiated sound from turbulent source terms computed from the DNS data. Preliminary computations (for the axisymmetric mode of the acoustic field) show good agreement between the acoustic field determined from DNS and acoustic analogy. Further work is needed to refine the calculations and investigate the source terms. Work was also begun to test the validity of linear stability wave models of sound generation in supersonic jets. An adjoint-based method was developed to project the DNS data onto the most unstable linear stability mode at different streamwise positions. This will allow the evolution of the wave and its radiated acoustic field, determined by solving the linear equations, to be compared directly with the evolution of the near- and far-field fluctuations in the DNS.
Author
Direct Numerical Simulation; Turbulent Jets; Compressible Flow; Noise Propagation; Acoustics; Supersonic Jet Flow; Sound Waves; Sound Fields

19990041445 United Technologies Corp., Pratt and Whitney, East Hartford, CT USA
TFaNS Tone Fan Noise Design/Prediction System, Volume 2, User's Manual, 1.4 ***Final Report***
Topol, David A., United Technologies Corp., USA; Eversman, Walter, Missouri Univ., USA; March 1999; 136p; In English
Contract(s)/Grant(s): NAS3-26618; NAS3-27727; RTOP 538-03-11
Report No.(s): NASA/CR-1999-208883; NAS 1.26:208883; E-11616; PWA-6420-102; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

TFaNS is the Tone Fan Noise Design/Prediction System developed by Pratt & Whitney under contract to NASA Lewis (presently NASA Glenn). The purpose of this system is to predict tone noise emanating from a fan stage including the effects of reflection and transmission by the rotor and stator and by the duct inlet and nozzle. These effects have been added to an existing annular duct/isolated stator noise prediction capability. TFaNS consists of: the codes that compute the acoustic properties (reflection and transmission coefficients) of the various elements and write them to files. CUP3D: Fan Noise Coupling Code that reads these files, solves the coupling problem, and outputs the desired noise predictions. AWAKEN: CFD/Measured Wake Postprocessor which reformats CFD wake predictions and/or measured wake data so it can be used by the system. This volume of the report provides information on code input and file structure essential for potential users of TFANS. This report is divided into three volumes: Volume 1. System Description, CUP3D Technical Documentation, and Manual for Code Developers; Volume 2. User's Manual, TFANS Vers. 1.4; Volume 3. Evaluation of System Codes.
Author
Acoustic Properties; Fan Blades; Noise Prediction; Fabrication; Prediction Analysis Techniques; Aerodynamic Noise

19990041617 United Technologies Corp., Pratt and Whitney, East Hartford, CT USA
TFaNS Tone Fan Noise Design/Prediction System, Volume 3, Evaluation of System Codes
Topol, David A., United Technologies Corp., USA; March 1999; 56p; In English
Contract(s)/Grant(s): NAS3-26618; RTOP 538-03-11
Report No.(s): NASA/CR-1999-208884; NAS 1.26:208884; E-11618; PWA-6420-103; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

TFANS is the Tone Fan Noise Design/Prediction System developed by Pratt & Whitney under contract to NASA Lewis (presently NASA Glenn). The purpose of this system is to predict tone noise emanating from a fan stage including the effects of reflection and transmission by the rotor and stator and by the duct inlet and nozzle. These effects have been added to an existing annular duct/isolated stator noise prediction capability. TFANS consists of: The codes that compute the acoustic properties (reflection and transmission coefficients) of the various elements and write them to files. Cup3D: Fan Noise Coupling Code that reads these files,

solves the coupling problem, and outputs the desired noise predictions. AWAKEN: CFD/Measured Wake Postprocessor which reformats CFD wake predictions and/or measured wake data so it can be used by the system. This volume of the report evaluates TFANS versus full-scale and ADP 22" fig data using the semi-empirical wake modelling in the system. This report is divided into three volumes: Volume 1: System Description, CUP3D Technical Documentation, and Manual for Code Developers; Volume II: User's Manual, TFANS Version 1.4; Volume III: Evaluation of System Codes.
Author
Aerodynamic Noise; Fan Blades; Rotors; Stators; Interactional Aerodynamics; Noise Prediction (Aircraft); Aircraft Noise; Propeller Noise; Computer Programs; Inlet Nozzles

19990041927 Naval Research Lab., Washington, DC USA
Rapid Geoacoustics Inversion Methods Used in LWAD98-2 Sea Test
Turgut, Altan; Apr. 12, 1999; 14p; In English
Report No.(s): AD-A361913; NRL/MR/7120-99-8369; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A concept for rapid environmental characterization of the sea bottom/subbottom has been successfully tested during the LWAD9S-2 seatest. As a proof-of-concept test, inversion of statistical parameters of a Jackson/Turgut bottomisubbottom scattering model from backscatter data is performed. Seabed geoacoustic properties are also inverted from normal-incidence acoustic data. Results are in agreement with the previously reported geoacoustic data for the area. Iterative time-reversal techniques were also used to improve backscattered signal quality in an engineering trial. All the time-reversal hardware and software components functioned well except for the proper band-pass filtering of the received backscatter signal.
DTIC
Backscattering; Underwater Acoustics; Inversions; Acoustic Properties

19990041982 NASA Langley Research Center, Hampton, VA USA
Verification and Analysis of Formulation 4 of Langley for the Study of Noise from High Speed Surfaces
Farassat, F., NASA Langley Research Center, USA; Farris, Mark, Midwestern State Univ., USA; 1999; In English; Aeroacoustics, 10-12 May 1999, Bellevue, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-1881; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
There are several approaches to the prediction of the noise from sources on high speed surfaces. Two of these are the Kirchhoff and the Ffowcs williams-Hawkings methods. It can be shown that both of these methods depend on the solution of the wave equation with mathematically similar inhomogeneous source terms. Two subsonic solutions known as Formulation 1 and 1A of Langley are simple and efficient for noise prediction. The supersonic solution known as Formulation 3 is very complicated and difficult to code. Because of the complexity of the result, the computation time is longer than the subsonic formulas. Furthermore, it is difficult to assess the accuracy of noise prediction. We have been searching for a new and simpler supersonic formulation without these shortcomings. In the last AIAA Aeroacoustics Conference in Toulouse, Farassat, Dunn and Brentner presented a paper in which such a result was presented and called Formulation 4 of Langley. In this paper we will present two analytic tests of the validity this Formulation: i) the noise from dipole distribution on on the unit circle whose strength varies radially with the square of the distance from the center and, ii) the noise from dipole distribution on the unit sphere whose strength varies with the cosine of the angle from the polar axis. We will discuss the question of singularities of Formulation 4.
Author
Aeroacoustics; Noise Prediction; Electric Dipoles; Formulations; Radiation Distribution

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990041200 Los Alamos National Lab., Theoretical Div., NM USA
Baryon-baryon mixing in hypernuclei
Gibson, B. F.; Dec. 31, 1998; 9p; In English; MESON '98: international workshop on production, properties and interaction of mesons and conference on structure of mesons, baryons and nuclei
Report No.(s): DE99-001227; LA-UR-98-2667; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Implications of few-body hypernuclei for the understanding of the baryon-baryon interaction are examined. Octet-octet coupling effects not present in conventional, non strange nuclei are the focus. The need to identify strangeness -2 hypernuclei to test model predictions is emphasized.
NTIS
Hypernuclei; Baryons

19990041875 Argonne National Lab., Chemical Technology Div., IL USA
Gas production due to alpha particle degradation of polyethylene and polyvinylchloride
Reed, D. T.; Hoh, J.; Emery, J.; Okajima, S.; Krause, T.; Jul. 31, 1998; 74p; In English
Report No.(s): DE99-000493; ANL-97/7; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Alpha particle degradation experiments were performed on polyethylene (PE) and polyvinylchloride (PVC) plastic samples typical of Westinghouse Savannah River Company (WSRC) transuranic (TRU) waste. This was done to evaluate the effects of sealing TRU waste during shipment. Experiments were conducted at three temperatures using low dose rates. Predominant products from both plastics were hydrogen, carbon dioxide, and various organic species, with the addition of hydrochloric acid from PVC. In all experiments, the total pressure decreased. Irradiation at 30 and 60 C and at various dose rates caused small changes for both plastics, but at 100 C coupled thermal-radiolytic effects included discoloration of the material as well as large differences in the gas phase composition.
NTIS
Plastics; Polyethylenes; Polyvinyl Chloride; Waste Disposal; Alpha Particles; Transuranium Elements; Radioactive Wastes

19990042070 Rutherford Appleton Lab., Chilton, UK
Femtosecond Laser Induced Ionization/Dissociation of Polyatomic Molecules: TMR Large-Scale Facilities Access Program
Kosmidis, C., Ioannina Univ., Greece; Tzallas, P., Ioannina Univ., Greece; Ledingham, K. W. D., Glasgow Univ., UK; Singhal, R. P., Glasgow Univ., UK; Smith, D. J., Glasgow Univ., UK; McCanny, T., Glasgow Univ., UK; Graham, P., Glasgow Univ., UK; Kilic, H. S., Selcuk Univ., Turkey; Peng, W. X., Jilin Univ., China; Wang, S. L., Edinburgh Univ., UK; Langley, A. J., Rutherford Appleton Lab., UK; Taday, P. F., Rutherford Appleton Lab., UK; Feb. 25, 1999; ISSN 1358-6254; In English
Contract(s)/Grant(s): ERBFMGECT950053
Report No.(s): RAL-TR-1999-010; Copyright; Avail: Issuing Activity (CDRL, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire OX11 0QX, UK), Hardcopy, Microfiche
This report describes the experiment entitled 'Femtosecond Laser Induced Ionization/Dissociation of Bimolecules'; carried out at the Central Laser Facility (CLF) from April 6th to May 4th 1998. The experiment, funded by the Framework IV Large-Scale Facilities Access Scheme, was proposed by Dr. C Kosmidis, Department of Physics, University of Ioannina, Greece and carried out by visiting researchers from the Department. They were supported by researchers from the Department of Physics and Astronomy, University of Glasgow and the Central Laser Facility, Rutherford Appleton Laboratory.
Author
Dissociation; Ionization; Polyatomic Molecules

19990042275 Department of Energy, Office of Energy Research, Washington, DC USA
Off-forward parton distribution
Ji, X.; Dec. 31, 1998; 12p; In English; Workshop on future directions in quark nuclear physics
Report No.(s): DE99-000993; DOE/ER/40762-154; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recent developments in studying off-forward parton distributions are discussed. In this talk, the author discusses the recent developments in studying the off-forward parton distributions (OFPD's). He has written a topical review article on the subject, which will soon be published in Journal of Physics G. The interested audience can consult that article for details. His talk consists of three parts: definition of the new distributions, their physical significance, and experimental measurements.
NTIS
Partons; Particle Spin

19990042330 National Inst. for Fusion Science, Toki, Japan
Computer-Assisted Particle-in-Cell Code Development
Drska, L., Czech Technical Univ., Czechoslovakia; Limpouch, J., Czech Technical Univ., Czechoslovakia; Liska, R., Czech Technical Univ., Czechoslovakia; Sinor, M., Czech Technical Univ., Czechoslovakia; Kawata, S., Nagaoka Univ. of Technology, Japan; Boonmee, C., Nagaoka Univ. of Technology, Japan; Teramoto, T., Tsuyama National Coll. of Technology, Japan; Dec. 1997;

ISSN 0915-633X; 16p; In English
Report No.(s): NIFS-533; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a new approach for an electromagnetic Particle-in-Cell (PIC) code development by a computer: in general PIC codes have a common structure, and consist of a particle pusher, a field solver, charge and current density collections, and a field interpolation. Because of the common feature, the main part of the PIC code can be mechanically developed on a computer. In this report we use the packages FIDE and GENTRAN of the REDUCE computer algebra system for discretizations of field equations and a particle equation, and for an automatic generation of FORTRAN codes. The approach proposed is successfully applied to the development of 1.5-dimensional PIC code. By using the generated PIC code the Weibel instability in a plasma is simulated. The obtained growth rate agrees well with the theoretical value.
Author
Computer Techniques; Computer Programs; Particles; Cells (Biology); Plasmas (Physics); FORTRAN; Electric Charge

19990042406 Clark-Atlanta Univ., Dept. of Physics, GA USA
Effective Collision Strengths for Electron Impact Excitation of Inelastic Transitions in S III
Tayal, S. S., Clark-Atlanta Univ., USA; Astrophysical Journal; May 20, 1997; Volume 481, pp. 550-556; In English
Contract(s)/Grant(s): NAGw-4447; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have calculated electron collisional excitation strengths for all electric dipole forbidden, semi-forbidden, and allowed transitions among the lowest 17 LS states 3s(exp 2)3p(exp 2) P-3, D-1, S-1, 3s3p(exp 3)S-5(exp 0), D-3(exp 0), P-3(exp 0), P-1(exp 0), S-3(exp 0), D-1(exp 0), 3S(exp 2)3p3d D-1(exp 0), F-3(exp 0), P-3(exp 0), D-3(exp 0), F-3(exp 0), P-1(exp 0), and 3S(exp 2)3p4S P-3(exp 0), P-l(exp 0) of S III using the R-matrix method. These S m states are represented by fairly extensive configuration-interaction wave functions that yield excited state energies in close agreement with recent laboratory measurements. Rydberg series of resonances converging to the excited state thresholds are explicitly included in the scattering calculation. The effective collision strengths are determined assuming Maxwellian distribution of electron energies. These are listed over a wide temperature range ([0.5-10] x 10(exp 4) K) and compared, where possible, with other available calculations. Subject headings: atomic data - atomic processes
Author
Collisions; Electron Impact; Excitation; Sulfur; Computation; Configuration Interaction; Electron Scattering

73
NUCLEAR AND HIGH-ENERGY PHYSICS

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

19990041662 Los Alamos National Lab., NM USA
First collision source method for ATTILA, an unstructured tetrahedral mesh discrete ordinates code
Wareing, T. A.; Morel, J. E.; Parsons, D. K.; Dec. 31, 1998; 7p; In English; Radiation protection and shielding topical meeting: technologies for the new century
Report No.(s): DE99-000616; LA-UR-98-1373; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A semi-analytic first collision source method is developed for the transport code, ATTILA, a three-dimensional, unstructured tetrahedral mesh, discrete-ordinates code. This first collision source method is intended to mitigate ray effects due to point sources. The method is third-order accurate, which is the same order of accuracy as the linear-discontinuous spatial differencing scheme used in ATTILA. Numerical results are provided to demonstrate the accuracy and efficiency of the first collision source method.
NTIS
Unstructured Grids (Mathematics); Collisions; Tetrahedrons; Point Sources; Grid Generation (Mathematics)

19990041666 Brookhaven National Lab., Upton, NY USA
Preliminary design studies for an iridium rod target at the BNL-AGS
Ludewig, H.; Hastings, J.; Montanez, P.; Todosow, M.; Dec. 31, 1998; 11p; In English; ICANS: 14. conference on the international collaboration on advanced neutron sources
Report No.(s): DE99-000609; BNL-65767; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The BNL-AGS is an intense source of 24 GeV protons. It is proposed to explore the potential to use these protons as the driver for a Pulsed Spallation Neutron Source target. The proposed target design is based on an edge cooled iridium rod concept--similar to the anti-proton production target which operated reliably at CERN under similar conditions. Lead, lead fluoride, and beryllium are investigated as possible reflector materials, and ambient temperature light water and 80 K light water ice are proposed as initial

moderator materials. Both moderators are decoupled by cadmium containing moderator chamber walls. The small size of the target has the advantage that the moderators can be placed close to the target (resulting in a bright source), and since a large fraction of the radioactive inventory is contained in the iridium rod, removal and disposition of this inventory should be relatively simple and inexpensive.
NTIS
Rods; Targets; Iridium; Design Analysis

19990041677 Los Alamos National Lab., Theoretical Div., NM USA
Instanton liquid model of QCD
Blotz, A.; Dec. 31, 1998; 9p; In English; Quantum Chromodynamics, USA
Report No.(s): DE99-000758; LA-UR-98-2071; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Within a microscopic model for the non-perturbative vacuum of Quantum Chromodynamics (QCD), hadronic correlation functions are calculated. In the model the vacuum is a statistical, interacting ensemble of instantons and anti-instantons at the scale of (Lambda) (sub QCD). Hadronic two-point as well as three-point correlation functions are evaluated and compared with phenomenological information about the spectra, couplings and form factors. Especially the electro magnetic form factor of the pion is obtained and new predictions for the charm contribution to DIS structure functions are made.
NTIS
Quantum Chromodynamics; Instantons; Liquids

19990041738 Los Alamos National Lab., NM USA
Exploring and testing the Standard Model and beyond
West, G.; Cooper, F.; Ginsparg, P.; Habib, S.; Gupta, R.; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-001121; LA-UR-98-1840; 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 goal of this project was to extend and develop the predictions of the Standard Model of particle physics in several different directions. This includes various aspects of the strong nuclear interactions in quantum chromodynamics (QCD), electroweak interactions and the origin of baryon asymmetry in the universe, as well as gravitational physics.
NTIS
Standard Model (Particle Physics); Nuclear Interactions

19990041778 Lawrence Livermore National Lab., Livermore, CA USA
Linear induction accelerator requirements for ion fast ignition
Logan, G.; Jan. 26, 1998; 37p; In English; 15th; International workshop on high energy density in matter
Report No.(s): DE98-057749; UCRL-JC-129618; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Fast ignition (fast heating of DT cores afief compression) reduces driver energy (by 10 X or more) by reducing the implosion velocity and energy for a given fuel compression ratio. For any type of driver that can deliver the ignition energy fast enough, fast ignition increases the target gain compared to targets using fast implosions for central ignition, as long as the energy to heat the core after compression is comparable to or less than the slow compression energy, and as long as the coupling efficiency of the fast ignitor beam to heat the core is comparable to the overall efficiency of compressing the core (in terms of beam energy-to-DT-efficiency). Ion driven fast ignition, compared to laser-driven fast ignition, has the advantage of direct (dE/dx) deposition of beam energy to the DT, eliminating inefficiencies for conversion into hot electrons, and direct ion heating also has a more favorable deposition profile with the Bragg-peak near the end of an ion range chosen to be deep inside a compressed DT core. While Petawatt laser experiments at LLNL have demonstrated adequate light-to-hot-electron conversion efficiency, it is not yet known if light and hot electrons can channel deeply enough to heat a small portion of a 1000 x LD compressed DT core to ignition. On the other hand, lasers with chirped-pulse amplification giving thoUSAnd-fold pulse compressions have been demonstrated to produce the short pulses, small focal spots and Petawatt peak powers approaching those required for fast ignition, whereas ion accelerators that can produce sufficient beam quality for similar compression ratios and focal spot sizes of ion bunches have not yet been demonstrated, where an imposed coherent velocity tilt plays the analogous role for beam compression as does frequency chirp with lasers. Accordingly, it is the driver technology, not the target coupling physics, that poses the main challenge to ion-driven fast ignition. As the mainline HIF program is concentrating on induction linacs, the purpose of this memo is to explore possible new features and characteristic parameters that induction linacs would need to meet the stringent requirements for beam quality and compression (sufficiently low longitudinal and transverse thermal spread) for ion driven fast ignition. Separately, Ed Lee at LBNL is looking at heavy-ion synchrotrons to meet similar fast ignition requirements. Parameters relating to cost (e.g, total beam-line length and transport quads, total core volt-seconds and power switching) have to be considered in addition to meeting the challeng-

ing beam quality requirements for fast ignition compared to conventional HIF. The aim of this preliminary study is to motivate, after critical debate, taking a next step to do more detailed designs, particle simulations, and experimental tests of the most critical accelerator elements and focusing optics, to further assess the feasibility of ion-driven fast ignition.
NTIS
Ion Accelerators; Ignition; Linear Accelerators

19990041855 Texas Univ., Austin, TX USA
Radiative corrections to the decays K(sub L)(sup 0)(r-arrow)e(+)e(-) and K(su L)(sup 0)(r-arrow)(mu)(+)(mu)(-)
Dicus, D. A.; Repko, W. W.; Dec. 31, 1998; 13p; In English
Report No.(s): DE99-001483; DOE/ER/40757-118; UTEXAS-HEP-98-17; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors calculate the rates and lepton ((ell)) invariant mass distributions for decays of the form 0(+)(r-arrow) (ell)(+)(ell)(-)(gamma), which are important radiative corrections to the purely leptonic decays 0(-/+)(r-arrow) (ell)(+)(ell)(-). The approach uses the loop diagrams which arise by including the two photon intermediate state and they retain the imaginary parts of the loops--a radiative extension of the unitarity bound for the process. These results are compared with those obtained using a model in which the meson couples directly to the leptons.
NTIS
Correction; Radioactive Decay

19990041977 North Carolina State Univ., Dept. of Physics, Raleigh, NC USA
Theoretical nuclear reaction and structure studies using hyperons and photons ***Final Report***
Cotanch, S. R.; Dec. 31, 1998; 14p; In English
Report No.(s): DE99-001294; DOE/ER/40461-10; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report details research progress and results obtained during the ten period from June 1, 1988 through May 31, 1998. In compliance with grant requirements the Principal Investigator, Professor Stephen R. Cotanch, has conducted a research program addressing theoretical investigations of reactions involving hyperons and photons. The Principal Investigator has devoted to this program 50% of his time during the academic year and 100% of this time in the summer. Highlights of significant research results are briefly summarized in this report which respectively correspond to the three sub-programs of this project.
NTIS
Hyperons; Nuclear Reactions; Photons; Photonuclear Reactions

19990042323 Rutherford Appleton Lab., Chilton, UK
The MuSR User Guide
King, P. J. C.; Cottrell, S. P., Rutherford Appleton Lab., UK; Lord, J. S., Rutherford Appleton Lab., UK; Scott, C. A., Rutherford Appleton Lab., UK; Kilcoyne, S. H., Rutherford Appleton Lab., UK; Jul. 28, 1998; ISSN 1358-6254; 72p; In English
Report No.(s): RAL-TR-1998-017; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX110QX, UK), Hardcopy, Microfiche

This User Guide is intended to be a practical manual to help users of MuSR set up and run an experiment on the instrument. It contains details of all the main procedures. Included is information on setting up the experiment and the MuSR area interlocks. A description of the MuSR spectrometer is included. The sample environment is described, including use of the dilution refrigerator, the orange cryostat, the closed-cycle refrigerator (CCR), and the furnace. The use of magnetic fields are described, specifically, the zero field, the calibration, and the applied fields. The instructions on the muon beam spot size, the event rate and the how to steer the beam are reviewed. A short guide to the computing facilities available to the users is included. Data acquisition procedures and data analysis procedures available to the users are described. Included also is a description of the utility programs available. Following these brief descriptions of the computing capability is a more detailed description of the data acquisition system (i.e., MCS) and the data analysis systems (i.e., UDA). Following these sections is a description of the other components of the muon beamlines, i.e., the beamline power supplies, the separator, the kicker, and the photomultiplier tubes. After the description of the other components, are sections on troubleshooting, contact points and sources about the ISIS muon beam lines, and local information.
CASI
Manuals; Muons; Spectrometers

19990042337 Los Alamos National Lab., NM USA
Supporting technologies for a long-pulse spallation source
Russell, G. J.; Weinacht, D. J.; Ferguson, P. D.; Pitcher, E. J.; Court, J. D.; Dec. 31, 1998; 5p; In English
Report No.(s): DE99-001268; LA-UR-98-2607; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a two-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The project is directed toward the development of the technologies required for a long-pulse, spallation neutron source (LPSS). Traditionally, spallation neutron sources have used proton accelerators that provide intense, short ((le) 1(micro) s) pulses of high-energy protons to a spallation target. A LPSS uses a proton pulse with longer time duration ((approximately) 1 ms) and offers the possibility of achieving very high spallation neutron fluxes at substantially lower cost. The performance of a LPSS is very dependent on the neutronic performance of the target-moderator system. A detailed study of this performance has been carried out using Monte Carlo simulations. It should be noted that a LPSS is optimally suited to a fully coupled moderator. Neutron production per proton from such a moderator is a factor of five to seven greater than that produced by moderators used at short pulse sources. The results of these efforts have been published in a series of articles.
NTIS
Spallation; Neutron Sources; Pulses

19990042340 Los Alamos National Lab., NM USA
Development of an automated core model for nuclear reactors
Mosteller, R. D.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-001260; LA-UR-98-2650; 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 objective of this project was to develop an automated package of computer codes that can model the steady-state behavior of nuclear-reactor cores of various designs. As an added benefit, data produced for steady-state analysis also can be used as input to the TRAC transient-analysis code for subsequent safety analysis of the reactor at any point in its operating lifetime. The basic capability to perform steady-state reactor-core analysis already existed in the combination of the HELIOS lattice-physics code and the NESTLE advanced nodal code. In this project, the automated package was completed by (1) obtaining cross-section libraries for HELIOS, (2) validating HELIOS by comparing its predictions to results from critical experiments and from the MCNP Monte Carlo code, (3) validating NESTLE by comparing its predictions to results from numerical benchmarks and to measured data from operating reactors, and (4) developing a linkage code to transform HELIOS output into NESTLE input.
NTIS
Nuclear Reactors; Reactor Cores

19990042345 Los Alamos National Lab., Theoretical Div., NM USA
Adiabatic interpretation of particle creation in a de Sitter universe
Molina-Paris, C.; Jun. 10, 1998; 16p; In English
Report No.(s): DE99-001252; LA-UR-98-2676; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The choice of vacuum state for a quantum scalar field propagating in a de Sitter spacetime (massive and arbitrarily coupled to the gravitational field) is discussed. The problem of finite-time initial conditions for the mode functions is analyzed, as well as how these determine the vacuum state of the quantum system. The principle guiding the choice of vacuum state is the following: one wants the vacuum contribution to the energy-momentum tensor to contain all the ultraviolet divergent terms, so that the particle creation terms are finite, and covariantly conserved. There is a suitable set of modes (instantaneous adiabatic basis) in which this splitting of the expectation value of the energy-momentum tensor can be carried out. Numerical results are presented for different finite-time initial conditions (m = 0.6, (zeta) = 1/6). The nature of the particle creation effect is described and its relationship to the concept of a horizon crossing time is shown. These numerical results imply that back-reaction can be important and should be the subject of further research.
NTIS
Particle Production; Space-Time Functions; Scalars

19990042357 Lawrence Livermore National Lab., Livermore, CA USA
New Monte Carlo Simulations of the LLNL Pulsed-Sphere Experiments
Marchetti, A. A.; Jul. 01, 1998; 119p; In English
Report No.(s): DE98-058821; UCRL-ID-131461; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

From the late 1960s to about 1985, the Pulsed-Sphere Program at Lawrence Livermore National Laboratory (LLNL) was carried out to measure 14-MeV neutron leakage spectra from target spheres made out of various elements, compounds, and mixtures. Data from these experiments have been and continue to be fundamental in the evaluation of neutron Monte Carlo transport codes and cross section data libraries. In addition, the data provide important integral information for stockpile stewardship, fusion technology, neutron therapy, and other applications. Therefore, comparisons between computer Monte Carlo simulations and the results of these experiments are pivotal for the integral testing of processed nuclear data libraries and transport codes. In the past years, there has been a remarkable improvement in computer performance that allows for more realistic simulations by Monte Carlo codes such as TART 4. Previous TART simulations of the pulsed-sphere experiments were performed using simplified models with relatively small numbers of histories and very large solid angle detectors to offset the limitations in computer power. These factors prompted a study to simulate in more detail all of the available pulsed-sphere experiments using the Monte Carlo transport code, TART, and the LLNL evaluated neutron data library, ENDL. The timing of this study is significant because many years have passed since those experiments were done, and only a few people who participated in them are still working at LLNL. Their help has been essential for an accurate documentation of the experiments. For the Stewardship Program it is important to preserve and make use of as much of the data as possible, because it represents a unique resource and an enormous effort that would be very costly to reproduce. The initial part of this study consisted of an analysis of the experimental setup and neutron source characteristics necessary to create the foundation for a TART input file. The next task was to create the input files for the various experiments by incorporating particular settings, such as flight path, sphere materials and dimension, etc, to the basic TART input. The results of the TART simulations of these experiments will be used to help assess the quality of evaluated data currently in ENDL. Further, other nuclear libraries, e.g., ENDF/B-VI, JENDL-3, and JEF-2, will be used in the Monte Carlo simulations after being reformatted for TART and other Laboratory codes. Finally, this work will be part of the integral check of the new evaluations being prepared for the Stewardship Barn Book by the LLNL Nuclear Data Group.
NTIS
Monte Carlo Method; Computerized Simulation; Neutron Spectra; Neutron Sources

74
OPTICS

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

19990041162 NASA Goddard Space Flight Center, Greenbelt, MD USA
Narrow Pass-Band Optical Filters for Space-Borne Remote Sensing Applications
Allan, Graham R., NASA Goddard Space Flight Center, USA; Krainak, Michael A., NASA Goddard Space Flight Center, USA; Stephen, Mark A., NASA Goddard Space Flight Center, USA; 1999; 4p; In English; Optical Remote Sensing for the Atmosphere, 21-24 Jun. 1999, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Optical characterisation of 532 nm, 200 pm passband and 1064 nm, I mn passband LkD filters after exposure to proton irradiation, temperature cycling and angle tuning.
Author
Remote Sensing; Proton Irradiation; Narrowband; Optical Filters

19990041475 Lawrence Livermore National Lab., Livermore, CA USA
Wavefront control system for the Keck telescope
Brase, J.; Mar. 01, 1998; 8p; In English; SPIE international symposium on astronomical telescopes and instrumentation
Report No.(s): DE98-058610; UCRL-JC-130919; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The laser guide star adaptive optics system currently being developed for the Keck 2 telescope consists of several major subsystems: the optical bench, wavefront control, user interface and supervisory control, and the laser system. The paper describes the design and implementation of the wavefront control subsystem that controls a 349 actuator deformable mirror for high order correction and tip-tilt mirrors for stabilizing the image and laser positions.
NTIS
Wave Fronts; Control Systems Design; Telescopes

19990041476 Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC USA
Wide baseline optical interferometry with Laser Guide Stars
Gavel, D.; Mar. 01, 1998; 10p; In English; SPIE international symposium on astronomical telescopes and instrumentation
Report No.(s): DE98-058611; UCRL-JC-130920; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Laser guide stars have been used successfully as a reference source for adaptive optics systems. We present a possible method for utilizing laser beacons as sources for interferometric phasing. The technique would extend the sky coverage for wide baseline interferometers and allow interferometric measurement and imaging of dim objects.
NTIS
Interferometry; Laser Guide Stars

19990041773 Lawrence Livermore National Lab., Livermore, CA USA
Observing techniques for astronomical laser guide star adaptive optics
Max, C. E.; Macintosh, B.; Olivier, S. S.; Gavel, D. T.; Friedman, H. W.; May 01, 1998; 8p; In English; SPIE international symposium on astronomical telescopes and instrumentation
Report No.(s): DE98-057709; UCRL-JC-130702; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We discuss astronomical observing requirements and their implementation using sodium-layer laser guide star adaptive optics. Specific issues requiring implementation include: the ability to place the astronomical object at different locations within the field of view; reliable subtraction of Rayleigh-scattered light; efficient focusing; and stable point-spread-function characterization.
NTIS
Astronomy; Laser Guide Stars; Adaptive Optics

19990041783 Lawrence Livermore National Lab., Livermore, CA USA
Interface reaction characterization and interfacial effects in multilayers
Barbee, T. W.; Apr. 01, 1998; 17p; In English
Report No.(s): DE98-057909; UCRL-ID-127976; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The performance of multilayer structures as x-ray, soft x-ray and extreme ultraviolet optics is dependent on the nature of the interfaces between constituent layers. Interfacial structure and the interaction between atoms at interfaces have also been demonstrated to have significant impact on the physical properties of multilayer materials in general and thus on their performance in other applied areas. As short summary of the approaches to characterization of interfaces in multilayer structures is presented as background. Two new techniques for the experimental evaluation of interfacial structure and interfacial structure effects are then considered and examples presented. Model calculations for one of these techniques which support the experimental results are also presented. In conclusion these results are reviewed of and an assessment of their implications relative to multilayer development given.
NTIS
Interfaces; Characterization; Laminates

19990042184 Naval Postgraduate School, Monterey, CA USA
An Infrared Model of R/V POINT SUR Using EOPACE Data
Yong, Tan C.; Mar. 1999; 106p; In English
Report No.(s): AD-A361651; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Infrared polarization techniques to improve the target-background contrast are the subject of much study lately. Polarized infrared images of the research vessel, R/V POINT SUR were taken extensively during the Electro-Optical Propagation Assessment in Coastal Environment (EOPACE) operational period in Mar-Apr 1996 at Point Loma, San Diego. Contrast improvement analysis of these images requires an infrared model of the research vessel. This thesis models the apparent infrared signature of the R/V POINT SUR using ship skin temperature records from the EOPACE measurements. Using a simple geometric model and adopting a pixel-by-pixel approach, the emitted radiation for each pixel surface is calculated from the Planck radiation law. Radiation reflected off the pixel surface is estimated using the polarized SeaRad atmospheric propagation code. The total radiance is compensated for atmospheric transmittance with the Navy Aerosol Model to arrive at the apparent radiance at the sensor. The apparent radiance is translated into apparent temperature for comparison with the recorded images to validate the accuracy of the model. There is moderate agreement between the model and recorded images with 45-50% of the pixels falling within 1.75K of the measured apparent temperatures.
DTIC
Infrared Signatures; Infrared Imagery; Atmospheric Models; Electro-Optics; Aerosols

19990042200 Lawrence Livermore National Lab., Livermore, CA USA
Compact and stable multibeam fiber injector
Collins, L.; Jul. 01, 1998; 11p; In English; International symposium on optical science, engineering, and instrumentation

Report No.(s): DE98-058594; UCRL-JC-130775; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A compact and stable 20-beam injector was built for launching laser light into fibers for Fabry Perot velocity measurements of shock-driven surfaces. The fiber injector uses commercial mounts on mini-rails. Dielectric-coated beamsplitters provide accurate amplitude division. Minimal adjustments for stable operation are permitted by the use of a real-time video-viewer. The video system includes a non-linear camera for CW alignment and a linearized camera with a frame grabber for pulsed measurement and analysis. All 20- injection points are displayed on a single monitor. Optical requirements are given for image relay and magnification. Stimulated Brillouin scattering limitations on high-power are quantified.

NTIS

Optical Fibers; Beam Injection; Solid State Lasers; Beam Splitters; Continuous Radiation; Light Beams; Real Time Operation; Velocity Measurement

19990042229 Osservatorio Astronomico di Brera, Merate, Italy

Perspective for the Use of Replication Techniques for the Manufacture of X-ray Optics for Future Missions

Citterio, O., Osservatorio Astronomico di Brera, Italy; Conconi, P., Osservatorio Astronomico di Brera, Italy; Ghigo, M., Osservatorio Astronomico di Brera, Italy; Mazzoleni, F., Osservatorio Astronomico di Brera, Italy; The Next Generation of X-Ray Observatories; 1997, pp. 107-113; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

To maximize the collecting area of an X ray telescope it is necessary to nest many coaxial and confocal mirror shells. This means that to obtain a light weight X ray telescope it is required to produce very thin and light mirror shells that, once integrated in a suitable mechanical structure, fulfil the required specification. Nowadays the most used technology to obtain thin mirrors shells is the replication technique by nickel electroforming. This technology has been successfully employed for project like SAX, JET-X and XMM. Nevertheless, the high density of the nickel poses some limitation to the possibility of extending the use of this technology for future X ray space missions demanding high collecting area and good angular resolution with low weight of the optics. In this respect the use of SiC for the manufacture of X ray optics appears to be a very attractive technology. by adopting the Chemical Vapor Deposition (CVD) process is possible to produce large diameter thin wall SiC carriers. These are later coated with the reflecting layer by replication on a superpolished gold coated aluminium mandrel using epoxy resin. In the paper we analyse which are the present limits of the nickel electroforming technology and examine some possibilities of improving this technology for future space missions. Moreover we underline the potentiality of using SiC mirrors for the manufacture of large and light X ray optics.

Author

X Ray Astronomy; X Ray Optics; Space Missions; Replicas; Design Analysis

19990042231 NASA Goddard Space Flight Center, Greenbelt, MD USA

Foil Mirrors and Multilayer Developments at Goddard

Serlemitsos, Peter J., NASA Goddard Space Flight Center, USA; The Next Generation of X-Ray Observatories; 1997, pp. 123-131; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

This paper summarizes progress at Goddard toward incorporating refinements into the foil mirror technology that extend its utilization in astronomical research well into the future. The Japan/US collaborative mission ASCA has demonstrated both the strengths of first generation foil mirrors but also the areas where improvements will be needed. A radical change in the way we smooth the foil surface has already been implemented and represents an important first step that has considerably improved the imaging capability of our second generation mirrors. Additional breakthroughs are still needed, however, if foil mirrors are to play a major role in the Next Generation X ray Observatory era. Foil mirrors offer, additionally, a number of attractive attributes as regards the use of multilayers to extend imaging spectroscopy to tens of keV. Preliminary results of multilayers deposited on our new foil reflectors are very encouraging.

Author

Mirrors; X Ray Astronomy; Foils (Materials); Optical Equipment

19990042232 Danish Space Research Inst., Copenhagen, Denmark

Multilayer Mirrors for Future X-ray Missions

Christensen, F. E., Danish Space Research Inst., Denmark; The Next Generation of X-Ray Observatories; 1997, pp. 133-140; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The next generation X ray missions after the currently planned AXAF, XMM, SRG, ASTRO-E and ABRIXAS are destined to include a focusing capability in the hard X ray band above 10 keV. In this paper recently obtained experimental data are shown which demonstrates that state-of-the-art multilayers can be deposited on thin foil substrates relevant for high throughput, hard X ray focusing and imaging telescopes. Taking these experimental data and the thin foil telescope technology developed for the SODART and the ASTRO-E projects as a baseline it is demonstrated that versatile multilayered hard X ray telescope designs can be realized. Three designs are presented. In each case an 8 m focal length is assumed but with different high energy cut offs. These are 55 keV, 69.5 keV and 78.4 keV. It is demonstrated that a multifocus design suitable for the HXT telescopes on the new HTXS mission concept can yield 1500 sq cm at 40 keV using a total of 18 modules. If launched on 6 satellites, as planned, the 3 HXT modules on each satellite has a mass ranging from 59 to 86 kg and will require from 0.2 to 0.3 sq m geometrical aperture on each satellite. The focusing factor as defined by half of the effective area divided by the half power focal area is shown to be more than 1000 at 30 keV and ca. 900 at 40 keV for an assumed Half Power Diameter of 1 arcmin. The Field of View is 7 arcmin (FWHM) at 40 keV and the continuum sensitivity is 10(exp -7) ph/sq cm/sec/keV throughout the energy band from 10 - 80 keV for an observation time of 10(exp 5) sec, a signal to noise ratio of 5, an energy bandwidth of 10% and a Half Power Diameter of 1 arcmin.
Author
X Ray Astronomy; Space Missions; Mirrors; Mission Planning; Optical Equipment; Design Analysis

19990042233 NASA Marshall Space Flight Center, Huntsville, AL USA
Graded Multilayers not Required for Hard X-ray Imaging!
Weisskopf, M. C., NASA Marshall Space Flight Center, USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Joy, M. K., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; The Next Generation of X-Ray Observatories; 1997, pp. 141-145; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

For a given X ray optic, a graded-multilayer coating extends the energy response to higher energies. However, this does not imply that graded multilayers are required for efficient hard X ray focusing. Indeed, smaller X ray optics using conventional coatings provide advantages -- namely, greater effective area per unit mass, less diffractive scattering by surface micro-roughness, and demonstrated feasibility - over larger optics coated with multilayers.
Author
Imaging Techniques; X Ray Imagery; X Ray Optics; X Ray Astronomy; Metal Coatings

19990042234 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
High Resolution X-ray Imaging
Cash, Webster, Colorado Univ., USA; The Next Generation of X-Ray Observatories; 1997, pp. 147-152; In English; See also 19990042217
Contract(s)/Grant(s): NAGw-4803; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Improved image quality is of central importance to the future of X ray astronomy. We show that the optical tolerances necessary to push the quality of grazing incidence telescopes well beyond their current one arcsecond limit, are achievable. We also discuss a new approach to X ray optics that has been under development and is already showing resolution as high a 0.1 arcseconds. We argue that diffraction limited resolution should be considered as a viable goal for a new start among the next generation observatories, and follow the line of reasoning into X ray interferometry as a long term goal.
Author
Imaging Techniques; Image Resolution; X Ray Astronomy; High Resolution; X Ray Imagery

19990042239 Leicester Univ., X-ray Astronomy Group, UK
Microchannel Plate X-ray Optics
Fraser, G. W., Leicester Univ., UK; The Next Generation of X-Ray Observatories; 1997, pp. 191-199; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

This paper briefly summarizes the current state of development of square-pore microchannel plate (MCP) X ray optics, viewed against the requirements of three classes of astronomical X ray telescope: (i) the wide-field-of-view Lobster Eye X ray monitor (ii) the multi-focus hard X ray (10-100 keV) telescope (HXT) and (iii) a speculative 15 m focal length high throughput ”next generation” optic.
Author
X Ray Optics; X Ray Astronomy; Microchannel Plates

19990042359 Lawrence Livermore National Lab., Livermore, CA USA

Large Aperture Fresnel Telescopes/011

Hyde, R. A.; Jul. 16, 1998; 10p; In English

Report No.(s): DE98-058780; UCRL-ID-131320; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

At Livermore we've spent the last two years examining an alternative approach towards very large aperture (VLA) telescopes, one based upon transmissive Fresnel lenses rather than on mirrors. Fresnel lenses are attractive for VLA telescopes because they are launchable (lightweight, packagable, and deployable) and because they virtually eliminate the traditional, very tight, surface shape requirements faced by reflecting telescopes. Their (potentially severe) optical drawback, a very narrow spectral bandwidth, can be eliminated by use of a second (much smaller) chromatically-correcting Fresnel element. This enables Fresnel VLA telescopes to provide either single band (Delta.lambda/lambda approximately 0.1), multiple band, or continuous spectral coverage. Building and fielding such large Fresnel lenses will present a significant challenge, but one which appears, with effort, to be solvable.

NTIS

Apertures; Telescopes; Radio Astronomy

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990041201 Los Alamos National Lab., NM USA

Experimental configuration of direct drive cylindrical implosions on the Omega Laser

Barnes, C. W.; Tubbs, D. L.; Beck, J. B.; Dec. 31, 1998; 16p; In English; Topical conference on high-temperature plasma diagnostics

Report No.(s): DE99-001234; LA-UR-98-2522; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Details about the cylindrical implosions using direct-drive irradiation on the OMEGA Laser facility are provided. The experimental configuration, including orientation, construction, and mounting of the targets is described. An attempt to characterize the modulation transfer function of the primary x-ray framing camera diagnostic results in insufficient exposure contrast but relative agreement with other determinations. The x-ray intensity of the titanium backlighter driven by the 2.5 nsec linear ramp of the laser beams is described, and the relative intensity on film is compared to similar Nova experiments. The parallax effects of different length marker layers of high- opacity dichloropolystyrene is measured, resulting in the conclusion that the marker layer length should be matched to the laser drive illumination profile.

NTIS

Cylindrical Bodies; Implosions; Lasers; Mechanical Drives

19990041204 General Atomics Co., San Diego, CA USA

Comprehensive energy transport scalings derived from DIII-D similarity experiments

Petty, C. C.; Luce, T. C.; Baity, F. W.; Dec. 31, 1998; 7p; In English; 17th; IAEA fusion energy conference

Report No.(s): DE99-001351; GA-A22992; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The dependences of heat transport on the dimensionless plasma physics parameters has been measured for both L-mode and H-mode plasmas on the DIII-D tokamak. Heat transport in L-mode plasmas has a gyroradius scaling that is gyro-Bohm-like for electrons and worse than Bohm-like for ions, with no measurable beta or collisionality dependence; this corresponds to having an energy confinement time that scales like (tau)(sub E) (proportional-to) n(sup 0.5) P(sup -0.5). H-mode plasmas have gyro-Bohm-like scaling of heat transport for both electrons and ions, weak beta scaling, and moderate collisionality scaling. In addition, H-mode plasmas have a strong safety factor scaling ((chi) approximately q(sup 2)) at all radii. Combining these four dimensionless parameter scalings together gives an energy confinement time scaling for H-mode plasmas like (tau)(sub E) (proportional-to) B(sup -1)(rho)(sup -3.15)(beta)(sup 0.03)v(sup -0.42)q(sub 95)(sup -1.43) (proportional-to) I(sup 0.84)B(sup 0.39)n(sup 0.18)P(sup -0.41)L(sup 2.0), which is similar to empirical scalings derived from global confinement databases.

NTIS

Tokamak Devices; Energy Transfer; Scaling Laws

19990041205 General Atomics Co., San Diego, CA USA

Experimental tests of transport models using modulated ECH

DeBoo, J. C.; Kinsey, J. E.; Bravenec, R.; Dec. 31, 1998; 24p; In English; 17th; IAEA fusion energy conference

Report No.(s): DE99-001354; GA-A22982; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Both the dynamic and equilibrium thermal responses of an L-mode plasma to repetitive Electron Cyclotron Heating (ECH) heat pulses were measured and compared to predictions from several thermal transport models. While no model consistently agreed with all observations, the GLF23 model was most consistent with the perturbated electron and ion temperature responses for one of the cases studied which may indicate a key role played by electron modes in the core of these discharges. Generally, the IIF and MM models performed well for the perturbed electron response while the GLF23 and IFS/PPPL models agreed with the perturbed ion response for all three cases studied. No single model agreed well with the equilibrium temperature profiles measured.

NTIS

Temperature Profiles; Temperature Distribution; Dynamic Response; Electron Cyclotron Heating; Heat Transfer

19990041349 Los Alamos National Lab., NM USA

Measurement and simulation of apertures on Z hohlraums

Chrien, R. E.; Matuska, W.; Swenson, F. J.; Dec. 31, 1998; 15p; In English; 12th; Topical conference on high-temperature plasma diagnostics

Report No.(s): DE99-001136; LA-UR-98-2354; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have performed aperture measurements and simulations for vacuum hohlraums heated by wire array implosions. A low-Z plastic coating is often applied to the aperture to create a high ablation pressure which retards the expansion of the gold hohlraum wall. However, this interface is unstable and may be subjects to the development of highly nonlinear perturbations (jets) as a result of shocks converging near the edge of the aperture. These experiments have been simulated using Lagrangian and Eulerian radiation hydrodynamics codes.

NTIS

Apertures; Hohlraums; Vacuum; Simulation

19990041355 General Atomics Co., San Diego, CA USA

Behavior of electron and ion transport in discharges with an internal transport barrier in the DIII-D tokamak

Greenfield, C. M.; Staebler, G. M.; Rettig, C. L.; Dec. 31, 1998; 15p; In English; 17th; IAEA fusion energy conference

Report No.(s): DE99-001201; GA-A22990; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors report results of experiments to further determine the underlying physics behind the formation and development of internal transport barriers (ITB) in the DIII-D tokamak. The initial ITB formation occurs when the neutral beam heating power exceeds a threshold value during the early stages of the current ramp in low-density discharges. This region of reduced transport, made accessible by suppression of long-wavelength turbulence by sheared flows, is most evident in the ion temperature and impurity rotation profiles. In some cases, reduced transport is also observed in the electron temperature and density profiles. If the power is near the threshold, the barrier remains stationary and enclosed only a small fraction of the plasma volume. If, however, the power is increased, the transport barrier expands to encompass a larger fraction of the plasma volume. The dynamic behavior of the transport barrier during the growth phase exhibits rapid transport events that are associated with both broadening of the profiles and reductions in turbulence and associated transport. In some, but not all, cases, these events are correlated with the safety factor q passing through integer values. The final state following this evolution is a plasma exhibiting ion thermal transport at or below neoclassical levels. Typically, the electron thermal transport remains anomalously high. Recent experimental results are reported in which rf electron heating was applied to plasmas with an ion ITB, thereby increasing both the electron and ion transport. Although the results are partially in agreement with the usual (rvec E) x (rvec B) shear suppression hypothesis, the results still leave questions that must be addressed in future experiments.

NTIS

Tokamak Devices; Electron Transfer; Ion Temperature

19990041356 General Atomics Co., San Diego, CA USA

Remote collaboration and data access at the DIII-D National Fusion Facility

Schissel, D. P.; Sep. 30, 1998; 5p; In English; Workshop on remote participation in fusion experiments

Report No.(s): DE99-001202; GA-A22922; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As the number of on-site and remote collaborators has increased, the demands on the DIII-D National Program's computational infrastructure has become more severe. The Director of the DIII-D Program recognized the increased importance of com-

puters in carrying out the DIII-D mission and in late 1997 formed the Data Analysis Programming Group. Utilizing both software and hardware improvements, this new group has been charged with increasing the DIII-D data analysis throughput and data retrieval rate. Understanding the importance of the remote collaborators, this group has developed a long term plan that will allow for fast 24 hour data access (7 x 24) with complete documentation and a set of data viewing and analysis tools that can be run either on the collaborators' or DIII-D's computer systems. This paper presents the group's long term plan and progress to date.
NTIS
Data Retrieval; Tokamak Devices; Information Retrieval; Data Base Management Systems

19990041357 General Atomics Co., San Diego, CA USA
Simple catalytic cell for restoring He leak detector sensitivity on vacuum systems with high D2 backgrounds
BUSAth, J.; Chiu, H. K.; Dec. 31, 1998; 22p; In English; 45th; Annual American Vacuum Society symposium and topical conference
Report No.(s): DE99-001203; GA-A22965; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The DIII-D National Fusion Facility at General Atomics focuses on plasma physics and fusion energy science. The DIII-D tokamak is a 35 cu m toroidal vacuum vessel with over 200 ports for diagnostic instrumentation, cryogenics, microwave heating, and four large neutral beam injectors. Maintaining vacuum in the 10(exp -8) Torr range is crucial for producing high performance plasma discharges. He leak checking the DIII-D tokamak and the neutral beamlines has historically been difficult. D2 is used as the fuel gas in most plasma discharges and neutral beams. After plasma operations, D2 out-gassing from the torus walls and internal beamline components can exceed 10(exp -4) std cc/s. The mass of the D2 molecule (4.028 u) is indistinguishable from that of the He atom (4.003 u) to a standard mass spectrometer leak detector. High levels of D2 reduce leak detector sensitivity and effectively mask the He trace gas signal rendering normal leak checking techniques ineffective. A simple apparatus was developed at GA to address these problems. It consists of a palladium based catalyst cell and associated valves and piping placed in series with the leak detector. This reduces the D2 throughput by a factor greater than 10,000, restoring leak detector sensitivity. This paper will briefly discuss the development of the cell, the physical processes involved, the tests performed to quantify and optimize the processes, and the operational results at DIII-D.
NTIS
Catalysts; Helium; Leakage; Sensitivity; Vacuum Systems; Deuterium; Gas Detectors

19990041358 General Atomics Co., San Diego, CA USA
Outgassing tests on materials used in the DIII-D magnetic fusion tokamak
Holtrop, K. L.; Hansink, M.; Kellman, A. G.; Dec. 31, 1998; 28p; In English; 45th; Annual American Vacuum Society symposium and topical conference
Report No.(s): DE99-001204; GA-A22968; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In order to achieve high performance plasma discharges in the DIII-D magnetic fusion tokamak, impurity levels must be carefully controlled. Since first wall materials can desorb volatile impurities during these discharges, it is important to characterize and control the outgassing of these materials. An outgassing chamber was built to measure the outgassing properties of various materials used in the DIII-D vessel. The results of pump-down tests performed on ATJ graphite, thin Grafoil (reg-sign) gaskets, and MgO coaxial cables will be presented. In addition to pumpdown tests it was desired to study the behavior of the materials at temperatures up to 400 C, which is the maximum temperature to which the DIII-D vessel is baked. The station was modified to include independent heating control of the sample and a simple load-lock chamber.
NTIS
Outgassing; Tokamak Devices; Magnesium Oxides; Nuclear Fusion

19990041467 Department of Energy, Washington, DC USA
Supernova experiments on the Nova Laser
Kane, J.; Arnett, D.; Remington, B. A.; Glendinning, S. G.; Wallace, R.; Dec. 02, 1997; 9p; In English; 2nd; Oak Ridge symposium on atomic and nuclear astrophysics
Report No.(s): DE98-058288; UCRL-JC-129000; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Supernova (SN) 1987A focused attention on the critical role of hydrodynamic instabilities in the evolution of supernovae. to test the modeling of these instabilities, we are developing laboratory experiments of hydrodynamic mixing under conditions relevant to supernovae. Initial results were reported in (l). The Nova laser is used to generate a 10-15 Mbar shock at the interface of a two- layer planar target, which triggers perturbation growth, due to the Richtmyer-Meshkov and Rayleigh-Taylor instabilities as the interface decelerates. This resembles the hydrodynamics of the He-H interface of a Type II supernova at intermediate times, up to a few x 10(exp 3) s. The experiment is modeled using the hydrodynamics codes HYADES and CALE, and the supernova

code PROMETHEUS. Results of the experiments and simulations are presented. New analysis of the bubble velocity is presented, as well as a study of 2D vs. 3D difference in growth at the He-H interface of SN 1987A.
NTIS
Nova Laser System; Supernova 1987A

19990041471 Lawrence Livermore National Lab., Livermore, CA USA
Laser-induced damage initiated on the surface of particle contamination fused silica at 1064 nm
Michlitsch, K. J.; Jun. 01, 1998; 51p; In English
Report No.(s): DE98-058344; UCRL-LR-130583; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
An experimental study was undertaken to quantify the effects of contamination particles on the damage threshold of laser-illuminated fused silica optics and set cleanliness requirements for optics on the beam line of the National Ignition Facility at Lawrence Livermore National Laboratory. Circular contamination particles were sputter-deposited onto fused silica windows which were then illuminated repetitively using a 1064 nm laser. A variety of contaminants were tested including metals, oxides, and organics. Tests were conducted with particles on the input and output surfaces of the window, and the morphological features of the damage were very reproducible. A plasma often ignited at the contamination particle; its intensity was dependent upon the mass of the contaminant. Input surface damage was characteristically more severe than output surface damage. The size of the damaged area scaled with the size of the particle. On a few occasions, catastrophic damage (cracking or ablation of the substrate) initiated on the output surface due to contamination particles on either the input or output surface. From damage growth plots, predictions can be made about the severity of damage expected from contamination particles of known size and material.
NTIS
Laser Damage; Silica Glass; Contamination

19990041473 Lawrence Livermore National Lab., Livermore, CA USA
Diagnosing hot electron production by short pulse, high intensity lasers using photonuclear reactions
Phillips, T.; Jun. 02, 1998; 20p; In English; 12th; Topical conference on high-temperature plasma diagnostics
Report No.(s): DE98-058592; UCRL-JC-129813; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Solid targets irradiated with 10(exp 19) W/sq cm or greater of 1 (mu)m light in picosecond pulses are found to be radioactive. The strongest activities observed are the result of photonuclear reactions in which an energetic photon excites the nucleus sufficiently to produce particle emission leaving a radioactive daughter. The photoreaction cross sections are known for a wide range of nuclei and provide a quantitative measure of the photon flux produced in the target. Both the delayed daughter activities and measurements of the prompt particles emitted in the reaction can be used as diagnostics. Examples of these techniques applied in diagnosing experiments at the Nova laser facility adapted to generate petawatt pulses using chirped pulse amplification will be presented. These results will be compared with bremsstrahlung photon spectra calculated using electron spectra measured in a magnetic spectrograph.
NTIS
Hot Electrons; Pulsed Lasers; High Power Lasers; Photonuclear Reactions; Plasma Diagnostics

19990041474 Lawrence Livermore National Lab., Livermore, CA USA
Detached divertor operation in DIII-D helium plasmas
Hill, D.; May 01, 1998; 17p; In English; 13th; International conference on plasma surface interactions
Report No.(s): DE98-058595; UCRL-JC-130766; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper presents results from operating helium plasmas in DIII-D in which helium gas puffing is used to reduce the peak divertor heat flux by factors of four or more. The threshold density for achieving these conditions is nearly the same as for deuterium plasmas, which is surprising given the fact that lack of chemical sputtering reduces the carbon concentration in the plasma by more than a factor of five. Spectroscopic analysis shows that helium becomes the primary radiation in these plasmas, which is possible because, unlike carbon, it is the primary species present. These plasmas differ from the usual partially detached divertor (PDD) plasmas in that there is no concomitant reduction in target plate ion flux with target plate heat flux in the scrape off later outside the separatrix.
NTIS
Diverters; Tokamak Devices; Helium Plasma

19990041586 General Atomics Co., San Diego, CA USA

H-mode pedestal characteristics in ITER shape discharges on DIII-D

Osborne, T. H.; Burrell, K. H.; Groebner, R. J.; Sep. 30, 1998; 20p; In English; 13th; International conference on plasma surface interactions

Report No.(s): DE99-000499; GA-A-22882; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Characteristics of the H-mode pedestal are studied in Type 1 Edge Localized Modes (ELM) discharges with ITER cross-sectional shape and aspect ratio. The scaling of the width of the edge step gradient region, (delta), which is most consistent with the data is with the normalized edge pressure, ((beta)(sub POL)(sup PED))(sup 0.4). Fits of (delta) to a function of temperature, such as (rho)(sub POL), are ruled out in divertor pumping experiments. The edge pressure gradient is found to scale as would be expected from infinite n ballooning mode theory; however, the value of the pressure gradient exceeds the calculated first stable limit by more than a factor of 2 in some discharges. This high edge pressure gradient is consistent with access to the second stable regime for ideal ballooning for surfaces near the edge. In lower q discharges, including discharges at the ITER value of q, edge second stability requires significant edge current density. Transport simulations give edge bootstrap current of sufficient magnitude to open second stable access in these discharges. Ideal kink analysis using current density profiles including edge bootstrap current indicate that before the ELM these discharges may be unstable to low n, edge localized modes.

NTIS

Tokamak Devices; Plasma Control

19990041589 General Atomics Co., San Diego, CA USA

Observation and control of resistive wall modes

Strait, E. J.; Garofalo, A. M.; Austin, M. E.; Dec. 31, 1998; 18p; In English; 17th; IAEA fusion energy conference

Report No.(s): DE99-001355; GA-A22994; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two approaches to achieving long-time scale stabilization of the ideal kink mode with a real, finite conductivity wall are considered: plasma rotation and active feedback control, DIII-D experiments have demonstrated stabilization of the resistive wall mode (RWM) by sustaining beta greater than the no-wall limit for up to 200 ms, much longer than the wall penetration time of a few ms. These plasmas are typically terminated by an m = 3, n = 1 mode as the plasma rotation slows below a few kHz. Recent temperature profile data shows an ideal Magnetohydrodynamics (MHD) mode structure, as expected for the resistive wall mode at beta above the no-wall limit. The critical rotation rate for stabilization is in qualitative agreement with recent theories for dissipative stabilization in the absence of magnetic islands. However, drag by small-amplitude RWMs or damping of stable RWMs may contribute to an observed slowing of rotation at high beta, rendering rotational stabilization more difficult. An initial open-loop active control experiment, using non-axisymmetric external coils and a new array of saddle loop detectors, has yielded encouraging results, delaying the onset of the RWM.

NTIS

Walls; Feedback Control

19990041606 Oak Ridge National Lab., TN USA

Effects of particle exhaust on neutral compression ratios in DIII-D

Colchin, R. J.; Maingi, R.; Wade, M. R.; Allen, S. L.; Greenfield, C. M.; Aug. 31, 1998; 20p; In English; 13th; International conference on plasma surface interactions

Report No.(s): DE99-000498; GA-A-22865; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper, neutral particles in DIII-D are studied via their compression in the plenum and via particle exhaust. The compression of gas in the plena is examined in terms of the magnetic field configuration and wall conditions. DIII-D compression ratios are observed in the range from 1 to (ge) 1,000. Particle control ultimately depends on the exhaust of neutrals via plenum or wall pumping. Wall pumping or outgassing is calculated by means of a detailed particle balance throughout individual discharges, and its effect on particle control is discussed. It is demonstrated that particle control through wall conditioning leads to lower normalized densities. A two-region model shows that the gas compression ratio (C(sub div) = divertor plenum neutral pressure/torus neutral pressure) can be interpreted in relation to gas flows in the torus and divertor including the pumping speed of the plenum cryopumps, plasma pumping, and the pumping or outgassing of the walls.

NTIS

Neutral Particles; Compression Ratio; Tokamak Devices

19990041669 General Atomics Co., San Diego, CA USA

Recent developments on the high power ECH installation at the DIII-D tokamak

Lohr, J.; Ponce, D.; Callis, R. W.; Doane, J. L.; Ikezi, H.; Sep. 30, 1998; 15p; In English; 23rd; International conference on infrared and millimeter waves

Report No.(s): DE99-000501; GA-A-22963; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The 110 GHz gyrotron installation on the DIII-D tokamak has been upgraded to three tubes in the megawatt class with plans for further upgrades. The latest addition uses a diamond output window. The report describes the installation, plans, and experimental results to date.

NTIS

Tokamak Devices; Installing

19990041673 Los Alamos National Lab., NM USA

Neutron cameras for ITER

Johnson, L. C.; Barnes, C. W.; Batistoni, P.; Dec. 31, 1998; 19p; In English; 12th; Topical conference on high-temperature plasma diagnostics

Report No.(s): DE99-001075; LA-UR-98-2202; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Neutron cameras with horizontal and vertical views have been designed for ITER, based on systems used on JET and TFTR. The cameras consist of fan-shaped arrays of collimated flight tubes, with suitably chosen detectors situated outside the biological shield. The sight lines view the ITER plasma through slots in the shield blanket and penetrate the vacuum vessel, cryostat, and biological shield through stainless steel windows. This paper analyzes the expected performance of several neutron camera arrangements for ITER. In addition to the reference designs, the authors examine proposed compact cameras, in which neutron fluxes are inferred from N-16 decay gammas in dedicated flowing water loops, and conventional cameras with fewer sight lines and more limited fields of view than in the reference designs. It is shown that the spatial sampling provided by the reference designs is sufficient to satisfy target measurement requirements and that some reduction in field of view may be permissible. The accuracy of measurements with N-16 based compact cameras is not yet established, and they fail to satisfy requirements for parameter range and time resolution by large margins.

NTIS

Neutrons; Cameras; Tokamak Devices

19990041679 Swedish Inst. of Space Physics, Uppsala, Sweden

Theoretical and Numerical Study of Non-Linear Interactions Between Electromagnetic Waves and Space Plasma

Eliasson, Bengt, Swedish Inst. of Space Physics, Sweden; December 1998; ISSN 0284-1703; 62p; In English

Report No.(s): IRF-SR-250; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The interaction between plasma and electromagnetic high-frequency waves gives rise to phenomena on many time scales. On a fast, high-frequency time scale electromagnetic waves interact with electrons in the plasma, creating high-frequency electron waves. On a much slower, low-frequency time scale, non-linear processes create particle density fluctuations and ion-acoustic waves in the plasma. This thesis is a numerical study based on the so called Zakharov equations which model the non-linear interaction between high-frequency electromagnetic waves and low-frequency plasma waves on these two time scales. They are derived from a combination of the Navier-Stokes and Maxwell equations. The Zakharov model separates the time scales and makes it possible to analyze certain basic non-linear properties of the plasma. However, the very slow thermal time scale phenomena are neglected altogether. In this thesis one version of the Zakharov equations for magnetized plasma are derived. These equations are simplified into the Zakharov equations for unmagnetized plasma, and computer simulations are made for a simpler one-dimensional version of the equations. The results are compared with known theory and with experimental results.

Author

Electromagnetic Radiation; Plasma Waves; Space Plasmas; Plasma-Electromagnetic Interaction; Wave-Particle Interactions; Plasma-Particle Interactions

19990041717 General Atomics Co., San Diego, CA USA

Plasma pressure and flows during divertor detachment

Schaffer, M. J.; Brooks, N. H.; Boedo, J. A.; Isler, R. C.; Moyer, R. A.; Aug. 31, 1998; 20p; In English; 13th; International conference on plasma surface interactions

Report No.(s): DE99-000500; GA-A-22863; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Magnetohydrodynamics (MHD) theory applied to tokamak plasma scrape-off layer (SOL) equilibria requires Pfirsch-Schlueter current, which, because the magnetic lines are open, normally closes through electrically conducting divertor or limiter

components. During detached divertor operation the Pfirsch-Schlueter current path to the divertor target is sometimes blocked, in which case theory predicts that the plasma develops a poloidal pressure gradient around the upstream SOL and a corresponding parallel flow, in order to satisfy all the conditions of MHD equilibrium. This paper reports the only known examples of detached diverted plasma in the DIII-D tokamak with blocked Pfirsch-Schlueter current, and they show no clear SOL poloidal pressure differences. However, the predicted pressure differences are small, near the limit of detectability with the available diagnostics. In the more usual DIII-D partially detached divertor operation mode, the Pfirsch-Schlueter current appears to never be blocked, and no unusual poloidal pressure differences are observed, as expected. Finally, a local overpressure is observed just inside the magnetic separatrix near the X-point in both attached and detached Ohmically heated plasmas.
NTIS
Diverters; Detachment; Plasma Pressure; Magnetohydrodynamic Flow

19990041770 Lawrence Livermore National Lab., Livermore, CA USA
Electromagnetic acceleration of material from a plate hit by a pulsed electron beam
Garcia, M.; Apr. 16, 1998; 26p; In English; 25th; International conference on plasma science
Report No.(s): DE98-057702; UCRL-JC-130448; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
An intense pulsed electron beam traversing a thin metal plate creates a volume of dense plasma. Current flows in this plasma as a result of the charge and magnetic field introduced by the relativistic electrons. A magnetic field may linger after the electron beam pulse because of the conductivity of the material. This field decays by both diffusing out of the conducting matter and causing it to expand. If the magnetized matter is of low density and high conductivity, it may expand quickly. Scaling laws for this acceleration are sought by analyzing the idealization of a steady axisymmetric flow. This case simplifies a general formulation based on both Euler's and Maxwell's equations. As an example, fluid with conductivity sigma = 80,000 Siemens/m, density (rho) = 8 x 10 (exp -3) kg/cu m, and initially magnetized to B = 1 Tesla can accelerate to v = 10,000 m/s within a distance comparable to L = 1 mm and a time comparable to sigma(mu)L(sup 2) = 100 ns, which is the magnetic diffusion time. If instead, sigma = 8,000 Siemens/m and rho = 8 x 10 (exp -5) kg/cu m then v = 100,000 m/s with a magnetic diffusion time sigma(mu)L(sup 2) = 10 ns. These idealized flows have R(sub M) = sigma(mu) vL = 1, where R(sub M) is the magnetic Reynolds number. The target magnetizes by a thermal electric effect.
NTIS
Electromagnetic Acceleration; Metal Plates; Electron Beams

19990041777 Lawrence Livermore National Lab., Livermore, CA USA
Optical assembly and alignment for the National Ignition Facility project
Hurst, P. A.; Grasz, E. L.; Wong, H.; Schmitt, E. H.; Simmons, M. R.; Dec. 23, 1997; 10p; In English; BIOS '98: an international symposium on biomedical optics
Report No.(s): DE98-057746; UCRL-JC-129821; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Ignition Facility (NIF) will use about 8,000 large optics to carry a high-power laser through a stadium-size building, and will do so on a very tight schedule and budget. The collocated Optics Assembly Building (OAB) will assemble and align, in a clean-room environment, the NIF's large optics, which are the biggest optics ever assembled in such an environment. In addition, the OAB must allow for just-in-time processing and clean transfer to the areas where the optics will be used. by using a mixture of off-the-shelf and newly designed equipment and by working with industry, we have developed innovative handling systems to perform the clean assembly and precise alignment required for the full variety of optics, as well as for postassembly inspection. We have also developed a set of loading mechanisms that safely get the clean optics to their places in the main NIF building.
NTIS
Assembling; Alignment; Optical Equipment

19990041782 Princeton Univ., Plasma Physics Lab., NJ USA
Results from D-T experiments on TFTR and implications for achieving an ignited plasma
Hawryluk, R. J.; Blanchard, W.; Batha, S.; Dec. 31, 1998; 43p; In English; The approach to an ignited plasma, USA
Report No.(s): DE98-057777; PPPL-CFP-3928; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Progress in the performance of tokamak devices has enable not only the production of significant bursts of fusion energy from deuterium-tritium plasmas in the Tokamak Fusion Test Reactor (TFTR) and the Joint European Torus (JET) but, more importantly, the initial study of the physics of burning magnetically confined plasmas. As a result of the worldwide research on tokamaks, the scientific and technical issues for achieving an ignited plasma are better understood and the remaining questions more clearly defined. The principal research topics which have been studied on TFTR are transport, magnetohydrodynamic stability, and energetic particle confinement. The integration of separate solutions to problems in each of these research areas has also been of major

interest. Although significant advances, such as the reduction of turbulent transport by means of internal transport barriers, identification of the theoretically predicted bootstrap current, and the study of the confinement of energetic fusion alpha-particles have been made, interesting and important scientific and technical issues remain. In this paper, the implications for the TFTR experiments for overcoming these remaining issues will be discussed.
NTIS
Tokamak Devices; Fusion Reactors; Ignition

19990041786 Lawrence Livermore National Lab., Livermore, CA USA
Frequency converter design and manufacturing considerations for the National Ignition Facility
Hibbard, R. L.; English, R. E.; De Yoreo, J. J.; Montesanti, R. C.; Mar. 25, 1998; 7p; In English; 1998 diffractive optic and micro optics conference
Report No.(s): DE98-058287; UCRL-JC-130316; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Ignition Facility (NIF), being constructed at Lawrence Livermore National Laboratory (LLNL), comprises 192 laser beams, Figure 1. The lasing medium is neodymium in phosphate glass with a fundamental frequency (1(omega)) of 1.053 (micro)m. Sum frequency generation in a pair of conversion crystals (KDP/KD*P) produces 1.8 Mj of the third harmonic light (3(omega) or (lambda)=0.35). On NIF the frequency conversion crystals are part of the Final Optics Assembly (FOA), whose two principal functions are to convert the laser light to 3(omega) and focus it on target. In addition, the FOA provides a vacuum window to the target chamber, smoothest the on- target irradiance profile, moves the unconverted light away from the target, and provides signals for alignment and diagnostics. The FOA has four Integrated Optics Modules (IOM), Figure 4, each of which contains two 41 cm square crystals are mounted with the full edge support to micro radian angular and micron flatness tolerances. This paper is intended to be an overview of the important factors that affect frequency conversion on NIF. Chief among these are angular errors arising from crystal growth, finishing, and mounting. The general nature of these errors and how they affect frequency conversion, and finally the importance of a frequency conversion metrology tool in assessing converter performance before optomechanical assemblies are installed on NIF will be discussed.
NTIS
Frequency Converters; Manufacturing; Design Analysis

19990041871 Oak Ridge National Lab., TN USA
Assessment of effects of neutrals on the power threshold for L to H transitions in D3-D
Owen, L. W.; Carreras, B. A.; Maingi, R.; Mioduszewski, P. K.; Carlstrom, T. N.; Dec. 31, 1998; 5p; In English; International conference on engineering structural integrity assessment
Report No.(s): DE99-000224; ORNL/CP-99185; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
To assess the effect of edge neutrals on the low-to-high confinement transition threshold, a broad range of plasma discharges has been analyzed. From this analysis, the transition power divided by the density, at constant magnetic field, appears to be a function of a single parameter measuring the neutrals' effect. This results suggest that there is a missing parameter linked to the neutrals in the power threshold scaling laws.
NTIS
Confinement; Magnetic Fields; Plasma Jets; Scaling Laws; Tokamak Devices; Neutral Particles

19990042038 Lawrence Livermore National Lab., Livermore, CA USA
Thermodynamic and Structural Properties of Strongly Coupled Plasma Mixtures from the Perturbative HNC-Equation
Kang, H. S.; Ree, F. H.; Dec. 01, 1997; 9p; In English; International conference on strongly coupled coulomb systems
Report No.(s): DE98-057441; UCRL-JC-127237; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recently, we developed the perturbative hypernetted-chain (PHNC) integral equation which can predict reliable thermodynamic and structural data for a system of particles interacting with either short range or long range (Coulomb) potential. The present work extends this earlier work to mixtures. This is done by employing a reference potential which is designed to satisfy a thermodynamic consistency on the isothermal compressibility as described in the next section. We test the present theory in Sec. III by applying it to plasma mixtures interacting with either an unscreened or a screened Coulomb potential. We made comparisons of results from the present theory with those from the best available theory, i.e., Rosenfeld's density functional theory (DFT). The DFT was shown to give internal energy with three to five figure accuracy compared to a wide range of Monte Carlo data. Meanwhile, small deviations of excess internal energy from the so-called "liner mixing rule" (LMR) are better predicted by a less sophiscated theory like the hypernetted-chain (HNC) equation. This rule relates thermodynamics of an unscreened mixture to those for individual components in a strongly coupled regime where the potential energy of a constituent particle is much larger than its kinetic energy. We also apply the present theory to a H2 + H mixture interacting with Morse potentials. For this system, comparison

of thermodynamic properties and radial distribution functions from the present theory will be made with those from another successful theory of dense fluid, i.e., the HMSA equation of Zerah and Hansen.
NTIS
Thermodynamics; Thermodynamic Properties; Strongly Coupled Plasmas

19990042043 Department of Energy, Office of Energy Research, Washington, DC USA
Coupled Spheromak-Helicity Injector in the Sustained Spheromak Physics Experiment, SSPX
Hooper, E. B.; Apr. 01, 1998; 7p; In English; US-Japan workshop physics base on DHe3 fusion
Report No.(s): DE98-057740; UCRL-JC-130428; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Sustained Spheromak Physics Experiment, now under construction at LLNL, will be sustained by helicity injected from a coaxial plasma source. The ideal MHD (Magnetohydrodynamics) equilibrium of the coupled spheromak and source plasmas is calculated in this report, with the plasma in the injector treated in the force free approximation. The two regions are linked by a current-carrying edge plasma region, with field lines which end on the injector electrodes and a width determined by the ratio of the poloidal flux applied to the injector by external coils and that generated in the spheromak. The safety factor, q, on the magnetic axis and its profile within the spheromak separatrix are determined primarily by the ratio of the external and internal values of lambda = j(sub (vert-bar)(vert-bar))/B and by the internal profile of lambda. The q-profile is expected to have significant effect on the operation of the experiment, particularly on the stability of the equilibrium and the associated magnetic dynamo.
NTIS
Spheromaks; Magnetohydrodynamics; Plasmas (Physics); Plasma Control; Plasma Currents

19990042044 Lawrence Livermore National Lab., Livermore, CA USA
Analysis of Separatrix Plasma Parameters Using Local and Multi-Machine Databases
Porter, G.; May 11, 1998; 8p; In English; International conference on plasma surface interactions
Report No.(s): DE98-057939; UCRL-JC-130757; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The ITER divertor modeling and database expert groups have assembled a scalar database of the edge plasma parameters for existing diverted tokamak devices as a means of enabling scaling studies of the SOL plasma. Data exist from ASDEX, ASDEX-Upgrade, C-MOD, COMPASS-D, DIII-D, JET, JFT-2M, and JT-6OU. We describe the scaling of plasma parameters at the outer midplane obtained from examination of this multi-machine database in this paper. The plasma parameters at the outer midplane are used as a boundary condition for all simulations of the SOL plasma, and hence understanding of the expected value of these parameters is crucial for the successful design of the ITER divertor.
NTIS
Plasmas (Physics); Data Bases; Tokamak Devices; Scaling Laws

19990042069 Rutherford Appleton Lab., Chilton, UK
Electron Acceleration in a Pre-Formed Plasma at 527 nm: TMR Large-Scale Facilities Access Program
Amiranoff, F., Ecole Polytechnique, France; Malka, V., Ecole Polytechnique, France; Salvati, M., Ecole Polytechnique, France; Clark, E. L., Imperial Coll. of Science and Technology, UK; Dangor, A. E., Imperial Coll. of Science and Technology, UK; Krushelnick, K., Imperial Coll. of Science and Technology, UK; Modena, A., Imperial Coll. of Science and Technology, UK; Najmudin, Z., Imperial Coll. of Science and Technology, UK; Santala, M., Imperial Coll. of Science and Technology, UK; Tatarakis, M., Imperial Coll. of Science and Technology, UK; Clayton, C., California Univ., USA; Gordon, D., California Univ., USA; Malka, G., Paris-Sud Univ., France; Neeley, D., Rutherford Appleton Lab., UK; Allott, R., Rutherford Appleton Lab., UK; Collier, J. L., Rutherford Appleton Lab., UK; Danson, C. N., Rutherford Appleton Lab., UK; Djaoui, A., Rutherford Appleton Lab., UK; Edwards, C. B., Rutherford Appleton Lab., UK; Flintoff, P., Rutherford Appleton Lab., UK; Feb. 24, 1999; ISSN 1358-6254; In English
Contract(s)/Grant(s): ERBFMGE-CT950053
Report No.(s): RAL-TR-1999-008; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

This report describes the experiment ”Electron acceleration in a pre-formed plasma at 527 nm.”; carried out at the Central Laser Facility (CLF) from Jan. 5th to Feb. 14th 1998. The experiment, funded by the Framework IV Large Scale Facilities access scheme, was proposed by Dr. F. Amiranoff, LULI, Ecole Polytechnique, France and carried out by visiting researchers from the Laboratory. They were supported by researchers from: Imperial College, London, UK; UCLA, Los Angeles, California, US; University of Orsay, France; and the Central Laser Facility, Rutherford Appleton Laboratory.
Author
Electron Acceleration; Raman Spectra; Emission Spectra; Plasmas (Physics)

19990042075 Rutherford Appleton Lab., Chilton, UK

Spatio-Temporally Resolved Dual Laser Plasma Photoabsorption Studies of Thorium Plasmas with an Extreme UV Continuum Light Source: TMR Large-Scale Facilities Access Program

Costello, J. T., Dublin City Univ., Ireland; McGuinness, C., Dublin City Univ., Ireland; Dardis, L., Dublin City Univ., Ireland; Moloney, C., Dublin City Univ., Ireland; Meighan, O., Dublin City Univ., Ireland; Lewis, C. L. S., Queens Univ., UK; ORourke, R., Queens Univ., UK; MacPhee, A., Queens Univ., UK; Turcu, I. C. E., Rutherford Appleton Lab., UK; Danson, C., Rutherford Appleton Lab., UK; Huntingdon, S., Rutherford Appleton Lab., UK; Takeyasu, N., Rutherford Appleton Lab., UK; Shaikh, W., Rutherford Appleton Lab., UK; Feb. 26, 1999; ISSN 1358-6254; In English

Contract(s)/Grant(s): ERBFMGE-CT950053

Report No.(s): RAL-TR-1999003; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

This report describes the experiment entitled 'Spatio-Temporally Resolved Dual Laser Plasma Photoabsorption Studies of Thorium Plasmas with an Extreme UV Continuum Light Source'; carried out at the Central Laser Facility (CLF) from July 28th to August 25th 1997. The experiment, funded by the Framework IV Large-Scale Facilities Access Scheme, was proposed by Dr. J. T. Costelo, Center for Laser Plasma Research, and carried out by visiting researchers from the Center. They were supported by researchers from Queens University of Belfast and the Central Laser Facility, Rutherford Appleton Laboratory.

Author

Laser Plasmas; Plasmas (Physics); Photoabsorption

19990042076 Los Alamos National Lab., NM USA

Surface roughness statistics and temperature step stress effects for D-T solid layers equilibrated inside a 2 mm beryllium torus

Sheliak, J. D.; Hoffer, J. K.; Dec. 31, 1998; 27p; In English; Target fabrication meeting

Report No.(s): DE99-001240; LA-UR-98-2521; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Solid D-T layers are equilibrated inside a 2 mm diameter beryllium toroidal cell at temperatures ranging from 19.0 K to 19.6 K, using the beta-layering process. The experimental runs consists of multiple cycles of rapid- or slow- freezing of the initially liquid D-T charge, followed by a lengthy period of beta-layering equilibration, terminated by melting the layer. The temperature was changed in discrete steps at the end of some equilibration cycles in an attempt to simulate actual ICF target conditions. High-precision images of the D-T solid-vapor interface were analyzed to yield the surface roughness (sigma)(sub mns) as a sum of modal contributions. Results show an overage (sigma)(sub mns) of 1.3 (+/-) 0.3 (micro)m for layers equilibrated at 19.0 K and show an inverse dependence of (sigma)(sub mns) on equilibration temperature up to 19.525 K. Inducing sudden temperature perturbations lowered (sigma)(sub mns) to 1.0 (+/-) 0.05 (micro)m.

NTIS

Surface Roughness; Toruses; Temperature Effects; Beryllium

19990042077 Los Alamos National Lab., NM USA

Target requirements on the path to ignition

Wilson, D. C.; Bradley, P. A.; Barnes, C. W.; Caldwell, S. E.; Chrien, R. E.; Dec. 31, 1998; 6p; In English; Target fabrication meeting

Report No.(s): DE99-001239; LA-UR-98-2602; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Los Alamos ICF program has made several advances in learning what is required for ignition on NIF. This work continues to focus on beryllium-- understanding why it appears less sensitive to DT ice roughness, the feed- out/feed-in phenomena, applying that understanding to new designs, performing experiments to confirm this mechanism, and studying the effects of joints in beryllium components.

NTIS

Ignition; Laser Targets

19990042188 Princeton Univ., Plasma Physics Lab., NJ USA

Neoclassical transport in quasi-axially symmetric stellarators

Mynick, H. E.; Dec. 31, 1997; 30p; In English

Report No.(s): DE97-051924; PPPL-3229; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The author presents a numerical and analytic assessment of the transport in two quasi-axially symmetric stellarators, including one variant of the MHH2 class of such devices, and a configuration they refer to as NHH2, closely related to MHH2. Monte Carlo simulation results are compared with expectations from established stellarator neoclassical theory, and with some empirical

stellarator scalings, used as an estimate of the turbulent transport which might be expected. From the standpoint of transport, these may be viewed as either tokamaks with large ((delta) (approximately) 1%) but low-n ripple, or as stellarators with small ripple. For NHH2, numerical results are reasonably well explained by analytic neoclassical theory. MHH2 adheres less to assumptions made in most analytic theory, and its numerical results agree less well with theory than those for NHH2. However, for both, the non-axisymmetric contribution to the heat flux is comparable with the symmetric neoclassical contribution, and also falls into the range of the expected anomalous (turbulent) contribution. Thus, it appears effort to further optimize the thermal transport beyond the particular incarnations studied here would be of at most modest utility. However, the favorable thermal confinement relies heavily on the radial electric field. Thus, the present configurations will have a loss cone for trapped energetic ions, so that further optimization may be indicated for large devices of this type.
NTIS
Transport Theory; Stellarators; Axisymmetric Flow

19990042195 Princeton Univ., Plasma Physics Lab., NJ USA
Recent progress in linear and nonlinear studies of toroidal Alfven eigenmode
Fu, G. Y.; Chen, Y.; Budny, R.; Dec. 31, 1997; 10p; In English
Report No.(s): DE97-052375; PPPL-3223; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
TAE modes are studied in linear and nonlinear regimes using several kinetic/MHD hybrid models. It is shown that the stability of TAE mode is largely determined by its radial mode structure. The calculated stability thresholds are correlated well with observations, including the recently observed alpha-driven TAE modes in the TFTR DT experiments. In the nonlinear regime, quasilinear simulations with multiple modes show that the saturation level is enhanced by nonlinear wave-particle resonance overlapping when the linear growth rate exceeds a critical value. A fully self-consistent (delta)f noise reduction method for the 3D particle/MHD hybrid model is developed.
NTIS
Magnetohydrodynamics; Tokamak Devices; Fusion Reactors; Nonlinearity

19990042199 Lawrence Livermore National Lab., Livermore, CA USA
Precision assembly and alignment of large optic modules for the National Ignition Facility
Hurst, P.; Grasz, E.; May 12, 1998; 7p; In English; International conference on engineering design and automation
Report No.(s): DE98-058347; UCRL-JC-130309; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Ignition Facility (NIF), currently under design and construction at Lawrence Livermore National Laboratory (LLNL), will be the world's biggest laser. The optics for the multipass, 192-beam, high-power, neodymium-glass laser will be assembled and aligned in the NIF Optics Assembly Building (OAB), adjacent to the huge Laser and Target Area Building (LTAB), where they will be installed. to accommodate the aggressive schedule for initial installation and activation, rapid assembly and alignment of large aperture optics into line replaceable units (LRUs) will occur through the use of automated handling, semi-autonomous operations, and strict protocols. The OAB will have to maintain rigorous cleanliness levels, achieve both commonality and versatility to handle the various optic types, and allow for just-in-time processing and delivery of the optics into the LTAB without undoing their strict cleanliness and precise alignment. This paper describes the Project's design philosophy of modularity and hardware commonality and presents the many design challenges encountered. It also describes how, by using a mixture of commercially available and newly designed equipment, we have developed unique systems for assembly and alignment, inspection and verification, and LRU loading and transfer.
NTIS
High Power Lasers; Optical Equipment; Construction; Modules; Plant Design

19990042201 Lawrence Livermore National Lab., Livermore, CA USA
Sheath over a finely structured divertor plate
Cohen, R.; May 15, 1998; 16p; In English; International conference on plasma surface interactions
Report No.(s): DE98-058598; UCRL-JC-128903; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The surface of a divertor plate typically has fine structure. Depending on the material - and the duration of exposure to the plasma, the characteristic size of the surface imperfections may vary over a broad range. In this paper, we consider the case where these structures have scale h that is much smaller than the ion gyroradius rho(sub i) but greater than the electron gyroradius rho(sub e). The magnetic field intersects the divertor plate at a shallow angle. The present paper demonstrates that the combination of these two factors, fine surface structures and strongly tilted magnetic field, gives rise to many interesting new phenomena in the sheath. We consider only the plasma part of the problem: given the presence of some structure, what are the consequences in terms of the plasma properties in the vicinity of the surface. We are not addressing the issue of what process has caused the appearance

of the structure. However, once the plasma part of the problem is solved, on could return to the analysis of the wall erosion problem, based on the solution obtained. For the environment of the divertor region of a medium- size tokamak (plasma density n approximately 4 x 10(exp 13) cm(exp -3), plasma temperature T(approximately)50 eV, the magnetic field strength B approximately 2T), one has: rho(sub i) approximately500 micro-m (hydrogen), rho(sub e) approximately 10 micro-m These scales are mention that the Debye radius rho(sub D) is approximately 10 micro-m. We will use the following model of the surface: we assume that it is formed by the randomly distributed cones of height h, with base radius and the distance between neighboring cones both also of order h. This latter assumption means that the number of cones per unit surface area is approximately 1/h(sup 2). With minor modifications, the analysis can be extended to bumps with smooth tops. The approach used in this paper is based on scaling arguments and order of magnitude estimates. Despite its simplicity, it allows one to obtain basic scaling relations and reveal some interesting phenomena. After presenting a theoretical analysis of the plasma interaction with a finely structured surface, we present a brief description of a small-scale dedicated device for experimental studies of this problem.
NTIS
Divertors (Fusion Reactors); Plates (Structural Members); Tokamak Devices; Plasma Sheaths

19990042202 Lawrence Livermore National Lab., Livermore, CA USA
Characterization of fluence limiting defects in hafnia/silica multilayer coatings manufactured for the National Ignition Facility
Wu, Z.; Feb. 05, 1998; 7p; In English; Optical interference coatings topical meeting
Report No.(s): DE98-058622; UCRL-JC-129756; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A variety of microscopic techniques are employed to characterize fluence limiting defects in hafnia/silica multilayer coatings manufactured for the National Ignition Facility.
NTIS
Hafnium Compounds; Defects; Silicon Dioxide

19990042203 Lawrence Livermore National Lab., Livermore, CA USA
Cluster ion beam polishing for inertial confinement fusion target capsules
McEachern, R.; Jun. 09, 1998; 17p; In English; International conference on ion implantation technology
Report No.(s): DE98-058695; UCRL-JC-130683; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Targets for Inertial Confinement Fusion (ICF) typically consist of a hollow, spherical capsule filled with a mixture of hydrogen isotopes. Typically, these capsules are irradiated by short, intense pulses of either laser light ('direct drive') or laser-generated. This compresses and heats the fuel, leading to thermonuclear fusion. This process is highly sensitive to hydrodynamic (e.g., Rayleigh-Taylor) instabilities, which can be initiated by imperfections in the target. Thus, target capsules must be spherical and smooth One of the lead capsule designs for the National Ignition Facility, a 1.8 MJ laser being built at Livermore, calls for a 2-mm-diam capsule with a 150-(micro)m-thick copper-doped beryllium wall. These capsules can be fabricated by sputter depositing the metal onto a spherical plastic mandrel. This results in surfaces with measured Rq's of 50 to 150 nm, as measured with an atomic force microscope For optimal performance the roughness should be below 10 nm rms We have begun studying the use of ion cluster beam polishing as a means of improving the surface finish of as deposited capsules In this approach, a batch of capsules would be agitated in a bounce pan inside a vacuum chamber during exposure to the cluster beam. This would ensure a uniform beam dose around the capsule. We have performed preliminary experiments on both Be flats and on a stationary Be capsule. On the capsule, the measured Rq went from 64 nm before polishing to 15 nm after This result was obtained without any effort at Process optimization.
NTIS
Inertial Confinement Fusion; Ion Beams; Laser Targets; Light Beams; Surface Finishing

19990042204 Lawrence Livermore National Lab., Livermore, CA USA
Beam control and laser characterization for NIF
Boege, S.; Jun. 10, 1998; 8p; In English; Annual meeting of the American Nuclear Society
Report No.(s): DE98-058696; UCRL-JC-129854; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The demanding energy, power, pulse shape, focUSAbility, pointing, and availability requirements placed on the 192 National Ignition Facility (NIF) beams lead to the need for an automatic operation capability that is well beyond that of previous inertial confinement fusion (ICF) lasers. Alignment, diagnostic, and wavefront correction subsystems are integrated in an approach that, by permitting maximal sharing of instrumentation between subsystems, meets performance requirements at a reasonable cost.
NTIS
Inertial Confinement Fusion; Lasers; Automatic Control; Laser Beams

19990042205 Lawrence Livermore National Lab., Livermore, CA USA

Main amplifier power conditioning for the National Ignition Facility

Newton, M.; Jun. 08, 1998; 8p; In English; Annual meeting of the American Nuclear Society

Report No.(s): DE98-058703; UCRL-JC-130975; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Ignition Facility (NIF), being built at Lawrence Livermore National Laboratory (LLNL) will utilize a 18 MJ glass laser to study inertial confinement fusion. This laser will be driven by a power conditioning system which must simultaneously deliver over 260 MJ of electrical energy to the nearly 7700 flashlamps. The power conditioning system is divided into independent modules that store, shape and deliver pulses of energy to the flashlamps. The NIF power conditioning system which is being designed and built by Sandia National Laboratory (SNL) in collaboration with LLNL and industrial partners, is a different architecture from any laser power conditioning system previously built at LLNL. This particular design architecture was chosen as the most cost- effective way to reliably deliver the large amount of energy needed for NIF. This paper will describe the development and design of the NIF power conditioning system. It will discuss the design objectives as well as the key design issues and technical hurdles that are being addressed in an ongoing component development and system validation program being supported by both SNL and LLNL.

NTIS

Inertial Confinement Fusion; Lasers; Power Conditioning; Glass Lasers

19990042212 Los Alamos National Lab., NM USA

Multipurpose TIM-based optical telescope for Omega and the Trident laser facilities

Oertel, J. A.; Murphy, T. J.; Berggren, R. R.; Dec. 31, 1998; 13p; In English; Topical conference on high-temperature plasma diagnostics

Report No.(s): DE99-001228; LA-UR-98-2594; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have recently designed and are building a telescope which acts as an imaging light collector relaying the image to an optical table for experiment dependent analysis and recording. The expected primary use of this instrument is a streaked optical pyrometer for witness plate measurements of Hohlraum drive temperature. The telescope is based on University of Rochester's Ten Inch Manipulator (TIM) which allows compatibility between Omega, Trident, and the NIF lasers. The optics capture a f/7 cone of light, have a field of view of 6 mm, have a spatial resolution of 5 to 7-(micro)m per line pair at the object plane, and are optimized for operation at 280 nm. The image is at a magnification of 11.7x, which is convenient for many experiments, but can be changed using additional optics that reside outside the TIM.

NTIS

Manipulators; Telescopes; Lasers; Imaging Techniques; Design Analysis

19990042301 National Inst. for Fusion Science, Toki, Japan

Kinetic-Magnetohydrodynamic Simulation Study of Fast Ions and Toroidal Alfven Eigenmodes

Todo, Y., National Inst. for Fusion Science, Japan; Sato, T., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 8p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria

Report No.(s): IAEA-CN-69/THP2/22; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Particle-magnetohydrodynamic and Fokker-Planck-magnetohydrodynamic simulations of fast ions and toroidicity-induced Alfven eigenmodes (TAE modes) have been carried out. Alpha particle losses induced by TAE mode are investigated with particle-magnetohydrodynamic simulations. Trapped particles near the passing-trapped boundary in the phase space are also lost appreciably in addition to the counter-passing particles. In Fokker-Planck-magnetohydrodynamic simulation source and slowing-down of fast ions are considered. A coherent pulsating behavior of multiple TAE modes, which occurs in neutral beam injection experiments, is observed when the slowing-down time is much longer than the damping time of the TAE modes and the fast-ion pressure is sufficiently high. For a slowing-down time comparable to the damping time, the TAE modes reach steady saturation levels.

Author

Magnetohydrodynamics; Magnetohydrodynamic Waves; Magnetohydrodynamic Stability; Plasma Control; Toroidal Plasmas

19990042303 National Inst. for Fusion Science, Toki, Japan

Confinement Physics Study in a Small Low-Aspect-Ratio Helical Device CHS

Okamura, S., National Inst. for Fusion Science, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Darrow, D. S., Princeton Plasma Physics Lab., USA; Ejiri, A., Tokyo Univ., Japan; Fujisawa, A., National Inst. for Fusion Science, Japan; Fujiwara, M., 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; Iguchi, H., National Inst. for Fusion Science, Japan; Inoue, N., National Inst. for Fusion Science, Japan; Isobe, M., National Inst. for Fusion Science, Japan; Itoh, K., National Inst. for Fusion Science, Japan; Kado, S., National Inst. for Fusion Science, Japan; Khlopenkov, K., Graduate Univ. for Advanced Studies, Japan; Kondo, T., Graduate Univ. for Advanced Studies, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Lazaros, A., National Technical Univ., Greece; Okamura, S., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 30p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/OV4/5; NIFS-568; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The configuration parameter of the plasma position relative to the center of helical coil winding is very effective one to control the MHD (Magnetohydrodynamic) stability and the trapped particle confinement in Heliotron/Torsatron systems. But these two characteristics are contradictory in this parameter to each other. Inward shifted configuration is favorable for the drift-orbit-optimization but it is predicted unstable with the Mercier criterion. Various physics problems, such as an electric field structure, plasma rotation, MHD phenomena, have been studied in CHS (Compact Helical System) with a compromising intermediate position. With this standard configuration, CHS has supplied experimental results for understanding general toroidal confinement physics and low-aspect-ratio helical systems. In the recent experiments, it was found that the wide range of inward shifted configurations gives stable plasma discharges without any restriction to the special pressure profile. Such enhanced range of operation made it possible to study experimentally the drift-orbit-optimized configuration in the Heliotron/Torsatron systems. The effect of configuration improvement was studied with plasmas in a low collisionality regime.
Author
Magnetohydrodynamics; Magnetohydrodynamic Stability; Trajectory Optimization; Plasma Control; Low Aspect Ratio; Confinement; Heliotrons

19990042304 National Inst. for Fusion Science, Theory and Computer Simulation Center, Toki, Japan
Micro- and Macro-scale Self-organization in a Dissipative Plasma
Skoric, M. M., National Inst. for Fusion Science, Japan; Sato, T., National Inst. for Fusion Science, Japan; Maluckov, A., Nis Univ., Yugoslavia; Jovanovic, M. S., Nis Univ., Yugoslavia; Oct. 1998; ISSN 0915-633X; 14p; In English
Contract(s)/Grant(s): Proj. 01E11
Report No.(s): NIFS-569; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We study a nonlinear three-wave interaction in an open dissipative model of stimulated Raman backscattering in a plasma. A hybrid kinetic-fluid scheme is proposed to include anomalous kinetic dissipation due to electron trapping and plasma wave breaking. We simulate a finite plasma with open boundaries and vary a transport parameter to examine a route to spatio-temporal complexity. An interplay between self-organization at micro (kinetic) and macro (wave/fluid) scales is revealed through quasi-periodic and intermittent evolution of dynamical variables, dissipative structures and related entropy rates. An evidence that entropy rate extrema correspond to structural transitions is found.
Author
Backscattering; Wave Interaction; Anomalies; Plasma Waves; Dynamic Models; Simulation; Electron Plasma

19990042305 National Inst. for Fusion Science, Toki, Japan
LHD-Type Compact Helical Reactors
Sagara, A., National Inst. for Fusion Science, Japan; Watanabe, K. Y., National Inst. for Fusion Science, Japan; Yamazaki, K., National Inst. for Fusion Science, Japan; Motojima, O., National Inst. for Fusion Science, Japan; Fujiwara, M., National Inst. for Fusion Science, Japan; Mitarai, O., Kyushu Tokai Univ., Japan; Imagawa, S., National Inst. for Fusion Science, Japan; Yamanishi, H., National Inst. for Fusion Science, Japan; Chikaraishi, H., National Inst. for Fusion Science, Japan; Kohyama, A., Kyoto Univ., Japan; Matsui, H., Tohoku Univ., Japan; Muroga, T., National Inst. for Fusion Science, Japan; Noda, T., National Research Inst. for Metals, Japan; Ohyabu, N., National Inst. for Fusion Science, Japan; Satow, T., National Inst. for Fusion Science, Japan; Shishkin, A. A., National Science Center, Ukraine; Tanaka, S., Tokyo Univ., Japan; Terai, T., Tokyo Univ., Japan; October 1998; ISSN 0915-633X; 8p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/FTP/03(R); NIFS-565; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

From the point of view of D-T fusion demonstration reactors, the LHD-type (Large Helical Design) helical reactor designs are studied to clarify design issues for realizing compact reactors, where the major radius R should be as small as possible. The LHD concept is characterized by two advantages: (1) simplified superconducting continuous-coil system and (2) efficient closed helical divertor. Therefore, on the basis of physics and engineering results established in the LHD project, which has already started plasma confinement experiments, two possible approaches on reactor designs are investigated: increasing the toroidal field

B(sub 0) in the concept of Force-Free Helical Reactor (FFHR) with a continuous-coil system, and increasing the plasma minor radius a(sub p) in the concept of Modular Heliotron Reactor (MHR) with an efficient closed divertor. Physics and engineering results are presented, including new proposals.
Author
Plasma Control; Divertors (Fusion Reactors); Fusion Reactors; Reactor Design; Heliotrons; Toroidal Plasmas

19990042318 National Inst. for Fusion Science, Toki, Japan
Electron Heat Transport in a Self-Similar Structure of Magnetic Islands
Kanno, Ryutaro, National Inst. for Fusion Science, Japan; Nakajima, Noriyoshi, National Inst. for Fusion Science, Japan; Okamoto, Masao, National Inst. for Fusion Science, Japan; Apr. 1998; ISSN 0915-633X; 10p; In English
Report No.(s): NIFS-547; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A formula for the electron thermal conductivity in a self-similar structure of magnetic islands, e.g. in the edge region of a stellarator equilibrium, has been derived for the collisionless limit. It is described by using the non-Gaussian process with fractal nature. We have shown that the electron thermal conductivity in the edge region is reduced, if magnetic islands are large enough.
Author
Thermal Conductivity; Magnetic Islands; Collisionless Plasmas; Plasma Control; Conductive Heat Transfer; Electrons

19990042355 Lawrence Livermore National Lab., Livermore, CA USA
Role of the NIF in the Development of ICF Applications
Hogan, W.; Apr. 23, 1998; 13p; In English; International conference on emerging nuclear energy systems (ICENES '98)
Report No.(s): DE98-058846; UCRL-JC-130680; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Ignition Facility (NIF) is a 1.8 MJ (at 351 nm), 192 beam laser facility being built at the Lawrence Livermore National Laboratory (LLNL) to achieve inertial fusion ignition in the laboratory. The NIF Project is being designed and built by a team from LLNL, Los Alamos National Laboratory, Sandia National Laboratory, and the University of Rochester. When completed in 2003, it will be a multipurpose facility that will be used for many applications in national security, energy, and the basic sciences. In addition to the National Security Mission, these applications include, for example, electric power generation, space propulsion, and study of basic astrophysical phenomena in the laboratory. Such applications receive benefit both through the state-of-the-art technology developments necessary to build NIF and through specific experiments that will be performed on NIF.
NTIS
Research Facilities; Laser Fusion; Inertial Fusion (Reactor); Plasmas (Physics); Laboratories

19990042356 Lawrence Livermore National Lab., Livermore, CA USA
Toward Higher Order Particle Simulation of Space-Charge-Dominated Beams
Friedman, A.; Jan. 12, 1998; 7p; In English; International conference on numerical simulation of plasmas
Report No.(s): DE98-058835; UCRL-JC-129416; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The intense particle beams to be used as drivers for Heavy Ion Inertial Fusion exhibit dynamics which are dominated by space-charge (abbreviated s-c) forces, rather than by thermal pressure (as in most traditional accelerator applications). Such beams are non-neutral plasmas, and the particle-in-cell technique (with the addition of detailed models for the externally applied fields and the domain geometry) has proven effective in their study. Typically, the applied focusing, bending, and accelerating fields vary rapidly with axial position, while the s-c fields (which are comparable in strength to the applied fields) vary smoothly; it is desirable to avoid using many steps to resolve the applied field variations while still computing accurate orbits. We are exploring high-order particle advance methods and other techniques to enhance the efficiency of these simulations. The earlier stages of this work included initial studies of: sub-cycling of the particle advance relative to the field solution; higher-order time-advance algorithms; force-averaging by integration along approximate orbits; and orbit-averaging. In this paper we describe further progress: (1) development of prescriptions for "smooth" cutoffs of tabulated fringe-field data so as to preserve the convergence of a high-order advance, studied using the realistic-profile model problem described in (2) for a high order advance and the model problem, comparison of both "true" and "approximate" (old-data, non-symplectic) every-substep s-c force application to periodic ("operator-split") s-c force application; and (3) 2-d PIC (WARPxy code) convergence studies of the Candy-Rozmus (C-R) explicit fourth-order symplectic integrator using both "true" (every-substep) s-c and operator-split s-c, and of the leapfrog mover, modeling a transport line with sharp-edged fields.
NTIS
Space Charge; Plasmas (Physics)

19990042358 Lawrence Livermore National Lab., Livermore, CA USA

Safety and Environmental Process for the Design and Construction of the National Ignition Facility

Brereton, S. J.; May 27, 1998; 10p; In English; Annual meeting of the American Nuclear Society

Report No.(s): DE98-058799; UCRL-JC-130860; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Ignition Facility (NIF) is a U.S. Department of Energy (DOE) laser fusion experimental facility currently under construction at the Lawrence Livermore National Laboratory (LLNL). This paper describes the safety and environmental processes followed by NIF during the design and construction activities.

NTIS

Laboratories; Nuclear Research; Research Facilities; Laser Fusion; Inertial Fusion (Reactor)

19990042362 Lawrence Livermore National Lab., Livermore, CA USA

Dielectric Boundary Condition for the Embedded Curved Boundary (ECB) Method

Hewwitt, D.; Jan. 26, 1998; 7p; In English; International conference on numerical simulation of plasmas

Report No.(s): DE98-058723; UCRL-JC-129703; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new version of ECB has been completed that allows nonuniform grid spacing and a new dielectric boundary condition. ECB was developed to retain the simplicity and speed of an orthogonal mesh while capturing much of the fidelity of adaptive, unstructured finite element meshes. Codes based on orthogonal meshes are easy to work with and lead to well-posed elliptic and parabolic problems that are comparatively easy to solve. Generally, othogonal mesh representations lead to banded matrices while unstructured representations lead to more complicated sparse matrices. Recent advances in adapting banded linear systems to massively parallel computers reinforce our opinion that iterative field solutions utilizing banded matrix methods will continue to be competitive. Unfortunately, the underlying ”stair-step” boundary representation in simple orthogonal mesh (and recent Adaptive Mesh Refinement) applications is inadequate. With ECB, the curved boundary is represented by piece-wise-linear representations of curved internal boundaries embedded into the orthogonal mesh. ECB structures are constructed out of the superposition of analytically prescribed building blocks. A link-list AIRFOIL has also been constructed. In the ECB scheme, we first find each intercept of the structure boundary with an I or J grid line is assigned an index K. We store the actual z,y value at the intercept, and the slope of the boundary at that intercept, in arrays whose index K is associated with the corresponding mesh point just inside the structure. In 2-D, a point just outside a structure may have up to 4 intercepts associated with it. We now construct PieceWise Linear Segments (PWLS)-from the slope and intercept-that will serve as the computational boundary-a boundary constructed as a superposition of the analytic elements given as input. The intersection of these PWLSs with other nearby PWLSs define the endpoints. We insist that there be an endpoint within each cell for each sequence of PWLSs coming through that cell. We give directionality to a PWLS by the convention that looking from point 1 to point 2 will place the interior of the structure on the left. This scheme allows the generalization to those boundary structures that do not actually have any mesh points inside a structure. Since these structures are defined by their analytically defined bounding walls, points can always be found that are ”inside” a given wall segment-even though it may, in fact, be outside the opposite bounding segment. Such subgrid geometry is useful, for example, in a gun configuration with a thin electrode, perhaps not parallel to any axes of the orthogonal mesh, in which the electrode simply contributes to an external focusing field.

NTIS

Boundary Conditions; Computational Grids; Grid Generation (Mathematics); Dielectric Properties; Linear Systems

19990042363 Lawrence Livermore National Lab., Livermore, CA USA

Spheromak Path to Fusion Energy

Hooper, E. B.; Apr. 01, 1998; 30p; In English

Report No.(s): DE98-058721; UCRL-ID-130429; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The spheromak is a simple and robust magnetofluid configuration with several attractive reactor attributes including compact geometry, no material center post, high engineering (beta), and sustained steady state operation through helicity injection. Spheromak physics was extensively studied in the US program and abroad (especially Japan) in the 1980s with work continuing into the 1990s in Japan and the UK. Scientific results included demonstration of self-organization at constant helicity, control of the tilt and shift modes by shaped flux conservers, elucidation of the role of magnetic reconnection in the magnetic dynamo, and sustainment of a spheromak by helicity injection. Several groups attained electron temperatures above 100 eV in decaying plasmas, with CTX reaching 400 eV. This experiment had high magnetic field and (approximately 3 T near the symmetry axis) and good confinement. More recently, analysis of CTX found the energy confinement in the plasma core to be consistent with Rechester-Rosenbluth transport in a fluctuating magnetic field, potentially scaling to good confinement at higher electron temperatures. The SPHEX group developed an understanding of the dynamo in sustained spheromaks but in a relatively cold device. These and other physics results provide a foundation for a new ”concept exploration” experiment to study the physics of a hot, sustained spheromak. If

successful, this work leads to a next generation, proof-of-principle program. The new SSPX experiment will address the physics of a large-scale sustained spheromak in a national laboratory (LLNL) setting. The key issue in near term spheromak research will be to explore the possibly deleterious effects of sustainment on confinement. Other important issues include exploring the (beta) scaling of confinement, scaling with Lundquist number S, and determining the need for active current-profile control. Collaborators from universities and other national laboratories are contributing experience from previous work, diagnostics, and physics support. Experiments at PPPL and Swarthmore are being conducted on the physics of magnetic reconnection, yielding physics results which should help advance the confinement work. A spheromak reactor will require steady state operation with the equilibrium fully supported by external coils. Although the present generation of experiments can provide data on the initial stages of the transition from short-pulsed operation, sustainment longer than the wall resistance time will be addressed in the proof-of-principle experiments.
NTIS
Spheromaks; Confinement; Plasmas (Physics); Plasma Control; Beta Factor; Plasma Physics; Plasma Diagnostics

19990042366 National Inst. for Fusion Science, Toki, Japan
Dynamic Behavior Associated with Electric Field Transitions in CHS Heliotron/Torsatron
Fujisawa, A., National Inst. for Fusion Science, Japan; Iguchi, H., National Inst. for Fusion Science, Japan; Lee, S., National Inst. for Fusion Science, Japan; Tanaka, K., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; Yoshimura, Y., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; Okamura, S., National Inst. for Fusion Science, Japan; Idei, H., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Ohdachi, S., National Inst. for Fusion Science, Japan; Morita, S., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Toi, K., National Inst. for Fusion Science, Japan; Sanuki, H., National Inst. for Fusion Science, Japan; Itoh, K., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; Shimizu, A., National Inst. for Fusion Science, Japan; Takagi, 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/EX5/1; NIFS-561; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new kind of oscillatory steady state is discovered in observation of potential with a heavy ion beam probe in Compact Helical System Heliotron/Torsatron. Bulk plasma parameters, such as electron temperature and density profile, change being synchronized with the pulsation of potential. The phenomenon can be regarded as successive transitions between two bifurcative states of the plasma. The pulsation can be self-sustained and create a dynamic steady state in low density plasma with electron cyclotron heating. The cause of phenomenon is associated with the bifurcation nature of radial electric field, that is inherent with toroidal helical plasmas. This paper presents two examples of the phenomenon in different density regimes. Dependence of pulsation characteristics on several parameters is described. The bifurcation property predicted by a neoclassical theory is presented for comparison with the experimental observations.
Author
Heliotrons; Plasma Control; Electric Fields; Plasma Oscillations; Electric Pulses

19990042367 National Inst. for Fusion Science, Toki, Japan
Particle Transport Study with Tracer-Encapsulated Solid Pellet Injection
Sudo, S., National Inst. for Fusion Science, Japan; Khlopenkov, K., Graduate Univ. for Advanced Studies, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; Okamura, S., National Inst. for Fusion Science, Japan; Takahashi, C., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Fujisawa, A., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; 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, K., Kyoto Univ., Japan; Kubo, S., National Inst. for Fusion Science, Japan; Kuramoto, H., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; Morita, S., National Inst. for Fusion Science, Japan; Nishimura, S., Graduate Univ. for Advanced Studies, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Sasao, M., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 8p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/EXP1/18; NIFS-560; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In order to promote particle transport studies, a tracer-encapsulated solid pellet (TESPEL) is proposed to observe the behavior of tracer particles deposited locally. TESPEL consists of polystyrene as an outer part and LiH as an inner core. For proving the

essential concept of the new diagnostics, TESPEL is injected into a neutral-beam-heated plasma of the Compact Helical System. This experiment shows the successful local deposition of the tracer, and the behavior of tracer particles deposited locally in the plasma core region is also observed by a method of charge exchange recombination spectroscopy. Thus, our new diagnostic concept has been proven for the first time from the viewpoints of both the production method of a tracer-encapsulated pellet as well as from the observation of the tracer particles.
Author
Plasma Control; Pellets; Particles; Tracers; Injection; Deposition

19990042405 National Inst. for Fusion Science, Toki, Japan
Nonlinear Simulations of Internal Reconnection Event in Spherical Tokamak
Hayashi, T., National Inst. for Fusion Science, Japan; Mizuguchi, Naoki, National Inst. for Fusion Science, Japan; Watanabe, Tomo-Hiko, National Inst. for Fusion Science, Japan; Sato, Tetsuya, 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/TH3/3; NIFS-570; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Three dimensional magnetohydrodynamic simulations are executed in a full toroidal geometry to clarify the physical mechanisms of the Internal Reconnection Event (IRE), which is observed in the spherical tokamak experiments. The simulation results reproduce several main properties of IRE. The noticeable property in the linear growth of modes are the simultaneous excitation of multiple low n modes, which grow together with the similar growth rates. Spontaneous phase-alignment mechanism among those exited modes is found in the nonlinear stage of the development, which causes bulge-like deformation of torus and subsequent expulsion of heat energy to ambient region.
Author
Magnetohydrodynamics; Tokamak Devices; Simulation; Plasma Control; Plasma Heating

19990042423 Princeton Plasma Physics Lab., Princeton, NJ USA
Highly Radiative Plasmas for Local Transport Studies of Power and Particle Handling in Reactor Regimes
Bell, M. G.; Bell, R. E.; Budny, R.; Bush, C. E.; Hill, K. W.; Nov. 01, 1998; 168p; In English
Report No.(s): DE00-001774; PPPL-3325; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
To study the applicability of artificially enhanced impurity radiation for mitigation of the plasma-limiter interaction in reactor regimes, krypton and xenon gases were injected into the Tokamak Fusion Test Reactor (TFTR) supershots and high-l(subscripti) plasmas. At neutral beam injection (NBI) powers P(subscript B) greater than or equal to 30 MW, carbon influxes (blooms) were suppressed, leading to improved energy confinement and neutron production in both deuterium (D) and deuterium-tritium (DT) plasmas, and the highest DT fusion energy production (7.6 MJ) in a TFTR pulse. Comparisons of the measured radiated power profiles with predictions of the MIST impurity transport code have guided studies of highly-radiative plasmas in the International Thermonuclear Experimental Reactor (ITER). The response of the electron and ion temperatures to greatly increased radiative losses from the electrons was used to study thermal transport mechanisms.
NTIS
Fusion Reactors; Thermonuclear Reactions; Deuterium Plasma

19990042424 Princeton Plasma Physics Lab., Princeton, NJ USA
Linear and Nonlinear Study of Fast Particle Excitation of Alfvn Eigemodes
Berk, H. L.; Chen, Y.; Cheng, C. Z.; Fu, G. Y.; Gorelenkov, N.; Nov. 01, 1998; 740p; In English
Report No.(s): DE00-001773; PPPL-3324; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recent new results concerning toroidicity-induced Alfvn eigenmode (TAE) linear stability and nonlinear amplitude saturation and associated fast ion transport are presented for tokamaks, such as the National Spherical Torus Experiment (NSTX) and the International Thermonuclear Experimental Reactor (ITER), using the numerical codes HINST, NOVA-K, and ORBIT.
NTIS
Excitation; Fusion Reactors; Tokamak Devices; Toroidal Plasmas

19990042425 Princeton Plasma Physics Lab., Princeton, NJ USA

Geometrical Aspects of a Hollow-cathode Magnetron (HCM)

Cohen,; Wang,; Nov. 01, 1998; 728p; In English

Report No.(s): DE00-001771; PPPL-3321; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A hollow-cathode magnetron (HCM), built by surrounding a planar sputtering-magnetron cathode with a hollow-cathode structure (HCS), is operable at substantially lower pressures than its planar-magnetron counterpart. We have studied the dependence of magnetron operational parameters on the inner diameter D and length L of a cylindrical HCS. Only when L is greater than L sub zero, a critical length, is the HCM operable in the new low-pressure regime. The critical length varies with HCS inner diameter D. Explanations of the lower operational pressure regime, critical length, and plasma shape are proposed and compared with a one-dimension diffusion model for energetic or primary electron transport. At pressures above 1 m Torr, an electron-impact ionization model with Bohm diffusion at a temperature equivalent to one-half the primary electron energy and with an ambipolar constraint can explain the ion-electron pair creation required to sustain the discharge. The critical length L sub zero is determined by the magnetization length of the primary electrons.

NTIS

Magnetrons; Hollow Cathodes

19990042426 Princeton Plasma Physics Lab., Princeton, NJ USA

Helicity, Reconnection, and Dynamo Effects

Ji,; Nov. 01, 1998; 556p; In English

Report No.(s): DE00-001758; PPPL-3323; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The inter-relationships between magnetic helicity, magnetic reconnection, and dynamo effects are discussed. In laboratory experiments, where two plasmas are driven to merge, the helicity content of each plasma strongly affects the reconnection rate, as well as the shape of the diffusion region. Conversely, magnetic reconnection events also strongly affect the global helicity, resulting in efficient helicity cancellation (but not dissipation) during counter-helicity reconnection and a finite helicity increase or decrease (but less efficiently than dissipation of magnetic energy) during co-helicity reconnection. Close relationships also exist between magnetic helicity and dynamo effects. The turbulent electromotive force along the mean magnetic field (alpha-effect), due to either electrostatic turbulence or the electron diamagnetic effect, transports mean-field helicity across space without dissipation. This has been supported by direct measurements of helicity flux in a laboratory plasma. When the dynamo effect is driven by electromagnetic turbulence, helicity in the turbulent field is converted to mean-field helicity. In all cases, however, dynamo processes conserve total helicity except for a small battery effect, consistent with the observation that the helicity is approximately conserved during magnetic relaxation.

NTIS

Magnetic Effects; Magnetic Field Reconnection

19990042434 Sandia National Labs., Albuquerque, NM USA

Physics of fast Z pinches

Ryutov, D. D.; Derzon, M. S.; Matzen, M. K.; Jul. 31, 1998; 193p; In English

Report No.(s): DE98-006090; SAND-98-1632; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The spectacular progress made during the last few years in reaching high energy densities in fast implosions of annular current sheaths (fast Z pinches) opens new possibilities for a broad spectrum of experiments, from x-ray generation to controlled thermonuclear fusion and astrophysics. Presently Z pinches are the most intense laboratory X ray sources (1.8 MJ in 5 ns from a volume 2 mm in diameter and 2 cm tall). Powers in excess of 200 TW have been obtained. This warrants summarizes the present knowledge of physics that governs the behavior of radiating current-carrying plasma in fast Z-pinches. This survey covers essentially all aspects of the physics of fast Z pinches: initiation, instabilities of the early stage, magnetic Rayleigh-Taylor instability in the implosion phase, formation of a transient quasi-equilibrium near the stagnation point, and rebound. Considerable attention is paid to the analysis of hydrodynamic instabilities governing the implosion symmetry. Possible ways of mitigating these instabilities are discussed. Non-magnetohydrodynamic effects (anomalous resistivity, generation of particle beams, etc.) are summarized. Various applications of fast Z pinches are briefly described. Scaling laws governing development of more powerful Z pinches are presented.

NTIS

Zeta Pinch; Plasma Currents; Plasma Sheaths

76
SOLID-STATE PHYSICS

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

19990041176 Los Alamos National Lab., NM USA
Polaron: Ground state, excited states, and far from equilibrium
Trugman, S. A.; Bonca, J.; Dec. 31, 1998; 12p; In English; Euroconference on polarons: condensation, pairing, magnetism
Report No.(s): DE99-001206; LA-UR-98-2572; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors describe a variational approach for solving the Holstein polaron model with dynamical quantum phonons on an infinite lattice. The method is simple, fast, extremely accurate, and gives ground and excited state energies and wavefunctions at any momentum k. The method can also be used to calculate coherent quantum dynamics for inelastic tunneling and for strongly driven polarons far from equilibrium.
NTIS
Polarons; Ground State; Excitation

19990041328 NASA Marshall Space Flight Center, Huntsville, AL USA
Protein Crystal Movements and Fluid Flows During Microgravity Growth
Boggon, Titus J., Manchester Univ., UK; Chayen, Naomi E., Manchester Univ., UK; Snell, Edward H., Imperial Coll. of Science Technology and Medicine, UK; Dong, Jun, NASA Marshall Space Flight Center, USA; Lautenschlager, Peter, Manchester Univ., UK; Potthast, Lothar, Dornier-Werke G.m.b.H., Germany; Siddons, D. Peter, Dornier-Werke G.m.b.H., Germany; Stojanoff, Vivian, Brookhaven National Lab., USA; Gordon, Elspeth, European Synchrotron Radiation Facility, France; Thompson, Andrew W., Jean-Pierre Ebel Inst. of Structural Biology, France; Zagalsky, Peter F., European Synchrotron Radiation Facility, France; Bi, Ru-Chang, Royal Holloway and Bedford New Coll., UK; Helliwell, John R., Academia Sinica, China; Philosophical Transactions: Mathematical, Physical and Engineering Sciences; Apr. 15, 1998; ISSN 1364-503X; Volume 356, No. 1739, pp. 811-1061; In English; Sponsored in part by Wellcome Trust and Samuel Hall Fund for Studentship Support
Contract(s)/Grant(s): DE-AC02-76CH-00016; Copyright; Avail: Issuing Activity (The Royal Society, 6 Carlton House Terrace, London SW1Y5AG, UK), Hardcopy, Microfiche

The growth of protein crystals suitable for x-ray crystal structure analysis is an important topic. The quality (perfection) of protein crystals is now being evaluated by mosaicity analysis (rocking curves) and x-ray topographic images as well as the diffraction resolution limit and overall data quality. In yet another study, use of hanging drop vapour diffusion geometry on the IML-2 shuttle mission showed, again via CCD video monitoring, growing apocrustacyanin C(sub 1) protein crystal executing near cyclic movement, reminiscent of Marangoni convection flow of fluid, the crystals serving as ”markers” of the fluid flow. A review is given here of existing results and experience over several microgravity missions. Some comment is given on gel protein crystal growth in attempts to ’mimic’ the benefits of microgravity on Earth. Finally, the recent new results from our experiments on the shuttle mission LMS are described. These results include CCD video as well as interferometry during the mission, followed, on return to Earth, by reciprocal space mapping at the NSLS, Brookhaven, and full X-ray data collection on LMS and Earth control lysozyme crystals. Diffraction data recorded from LMS and ground control apocrustacyanin C(sub 1) crystals are also described. Derived from text
Protein Crystal Growth; Fluid Flow; Microgravity; X Ray Analysis; Crystal Structure; Spaceborne Experiments

19990041468 California Univ., Lawrence Berkeley Lab., Advanced Light Source Div., Berkeley, CA USA
Grain orientation mapping of passivated aluminum interconnect lines with X-ray micro-diffraction
Chang, C. H.; Patel, J. R.; MacDowell, A. A.; Padmore, H. A.; Thompson, A. C.; Dec. 31, 1998; 4p; In English; 1998 international conference on characterization and metrology for ULSI technology
Report No.(s): DE98-058298; LBNL-41018; LSBL-458; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A micro x-ray diffraction facility is under development at the Advanced Light Source. Spot sizes are typically about 1-(micro)m size generated by means of grazing incidence Kirkpatrick-Baez focusing mirrors. Photon energy is either white of energy range 6--14 keV or monochromatic generated from a pair of channel cut crystals. Laue diffraction pattern from a single grain in a passivated 2-(micro)m wide bamboo structured Aluminum interconnect line has been recorded. Acquisition times are

of the order of seconds. The Laue pattern has allowed the determination of the crystallographic orientation of individual grains along the line length. The experimental and analysis procedure used is described, as is the latest grain orientation result. The impact of x-ray micro-diffraction and its possible future direction are discussed in the context of other developments in the area of electromigration, and other technological problems.
NTIS
X Ray Diffraction; Aluminum; Grains

19990041672 Los Alamos National Lab., NM USA
High pressure metallization and amorphization of the molecular crystal Sn(IBr)2
Machavariani, G. Y.; Rozenberg, G. K.; Pasternak, M. P.; Naaman, O.; Taylor, R. D.; Dec. 31, 1998; 10p; In English; 36th; European high pressure research group on molecular and low dimensional systems under pressure, USA
Report No.(s): DE99-001080; LA-UR-98-2270; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An insulator-to-metal transition concurring with amorphization is found in the cubic (Pa(bar 3)) molecular crystal Sn(IBr)2 at P approximately 20 GPa. Measurements were carried out with diamond-anvil cells at pressures up to approximately 30 GPa using resistance measurements, X-ray diffraction (XRD), and Sn-119 Moessbauer spectroscopy (MS). With increasing pressure a new crystalline phase is observed in the 10--23 GPa range; at P approximately 16 GPa a gradual onset of structural disorder is first observed, and full amorphization takes place at P (ge) 21 GPa. Both electronic properties as measured by R(P,T) and MS data are consistent with a gradual growth of disordered (SnI2 Br2)(sub n) polymeric chains, formed by intermolecular I(single-bond)I bonding allowing for electronic delocalization to occur. Upon decompression both XRD and Sn-119 MS show a significant pressure hysteresis.
NTIS
High Pressure; Metallizing; Crystals; Tin Compounds; Iodine Compounds; Bromine Compounds; Amorphous Materials

19990041711 Los Alamos National Lab., Theoretical Div., NM USA
Accelerating the dynamics of infrequent events: Combining hyperdynamics and parallel replica dynamics to treat epitaxial layer growth
Voter, A. F.; Germann, T. C.; Dec. 31, 1998; 17p; In English; Spring meeting of the Materials Research Society
Report No.(s): DE99-000751; LA-UR-98-2136; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

During the growth of a surface, morphology-controlling diffusion events occur over time scales that far exceed those accessible to molecular dynamics (MD) simulation. Kinetic Monte Carlo offers a way to reach much longer times, but suffers from the fact that the dynamics are correct only if all possible diffusion events are specified in advance. This is difficult due to the concerted nature of many of the recently discovered surface diffusion mechanisms and the complex configurations that arise during real growth. Here the authors describe two new approaches for this type of problem. The first, hyperdynamics, is an accelerated MD method, in which the trajectory is run on a modified potential energy surface and time is accumulated as a statistical property. Relative to regular MD, hyperdynamics can give computational gains of more than 10(exp 2). The second method offers a way to parallelize the dynamics efficiently for systems too small for conventional parallel MD algorithms. Both methods exploit the infrequent-event nature of the diffusion process. After an introductory description of these methods, the authors present preliminary results from simulations combining the two approaches to reach near-millisecond time scales on systems relevant to epitaxial metal growth.
NTIS
Replicas; Molecular Dynamics

19990041779 Lawrence Livermore National Lab., Livermore, CA USA
Picosecond nonradiative processes in neodymium-doped crystals and glasses: mechanism for the energy gap law
Bibeau, C.; Payne, S. A.; Mar. 02, 1998; 7p; In English; 13th; Topical meeting on advanced solid-state lasers and radiative processes and dephasing in semiconductors topical meeting
Report No.(s): DE98-057757; UCRL-JC-128623-REV-2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report presents measurements of the (4)G(7/2) emission for 26 nd-doped materials. A model of nonradiative decay based on dipole-dipole energy is developed and found to be supported by the data.
NTIS
Doped Crystals; Neodymium; Glass; Energy Gaps (Solid State)

19990042039 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Microdefects and Self-Interstitial Diffusion in Crystalline Silicon

Knowlton, W. B.; May 31, 1998; 221p; In English

Report No.(s): DE98-057491; LBNL-41865; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this thesis, a study is presented of D-defects and self-interstitial diffusion in silicon using Li ion Li(+) drifting in an electric field and transmission electron microscopy (TEM). Obstruction of Li(+) drifting has been found in wafers from certain but not all FZ p-type Si. Incomplete Li(+) drifting always occurs in the central region of the wafers. This work established that interstitial oxygen is not responsible for hindering Li(+) drifting. TEM was performed on a samples from the partially Li(+) drifted area and compared to regions without D-defects. Precipitates were found only in the region containing D-defects that had partially Li(+) drifted. This result indicates D-defects are responsible for the precipitation that halts the Li(+) drift process. Nitrogen (N) doping has been shown to eliminate D-defects as measured by conventional techniques. Li(+) drifting and D-defects provide a useful means to study Si self-interstitial diffusion. The process modeling program SUPREM-IV was used to simulate the results of Si self-interstitial diffusion obtained from Li(+) drifting experiments. Anomalous results from the Si self-interstitial diffusion experiments forced a re-examination of the possibility of thermal dissociation of D-defects. Thermal annealing experiments that were performed support this possibility. A review of the current literature illustrates the need for more research on the effects of thermal processing on FZ Si to understand the dissolution kinetics of D-defects.

NTIS

Silicon; Interstitials; Crystal Defects

19990042141 Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA

Protein Crystal Growth Under Forced Solution Flow: Experimental Setup and General Response of Lysozyme

Vekilov, P. G., Alabama Univ., USA; Rosenberger, F., Alabama Univ., USA; Journal of Crystal Growth; 1998; ISSN 0022-0248; Volume 186, pp. 251-261; In English

Contract(s)/Grant(s): NAG8-1161; NAG8-1168; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have experimentally studied the effects of solution flow on the growth kinetics of the protein lysozyme. to this end, we have expanded our interferometry setup by a novel crystallization cell and solution recirculation system. This combination permits monitoring of interface morphology and kinetics with a depth resolution of 200 A at bulk flow rates of up to 2000 micron/s. Particular attention was paid to the prevention of protein denaturation that is often associated with the pumping of protein solutions. We found that at bulk flow rates it less than 250 microns/s the average growth rate and step velocity, R(sub avg) and upsilon(sub avg) increase with increasing it. This can be quantitatively understood in terms of the enhanced, convective solute supply to the interface. With high-purity solutions, it u greater than 250 microns/s lead to growth deceleration, and, at low supersaturations sigma, to growth cessation. When solutions containing approx. 1% of other protein impurities were used, growth deceleration occurred at any u greater than 0 and cessation in the low sigma experiments was reached at about half the it causing cessation with pure solution. The flow-induced changes in R(sub avg) and upsilon(sub avg) including growth cessation, were reversible and reproducible, independent of the direction of the u-changes and solution purity. Hence, we attribute the deceleration to the convection-enhanced supply of impurities to the interface, which at higher flow rates overpowers the effects of enhanced interfacial solute concentration. Most importantly, we found that convective transport leads to a significant reduction in kinetics fluctuations, in agreement with our earlier expectations for the lysozyme system. This supports our hypothesis that these long-term fluctuations represent an intrinsic response feature of the coupled bulk transport-interfacial kinetics system in the mixed growth control regime.

Author

Protein Crystal Growth; Lysozyme; Experiment Design; Morphology; Kinetics; Crystallization; Biopolymer Denaturation

19990042148 Los Alamos National Lab., NM USA

Effects of magnetization on hole localization and MnO6 octahedra disorder in hole-doped lanthanum manganese perovskites

Booth, C. H.; Brosha, E. L.; Kwei, G. H.; Bridges, F.; Neumeier, J. J.; Dec. 31, 1998; 11p; In English; Euroconference on polarons: condensation, pairing, magnetism

Report No.(s): DE99-001242; LA-UR-98-2531; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors review the distortions of the MnO6 octahedra reduced by magnetization in hole-doped lanthanum manganese perovskites. The systems they consider include the colossal magnetoresistance (CMR) samples La(1-x) Ca(x)MnO3 (x = 0.21, 0.25, 0.30), La(0.76)Ba(0.33)MnO3, and a poorer quality La(0.76)Pb(0.33)MnO3 sample. They also report preliminary work on three samples of oxygen-doped LaMnO(3+(delta)) and a lanthanum-deficient La(0.9)MnO3 sample. They find the same exponential relationship between the removal of the distortion and the sample magnetization in the Ba- and Pb-doped CMR

samples as was found previously for the Ca doped samples. The MnO6 distortion in the oxygen-doped materials is found to slightly reduce below the magnetic transition, although much less so than in the CMR samples. Above T(sub C), the antiferromagnetic LaMnO(3.006) sample shows a softer temperature dependence of the Mn-O bond length distribution broadening. Surprisingly, even this sample shows deviations from thermal (Debye) behavior near T(sub N), possibly due to FM coupling within MnO planes.
NTIS
Magnetization; Manganese Oxides; Doped Crystals; Distortion; Perovskites; Position (Location); Crystal Structure

19990042225 Oxford Univ., Dept. of Physics, Oxford, UK
Superconducting Tunnel Junctions and Calorimeters
Kraus, H., Oxford Univ., UK; The Next Generation of X-Ray Observatories; 1997, pp. 75-80; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Cryogenic detectors exhibit improved energy resolution compared to existing semiconductor detectors. We report on the development of superconducting tunnel junctions for this purpose as well as on calorimeter development.
Author
Calorimeters; Tunnel Junctions; Cryogenics; Superconductivity

19990042332 Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA
Increased Stability in Crystal Growth Kinetics in Response to Bulk Transport Enhancement
Vekilov, Peter G., Alabama Univ., USA; Rosenberger, Franz, Alabama Univ., USA; Physical Review Letters; Mar. 23, 1998; ISSN 0031-9007; Volume 80, No. 12, pp. 2654-2656; In English
Contract(s)/Grant(s): NAG8-1161; NAG8-1168; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

High-resolution interferometry on facets of lysozyme crystals growing under steady external conditions revealed intrinsic kinetics instabilities that occur as fluctuations in the spacing of growth steps. The amplitude of these fluctuations is reduced by forced solution flow. This increased stability is interpreted in terms of the ratio of the characteristic rates of lattice incorporation and bulk transport. Apparently a steady state is approached as an asymptote of a continuous family of unsteady states.
Author
Crystal Growth; Stability; Lysozyme

19990042333 Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA
Intrinsic Kinetics Fluctuations as Cause of Growth Inhomogeneity in Protein Crystals
Vekilov, Peter G., Alabama Univ., USA; Rosenberger, Franz, Alabama Univ., USA; Physical Review E; June 1998; ISSN 1063-651X; Volume 57, No. 6, pp. 6979-6981; In English
Contract(s)/Grant(s): NAG8-950; NAG8-1168; NAG8-1161; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Intrinsic kinetics instabilities in the form of growth step bunching during the crystallization of the protein lysozyme from solution were characterized by in situ high-resolution optical interferometry. Compositional variations (striations) in the crystal, which potentially decrease its utility, e.g., for molecular structure studies by diffraction methods, were visualized by polarized light reflection microscopy. A spatiotemporal correlation was established between the sequence of moving step bunches and the striations.
Author
Protein Crystal Growth; Kinetics; Inhomogeneity; Molecular Structure

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990041504 Michigan Univ., Artificial Intelligence Lab., Ann Arbor, MI USA
Decentralized Decision Making in Concurrent Engineering
Birmingham, William P., Michigan Univ., USA; DAmbrosio, Joseph, Michigan Univ., USA; Intelligent Agents and Their Potential for Future Design and Synthesis Environment; February 1999, pp. 63-82; In English; See also 19990041500; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes a view of concurrent engineering (CE) as a coordinated decision process. This view assumes that engineering design in general, and CE in particular, are fundamentally decentralized processes. Thus, it is important to find ways to coordinate decision making of all participants in any CE activity, while striking a balance between concurrency and coherent action. The main ideas of this talk are: (1) Concurrent engineering and design in general are naturally distributed and decentralized activities. (2) Designers act as decision makers, choosing among design alternatives and other activities, eventually resulting in their taking some action. (3) Preferences are central to this activity. Hierarchical preferences exist and can be exploited to increase concurrency (i.e., decrease design time) and design quality. (4) Design processes result from ”preference-guided” actions taken by designers.
Author
Concurrent Engineering; Decision Making; Distributed Processing

19990041721 National Inst. of Standards and Technology, Economic Assessment Office, Gaithersburg, MD USA
Annotated Bibliography: Works by Staff of the Economic Assessment Office and Its Contractors
Spivack, R. N.; Dec. 1998; 16p
Report No.(s): PB99-130494; NISTIR-6280; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This publication lists an annotated bibliography based on the works by staff of the economic assessment office and its contractors.
NTIS
Government/Industry Relations; Bibliographies; Technology Utilization; Research

19990041722 Office of Management and Budget, Washington, DC USA
Determining Probable and Reasonably Estimable for Environmental Liabilities in the Federal Government. Federal Financial Accounting and Auditing Standards: Technical Release Number 2
Mar. 15, 1998; 28p
Report No.(s): PB99-130130; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This technical release includes two sections and an appendix. Section 1 will help an agency determine whether its environmental contamination meets the definition of probable (i.e., a future outflow of resources will be required to clean up the contamination). Section 2 offers guidance in quantifying an agency’s liability for cleanup. Appendix I lists key laws and regulations relating to environmental contamination.
NTIS
Liabilities; Pollution Monitoring; Environment Management; Environmental Monitoring

19990041724 Interior Dept., Washington, DC USA
Management Control Program Guidance for Acquisition and Property Management, FY 1999
Nov. 1998; 18p
Report No.(s): PB99-126583; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This memorandum supplements the October 23, 1998, guidance and time frames provided by the office of Financial Management (PFM) concerning the Department’s FY 1999 Management Control Program.
NTIS
Financial Management; Management Planning; Management Analysis

19990041768 National Association of Management and Technical Assistance, Center for Improving Mountain Living, Cullawee, NC USA
Select Practices for Economic Development: EDA University Centers
McClure, T.; Eye, K.; Burdg, H.; Harris, T.; Johnson, S.; Jul. 1998; 146p; In English

Report No.(s): PB99-128167; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The EDA University Center Program is unique because it stands at the primary bridge between the critical technologies, research and expertise of American colleges and universities, and the towns and businesses that benefit from the application of these economic development-related resources. Funded by EDA, with substantial matching funds from state, local, and private resources, University Centers provide high-value economic development and technology transfer services to urban and rural communities and businesses. University Centers identify specific economic development needs in their respective states and then work to meet those needs through various forms of technical assistance and applied research. There are 68 Centers in the USA. Successful economic development models created by the Centers often become self-sufficient programs. Results of these successful programs and projects are disseminated to assist other Centers in helping their own clients. This publication is one such method to highlight and disseminate best practices of the centers. The practices contained in the report are from a multistep peer review process of 1997-98 managed by the grantee.

NTIS

Economic Development; Technology Transfer; Universities; Commerce

19990042209 New York State Energy Research and Development Authority, Albany, NY USA

New York State Energy Research and Development Authority Research Projects' Update. Project Status as of March 31, 1998

1998; 464p; In English

Report No.(s): PB99-134124; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created by the State Legislature in 1975 as the entity primarily responsible for planning and conducting energy R&D programs. NYSERDA manages a comprehensive energy research program to help secure the State's future energy supplies, while protecting environmental values and promoting economic growth. NYSERDA's R&D program emphasizes: Promoting energy efficiency to encourage economic development; Expanding use of New York State's own renewable energy resources; and Reducing or mitigating adverse environmental effects associated with energy production and use. NYSERDA's R&D program has five major areas: Industry, Buildings, Energy Resources, Transportation, and Environment. NYSERDA organizes projects within these five major areas based on energy use and supply, and end-use sectors. As a result, cross-cutting issues such as waste management, energy products, and renewable energy technologies, among others, are addressed in several areas of the R&D program. While projects span the entire basic-to-applied research continuum, R&D of technologies and services with potential for timely commercialization and application in New York State are emphasized. The strategies are to adapt federal and other public and private research results for application in New York State and to identify and fill research gaps to meet the State's energy, environmental, and economic needs. Working with New York contractors on energy-related growth opportunities is part of NYSERDA's effort to produce maximum benefits for the State's citizens and businesses.

NTIS

Research and Development; Energy Technology

82
DOCUMENTATION AND INFORMATION SCIENCE

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

19990041165 Los Alamos National Lab., NM USA

Models, controls, and levels of semiotic autonomy

Joslyn, C.; Dec. 31, 1998; 8p; In English; Intelligent systems and semiotics, 1998

Report No.(s): DE99-000629; LA-UR-98-1920; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper the authors consider forms of autonomy, forms of semiotic systems, and any necessary relations among them. Levels of autonomy are identified as levels of system identity, from adiabatic closure to disintegration. Forms of autonomy or closure in systems are also recognized, including physical, dynamical, functional, and semiotic. Models and controls are canonical linear and circular (closed) semiotic relations respectively. They conclude that only at higher levels of autonomy do semiotic properties become necessary. In particular, all control systems display at least a minimal degree of semiotic autonomy; and all systems with sufficiently interesting functional autonomy are semiotically related to their environments.

NTIS

Autonomy; Mathematical Models; Control

19990041177 Los Alamos National Lab., NM USA

Automation of procedure writing for the RLWTF

Farnham, M.; MacDonald, A.; Dec. 31, 1998; 37p; In English; Nuclear Information and Records Management Association symposium

Report No.(s): DE99-001215; LA-UR-98-2500; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In August of 1997, the Radioactive Liquid Waste Treatment Facility (RLWTF) at Los Alamos National Laboratory (LANL) recognized the need to re-engineer document management business process. All nuclear facilities at LANL are required to ensure that both the latest approved revision of controlled documents and any changes to those documents are available to operating personnel at all times. The Nuclear Materials Technology (NMT) Division was also re-engineering its document management business processes and searching for a solution. Both groups contacted several internal and external organizations in search of potential software solutions in use that would meet requirements. This report describes the objectives and features required by the software package, the choice of Procedure Design as the software package, and its implementation.

NTIS

Radioactive Wastes; Liquid Wastes; Waste Treatment

19990041202 Los Alamos National Lab., NM USA

Integrating the digital library puzzle: The library without walls at Los Alamos

Luce, R. E.; Dec. 31, 1998; 9p; In English

Report No.(s): DE99-001247; LA-UR-98-2575; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Current efforts at the Research Library, Los Alamos National Laboratory (LANL), to develop digital library services are described. A key principle of LANL's approach to delivering library information is the integration of products into a common interface and the use of the Web as the medium of service provision. Products described include science databases such as the SciSearch at LANL and electronic journals. Project developments described have significant ramifications for delivering library services over the Internet.

NTIS

Subroutine Libraries (Computers); Data Base Management Systems

19990041444 Science Applications International Corp., Advanced Technology Div., New York, NY USA

A Design Heritage-Based Forecasting Methodology for Risk Informed Management of Advanced Systems

Maggio, Gaspare, Science Applications International Corp., USA; Fragola, Joseph R., Science Applications International Corp., USA; 1999; 9p; In English; Probabilistic Safety Assessment (PSA '99), Aug. 1999, Washington, DC, USA

Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The development of next generation systems often carries with it the promise of improved performance, greater reliability, and reduced operational costs. These expectations arise from the use of novel designs, new materials, advanced integration and production technologies intended for functionality replacing the previous generation. However, the novelty of these nascent technologies is accompanied by lack of operational experience and, in many cases, no actual testing as well. Therefore some of the enthusiasm surrounding most new technologies may be due to inflated aspirations from lack of knowledge rather than actual future expectations. This paper proposes a design heritage approach for improved reliability forecasting of advanced system components. The basis of the design heritage approach is to relate advanced system components to similar designs currently in operation. The demonstrated performance of these components could then be used to forecast the expected performance and reliability of comparable advanced technology components. In this approach the greater the divergence of the advanced component designs from the current systems the higher the uncertainty that accompanies the associated failure estimates. Designers of advanced systems are faced with many difficult decisions. One of the most common and more difficult types of these decisions are those related to the choice between design alternatives. In the past decision-makers have found these decisions to be extremely difficult to make because they often involve the trade-off between a known performing fielded design and a promising paper design. When it comes to expected reliability performance the paper design always looks better because it is on paper and it addresses all the know failure modes of the fielded design. On the other hand there is a long, and sometimes very difficult road, between the promise of a paper design and its fulfillment; with the possibility that sometimes the reliability promise is not fulfilled at all. Decision makers in advanced technology areas have always known to discount the performance claims of a design to a degree in proportion to its stage of development, and at times have preferred the more mature design over the one of lesser maturity even with the latter promising substantially better performance once fielded. As with the broader measures of performance this has also been true for projected reliability performance. Paper estimates of potential advances in design reliability are to a degree uncertain in proportion to the

maturity of the features being proposed to secure those advances. This is especially true when performance-enhancing features in other areas are also planned to be part of the development program.
Derived from text
Forecasting; Reliability; Systems Engineering; Design Analysis; Reliability Analysis; Feasibility Analysis

19990041478 Lawrence Livermore National Lab., Livermore, CA USA
Code development for opacity database
Rozsnyai, B.; Jul. 01, 1998; 18p; In English
Report No.(s): DE98-058634; UCRL-ID-131728; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In connection with Stockpile Stewardship and designing meaningful experiments for the forthcoming NIF laser, the need of establishing a useful opacity database for single elements has become acute. An up-to-date opacity database has several requirements; it has to provide the best state of the art opacities and also it has to be in such a format that it lends itself to an easy calculation of mixture opacities. In view of the anticipated large scale calculations, the second requirement is absolutely essential. After some lengthy considerations the decision was made to establish a new single element opacity database at LLNL. This database will have the temperature and the averaged free electron density as an input grid. The underlying physical thought behind the idea of using the free electron density as an input variable is that under that condition the mixing of single element components is dynamically correct. We investigate the above assertion by presenting calculations for copper and beryllium. Copper and beryllium present an interesting study case because a copper-beryllium mixture is an alternate to the brominated plastic in NIF ICF capsule designs. In Section 11 we present some rudimentary theoretical formulas and in Section III we analyze computational results, as given by the new HOPE opacity code.
NTIS
Data Bases; Opacity

19990041590 Argonne National Lab., IL USA
Uses of the Internet in post-emergency response: Some issues
Herzenberg, C. L.; Dec. 31, 1998; 5p; In English; Post-emergency response issues conference
Report No.(s): DE98-058307; ANL/DIS/CP-97144; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Can the Internet be of value in post-emergency response? The answer is yes, to judge by its use following the Kobe earthquake in Japan and the ice storms in the US and Canada last winter. This will not be a technical account of the Internet, but rather a quick look at some advantages, disadvantages, promising applications, and issues that may arise in using the Internet for post-emergency response.
NTIS
Internets; Emergencies

19990041737 Los Alamos National Lab., NM USA
Threat reduction information management: The TREND (formerly referred to as the US/NIS ExtraNet)
Cernicek, M.; Reams, C. A.; May 31, 1998; 10p; In English
Report No.(s): DE99-001214; LA-UR-98-2478; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Defense programs still play a central role in protecting and defending US interests, while the government has also developed threat reduction programs to reduce dangers posed by the increasing specter of proliferation of weapons of mass destruction (WMD). Like other defense programs, threat reduction programs produce and manage a great deal of information. The programs involve interaction between collaborative partners, foreign and domestic, that act to prevent the spread of WMD. The unhindered flow of information between those involved in these projects is of great importance to the successes of these programs. For the nuclear threat reduction programs, a system with comprehensive access control was needed to support daily business processes, and to capture programmatic information, simplify it, and synthesize it -- the purpose and definition of information management in this case. Using these criteria, the Threat Reduction ExtraNet (TREND) system, formerly referred to as the US/NIS ExtraNet, was created and implemented by Los Alamos National Laboratory to meet the information management needs of threat reduction programs such as the Initiatives for Proliferation Prevention (IPP) program. by supporting this nonproliferation program alone, the TREND system supports US nuclear nonproliferation objectives, and it has enabled new opportunities for enhanced program transparency at many different levels, both in the US and Newly Independent States (NIS) of the Former Soviet Union (FSU).
NTIS
Information Management; Information Systems; Data Base Management Systems

19990041742 Massachusetts Univ., Dept. of Computer and Information Science, Amherst, MA USA

Browsing, Discovery and Search in Large Distributed Databases of Complex and Scanned Documents, ***1 Jan. 1999 - 31 Mar. 1999***

Croft, W. B.; Apr. 14, 1999; 9p; In English

Contract(s)/Grant(s): ARPA ORDER-D570

Report No.(s): AD-A361965; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project aims to integrate powerful, new techniques for interactive browsing, discovery, and retrieval in very large, distributed databases of complex and scanned documents. Emphasis is placed on going beyond full-text retrieval techniques developed in the DARPA TIPSTER program to support different types of access and non-textual content. These techniques should be particularly relevant to the patent domain where it is important to find relationships between documents and where the patent or trademark may be based on a visual design. The specific tasks identified involve studying representation techniques for long documents with complex structure, browsing and discovery techniques for large text databases, image retrieval and scanned document retrieval techniques, and architectures for large, distributed databases.

DTIC

Data Bases; Information Retrieval

19990041962 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Methodology for Application Design Using Information Dissemination and Active Database Technologies

Hartz, Robert H.; Mar. 1999; 89p; In English

Report No.(s): AD-A361617; AFIT/GCS/ENG/99M-08; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In dynamic data environments, the large volume of transactions requires flexible control structures to effectively balance the flow of information between producers and consumers. Information dissemination-based systems, using both data push and pull delivery mechanisms, provide a possible scalable solution for data-intensive applications. In this research, a methodology is proposed to capture information dissemination design features in the form of active database rules to effectively control dynamic data applications. As part of this design methodology, information distribution properties are analyzed, data dissemination mechanisms are transformed into an active rule framework, and the desired reactive behavior is achieved through rule customization. The methodology is applied to dynamic data test case scenarios to demonstrate the design of dissemination-based active rules. The results of applying the methodology to test case scenarios demonstrated that encapsulating information dissemination concepts into active rule structures could provide flexible database control strategies for dynamic data applications.

DTIC

Data Bases; Data Management; Data Transmission

19990041974 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Parallel Data Mining with the Message Passing Interface Standard on Clusters of Personal Computers

Hammack, Lonnie P.; Mar. 1999; 137p; In English

Report No.(s): AD-A361637; AFIT/GCS/ENG/99M-06; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Piles of personal computers (PoPCs) have begun to challenge the performance of the traditional Massively Parallel Processors (MPPs) and the less traditional networks of workstations (NOWs) as platforms for parallel computing. Large clusters of PCs have reached and at times exceeded the performance of modern MPPs at a fraction of the cost. Built with commodity components, these clusters can be constructed for about half the cost of a comparable NOW. The primary competing operating systems (OIS) in use on PoPCs are Linux and Windows NT. This thesis investigation compares the performance of an NT cluster with that of a Linux cluster, a NOW, and an MPP. A comparison of the MPI tools available for NT is also accomplished. These comparisons are made using the Pallas benchmark suite for MPI and a parallel data mining algorithm. This data mining technique, known as the Genetic Rule and Classifier Construction Environment (GRaCCE), uses a genetic algorithm to mine decision rules from data. Results from experimentation and statistical analysis have produced three important conclusions. First, NT clusters are viable, cost effective alternatives to Linux clusters, NOWs, and MPPs for parallel computing. Second, the two primary communication libraries currently available for NT-PaTENT MPI and MPI/Pro-are statistically equivalent in performance. Third, the parallel GRaCCE algorithm is capable of relatively good speedup and efficiency, even for significantly unbalanced processor workloads, if the effects of first loop iteration caching are ignored.

DTIC

Data Processing; Microcomputers; Parallel Processing (Computers); Clusters

19990042040 Oak Ridge Y-12 Plant, TN USA

Characterization Analysis Database System (CADS): A System Overview

Dec. 31, 1997; 48p; In English

Report No.(s): DE98-057569; Y/ES-240; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The CADS database is a standardized, quality-assured, and configuration-controlled data management system developed to assist in the task of characterizing the DOE surplus HEU material. Characterization of the surplus HEU inventory includes identifying the specific material; gathering existing data about the inventory; defining the processing steps that may be necessary to prepare the material for transfer to a blending site; and, ultimately, developing a range of the preliminary cost estimates for those processing steps. Characterization focuses on producing commercial reactor fuel as the final step in material disposition. Based on the project analysis results, the final determination will be made as to the viability of the disposition path for each particular item of HEU. The purpose of this document is to provide an informational overview of the CADS database, its evolution, and its current capabilities. This document describes the purpose of CADS, the system requirements it fulfills, the database structure, and the operational guidelines of the system.

NTIS

Information Systems; Data Base Management Systems; Management Information Systems; Information Management

19990042092 NASA Langley Research Center, Hampton, VA USA

NASA/DOD Aerospace Knowledge Diffusion Research Project. Paper 69: Writing for the Aerospace Industry, Chapter 3, The Practice of Technical and Scientific Communication: Writing in Professional Contexts

Barclay, Rebecca O., Knowledge Management Associates, USA; Pinelli, Thomas E., NASA Langley Research Center, USA; [1997]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The large and complex aerospace industry, which employed approximately 850,000 people in 1994 (Aerospace Facts, 1994-95, p. 11), plays a vital role in the nation's economy. Although only a small percentage of those employed in aerospace are technical communicators, they perform a wide variety of communication duties in government and the private sector.

Derived from text

Aerospace Engineering; Editing; NASA Programs; Information Dissemination

19990042314 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Geoprocessing Data Presentation Techniques ***Tecnicas de Apresentacao de Dados em Geoprocessamento***

Hara, Lauro Tsutomu, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 114p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-6839-TDI/647; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This work analyzes and implements techniques to present geographical data, concentrating on the access to cadastral data stored in a spatial database. The first part of the work includes a theoretical survey, where the main problems related to the visualization of geographic data are reviewed. The second part of the work discusses the implementation of a software module aimed at retrieving and presenting data for Geographic Information Systems (GIS). This system enables the integration of the graphical component of geographical data with its descriptive attributes, and aims at the association of multimedia representations. The results show that the understanding of the geographical reality is improved by the capacity to access new information based on attributes existing in databases, as well as by the interaction between tabular data and graphs available from interfaces. It is shown that the capacity of integration and interaction of data from varying sources, through the GIS technology, enriches the power of observation and analysis.

Author

Geographic Information Systems; Systems Integration; Cadastral Mapping

19990042347 Sandia National Labs., Albuquerque, NM USA

Internet enabled impact limiter material database

Wix, S.; Kanipe, F.; McMurtry, W.; Dec. 31, 1998; 7p; In English; PATRAM '98: 12. international conference on packaging and transportation of radioactive material

Report No.(s): DE98-004288; SAND-98-0066C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents a detailed explanation of the construction of an interest enabled database, also known as a database driven web site. The data contained in the internet enabled database are impact limiter material and seal properties. The technique used in constructing the internet enabled database presented in this paper are applicable when information that is changing in content needs to be disseminated to a wide audience.
NTIS
Internets; Data Bases; Information Systems

19990042373 NASA Ames Research Center, Moffett Field, CA USA
Representation and Integration of Scientific Information
1998; 2p; In English
Contract(s)/Grant(s): NCC2-5247; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The objective of this Joint Research Interchange with NASA-Ames was to investigate how the Tsimmis technology could be used to represent and integrate scientific information. The main goal of the Tsimmis project is to allow a decision maker to find information of interest from such sources, fuse it, and process it (e.g., summarize it, visualize it, discover trends). Another important goal is the easy incorporation of new sources, as well the ability to deal with sources whose structure or services evolve. During the Interchange we had research meetings approximately every month or two. The funds provided by NASA supported work that lead to the following two papers: Fusion Queries over Internet Databases; Efficient Query Subscription Processing in a Multicast Environment.
Derived from text
Information Systems; Information Transfer; Information Retrieval; Information Flow; Technology Transfer; Internet Resources; On-Line Systems

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

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

19990042322 General Accounting Office, National Securiyt and International Affairs Div., Washington, DC USA
Report to the Chairman, Subcommittee on International Security, Proliferation, and Federal Services, Committee on Government Affairs, US Senate. Export Controls: Information on the Decision to Revise High Performance Computer Controls
Sep. 1998; 50p; In English
Report No.(s): GAO/NSIAD-98-196; B-280320; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The U.S. export control policy limits the availability of High Performance Computers (HPCs) through exports to some countries that are deemed to pose a threat to the USA or intra-regional security, and lack commitment to non-proliferation of nuclear weapons. A HPC is defined as a computer with processing speed ranging from 4,000 to over 10,000 million theoretical operations per second (MTOP). The Departments of Commerce and Defense jointly commissioned a study by Stanford University, which was to provide an assessment of the availability of HPCs in selected countries and the capabilities of those countries to use HPCs for military applications. This study was cited in the decision to relax export restrictions to certain countries. The Chairman of the Senate Subcommittee on International Security, Proliferation and Federal Services requested a further study, and recommendations. This study found that the Stanford study did not have adequate analyses of critical issues; empirical data was lacking, as was analysis of the capabilities of countries to use HPCs to further their military programs, or engage in nuclear proliferation. It was recommended that further study be undertaken to assess the national security and proliferation impact on U.S. exports of HPCs to countries of concern. It was urged that the study address how and at what performance levels countries of concern use HPCs for military modernization and proliferation activities as well as the threat to U.S. security, and the extent to which HPCs are controllable. The study recommends the options of requiring government control of export computers at the higher end of the performance levels, and also requiring that lower end HPCs exported to certain countries be modified to preclude the upgrades to higher end performance levels.
CASI
International Trade; Military Technology; Nuclear Weapons; Policies; Security; Supercomputers

85
URBAN TECHNOLOGY AND TRANSPORTATION

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

19990041596 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Study of Urban Growth Near Minning Strip Area Through Remote Sensing, Morphometric Indexes and Geoprocessing Study Case: Congonhas, Minas Gerais, Brazil ***Estudo da Expansao Urbana Proxima a Areas de Mineracao Atraves de Sensoriamento Remoto, Indices Morfometricos e Geoprocessamento: Congohas - MG***
Jardim, Helder, Lages, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 192p; In Portuguese
Report No.(s): INPE-7029-TDI/661; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Strip Minning is one of the human activities that most impacts the environment, modifying the local topography, the vegetation cover, and polluting the hydraulic resources and the atmosphere. Also, due to the great demand for workers, there is a greater concentration of people in the area of the mine. The present work explores an evaluation of urban growth near an iron strip mine, using geoprocessing (morphometric data base) and remote sensing techniques in Congonhas, Minas Gerais, Brazil. The proposed methodology consists of first making maps of declivity, hydrographic frequency, relief amplitude and relief dissecation. Secondly, TM-LANDSAT images were acquired for the years of 1985, 1989 and 1992 and processed with atmospheric correction and linear contrast stretch and registered to identify the urban growth tendencies of Congonhas, between 1985/1989/1992 and to delinitate the area influenced by the minning. An integrated study of Congonhas urban growth was made to suggest a zoning of urban growth near strip mining. From this test, the system (SGI/INPE), which presented some limitations to the work with morphometric data, demonstrates the importance of a multidisciplinary study through remote sensing and geographic information systems technics in the evaluation of the tendencies of urban growth. This work also shows that the multidisciplinary study is fundamental to an urban and municipal planning proposal.
Author
Hydrography; Remote Sensing; Strip Mining; Topography; Urban Planning; Vegetation

88
SPACE SCIENCES (GENERAL)

19990041784 NASA Johnson Space Center, Houston, TX USA
Orbital Debris: A Chronology
Portree, Davis S. F., Editor, NASA Johnson Space Center, USA; Loftus, Joseph P., Jr., Editor, NASA Johnson Space Center, USA; January 1999; 172p; In English
Report No.(s): NASA/TP-1999-208856; NAS 1.60:208856; S-843; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This chronology covers the 37-year history of orbital debris concerns. It tracks orbital debris hazard creation, research, observation, experimentation, management, mitigation, protection, and policy. Included are debris-producing, events; U.N. orbital debris treaties, Space Shuttle and space station orbital debris issues; ASAT tests; milestones in theory and modeling; uncontrolled reentries; detection system development; shielding development; geosynchronous debris issues, including reboost policies: returned surfaces studies, seminar papers reports, conferences, and studies; the increasing effect of space activities on astronomy; and growing international awareness of the near-Earth environment.
Author
Hazards; Orbitals; Observation; Space Debris; Research Management; Protection

19990042245 Lunar and Planetary Inst., Houston, TX USA
In Situ Resource Utilization (ISRU 3) Technical Interchange Meeting: Abstracts
1999; 47p; In English; In-Situ Resource Utilization Technical Interchange, 11-12 Feb. 1999, Denver, CO, USA; Sponsored by Lunar and Planetary Inst., USA; See also 19990042246 through 19990042265
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI-Contrib-963; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Abstracts Only; Abstracts Only

This volume contains abstracts that have been accepted for presentation at the In Situ Resource Utilization (ISRU III) Technical Interchange Meeting, February 11-12, 1999, hosted by the Lockheed Martin Astronautics Waterton Facility, Denver, Colorado.

Administration and publication support for this meeting were provided by the staff of the Publications and Program Services Department at the Lunar and Planetary Institute.
Author
Abstracts; Conferences; Research and Development; Aerospace Technology Transfer; Technology Utilization; Information Flow

19990042316 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Interplanetary Trajectories *Trajetorias Interplanetarias*
Rocco, Evandro Marconi, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 74p; In Portuguese
Report No.(s): INPE-6832-NTC/334; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This work was developed during the course Seminario de Dinamica Orbital 3 (CEA-513). Therefore, we only intend to present the problem of interplanetary trajectories. We used as a base the work of Bonneau and Bernard (1995) which considers the interplanetary transfers using the Patched Conics method.
Author
Interplanetary Trajectories; Orbital Mechanics

89
ASTRONOMY

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

19990041680 Oxford Univ., Dept. of Astrophysics, Oxford, UK
Period Derivative of the M15 X-Ray Binary AC211/X2127+119
Homer, L., Oxford Univ., UK; Charles, P. A., Oxford Univ., UK; 1998; In English
Report No.(s): OUAST/98/16; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd., Oxford, OX1 3RH, UK), Hardcopy, Microfiche

We have combined Rossi X-ray Timing Explorer observations of X2127+119, the low-mass X-ray binary in the globular cluster M15, with archival X-ray lightcurves to study the stability of the 17.1 hr orbital period. We find that the data cannot be fit by the Ilovaisky ephemeris, and requires either a 7.sigma change to the period or a period derivative P prime/P approximately 9 x 10(exp -7)/yr. Given its remarkably low L(sub X)/L(sub opt) such a P prime lends support to models that require super-Eddington mass transfer in a q approximately 1 binary.
Author
X Ray Binaries; Accretion Disks; X Ray Astronomy

19990041681 Oxford Univ., Dept. of Astrophysics, Oxford, UK
The Radio luminosity Function of Radio-Loud Quasars from the 7C Redshift Survey
Willott, Chris J., Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; Blundell, Katherine M., Oxford Univ., UK; Lacy, Mark, Oxford Univ., UK; Aug. 11, 1998; In English
Report No.(s): OUAST/98/14; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd., Oxford, OX1 3RH, UK), Hardcopy, Microfiche

We present a complete sample of 24 radio-loud quasars (RLQs) from the new 7C Redshift Survey. Every quasar with a low-frequency (151 MHz) radio flux-density S(sub 151) is greater than 0.5 Jy in two regions of the sky covering 0.013 sr is included; 23 of these have sufficient extended flux to meet the selection criteria, 18 of these have steep radio spectra (hereafter denoted as SSQs). The key advantage of this sample over most samples of RLQs is the lack of an optical magnitude limit. by combining the 7C and 3CRR samples, we have investigated the properties of RLQs as a function of redshift z and radio luminosity L(sub 151). We derive the radio luminosity function (RLF) of RLQs and find that the data are well fitted by a single power-law with slope alpha(sub 1) = 1.9 +/- 0.1 (for H(sub 0) = 50 km/s.Mpc, OMEGA(sub M) = 1, OMEGA(sub DELTA) = 0). We find that there must be a break in the RLQ RLF at log(sub 10)(L(sub 151)/W Hz.sr) approximately is less than or = 27, in order for the models to be consistent with the 7C and 6C source counts. The z-dependence of the RLF follows a one-tailed gaussian which peaks at z = 1.7 +/- 0.2. We find no evidence for a decline in the co-moving space density of RLQs at higher redshifts. A positive correlation between the radio and optical luminosities of SSQs is observed, confirming a result of Serjeant. We are able to rule out this correlation being due to selection effects or biases in our combined sample. The radio-optical correlation and best-fit model RLF enable us to estimate the distribution of optical magnitudes of quasars in samples selected at low radio frequencies, We con- clude that

for samples with S(sub 151) approximately is less than or = 1 Jy one must use optical data significantly deeper than the POSS-I limit (R approximately equal 20), in order to avoid severe incompleteness.
Author
Quasars; Radio Galaxies; Active Galactic Nuclei; Radio Astronomy; Radio Emission; Line Spectra; Luminosity

19990041844 Oxford Univ., Dept. of Astrophysics, Oxford, UK
Thermal-Infrared Imaging of 3C Radio Galaxies at z approximately 1
Simpson, Chris, Subaru Telescope, USA; Rawlings, Steve, Oxford Univ., UK; Lacy, Mark, Oxford Univ., UK; Feb. 08, 1999; In English
Report No.(s): OUAST/99/5; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3RH, England), Hardcopy, Microfiche

We present the results of a programme of thermal-infrared imaging of nineteen z approx. 1 radio galaxies from the 3CR and 3CRR (LRL) samples. We detect emission at L' (3.8 microns) from four objects; in each case the emission is unresolved at 1-arcsec resolution. Fifteen radio galaxies remain undetected to sensitive limits of L' approx. = 15.5. Using these data in tandem with archived HST data and near-infrared spectroscopy we show that three of the detected 'radio galaxies' (3C 22, 3C 41, and 3C 65) harbor quasars reddened by A(sub v) approx. 5. Correcting for this reddening 3C 22 and 3C 41 are very similar to coeval 3C quasars, whilst 3C 65 seems unusually underluminous. The fourth radio galaxy detection (3C 265) is a more highly obscured (A(sub v) approx. 15) but otherwise typical quasar which previously has been evident only in scattered light. We determine the fraction of dust-reddened quasars at z approx. 1 to be 28(sup +25, sub -13)% at 90% confidence. On the assumption that the undetected radio galaxies harbour quasars similar to those in 3C 22, 3C 41 and 3C 265 (as seems reasonable given their similar narrow emission line luminosities) we deduce extinctions of A(sub v) approx. greater than 15 towards their nuclei. The contributions of reddened quasar nuclei to the total K-band light ranges from - 0 per cent for the non-detections, through - 10 per cent for 3C 265 to - 80 per cent for 3C 22 and 3C 41. Correcting for these effects does not remove the previously reported differences between the K magnitudes of 3C and 6C radio galaxies, so contamination by reddened quasar nuclei is not a serious problem for drawing cosmological conclusions from the K-z relation for radio galaxies. We discuss these results in the context of the 'receding torus' model which predicts a small fraction of lightly-reddened quasars in samples of high radio luminosity sources. We also examine the likely future importance of thermal-infrared imaging in the study of distant powerful radio sources.
Author
Infrared Imagery; Radio Galaxies; Correction; Dust; Infrared Radiation; Interstellar Extinction; Stellar Spectra

19990042035 NASA Goddard Space Flight Center, Greenbelt, MD USA
HST Spatially Resolved Spectra of the Accretion Disc and Gas Stream of the Nova-Like Variable UX Ursae Majoris
Baptista, Raymundo, Santa Catarina Univ., Brazil; Horne, Keith, Saint Andrew's Univ., UK; Wade, Richard A., Pennsylvania State Univ., USA; Hubeny, Ivan, NASA Goddard Space Flight Center, USA; Long, Knox S., Space Telescope Science Inst., USA; Rutten, Rene G. M., Isaac Newton Group, Spain; Mon. Not. Royal Astronomical Society; 1998; Volume 298, pp. 1079-1091; In English
Contract(s)/Grant(s): NAS5-26555; GO-5488; NAG5-3459; GO-3683.03; CNPq-300-354/96-7; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Time-resolved eclipse spectroscopy of the nova-like variable UX UMa obtained with the Hubble Space Telescope/Faint Object Spectrograph (HST/FOS) on 1994 August and November is analysed with eclipse mapping techniques to produce spatially resolved spectra of its accretion disk and gas stream as a function of distance from the disk centre. The inner accretion disk is characterized by a blue continuum filled with absorption bands and lines, which cross over to emission with increasing disk radius, similar to that reported at optical wavelengths. The comparison of spatially resolved spectra at different azimuths reveals a significant asymmetry in the disk emission at ultraviolet (UV) wavelengths, with the disk side closest to the secondary star showing pronounced absorption by an 'iron curtain' and a Balmer jump in absorption. These results suggest the existence of an absorbing ring of cold gas whose density and/or vertical scale increase with disk radius. The spectrum of the infalling gas stream is noticeably different from the disc spectrum at the same radius suggesting that gas overflows through the impact point at the disk rim and continues along the stream trajectory, producing distinct emission down to 0.1 R(sub LI). The spectrum of the uneclipsed light shows prominent emission lines of Lyalpha, N v lambda1241, SiIV Lambda 1400, C IV Lambda 1550, HeII Lambda 1640, and MgII Lambda 2800, and a UV continuum rising towards longer wavelengths. The Balmer jump appears clearly in emission indicating that the uneclipsed light has an important contribution from optically thin gas. The lines and optically thin continuum emission are most probably emitted in a vertically extended disk chromosphere + wind. The radial temperature profiles of the continuum maps are well described by a steady-state disc model in the inner and intermediate disk regions (R greater than or equal to 0.3R(sub LI)). There is evidence of an increase in the mass accretion rate from August to November (from V = 10 (exp -8.3

+/-0.1) to 10(exp -8.1 +/- 0.1 solar mass yr(exp -1)), in accordance with the observed increase in brightness. Since the UX UMA disc seems to be in a high mass accretion, high-viscosity regime in both epochs, this result suggests that the mass transfer rate of UX UMA varies substantially (approximately equal to 50 per cent) on time-scales of a few months. It is suggested that the reason for the discrepancies between the prediction of the standard disk model and observations is not an inadequate treatment of radiative transfer in the disc atmosphere, but rather the presence of addition important sources of light in the system besides the accretion disk (e.g., optically thin contiuum emission from the disk wind and possible absorption by circumstellar cool gas).
Author
Balmer Series; Chromosphere; Continuums; Eclipses; Mass Transfer; Stellar Envelopes; Stellar Mass; Accretion Disks; Cataclysmic Variables; Ultraviolet Astronomy; Novae

19990042036 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hubble Space Telescope Eclipse Observations of the Nova Like Cataclysmic Variable UX Ursae Majoris
Knigge, Christian, Space Telescope Science Inst., USA; Long, Knox S., Space Telescope Science Inst., USA; Wade, Richard A., Pennsylvania State Univ., USA; Baptista, Raymundo, Santa Catarina Univ., Brazil; Horne, Keith, Saint Andrew's Univ., UK; Hubeny, Ivan, NASA Goddard Space Flight Center, USA; Rutten, Rene G. M., Isaac Newton Group, Spain; Astrophysical Journal; May 30, 1998; Volume 499, pp. 414-428; In English
Contract(s)/Grant(s): NAS5-2655; GO-5448; NAGw-3171; GO-3683.03-91A; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present and analyze Hubble Space Telescope observations of the eclipsing nova-like cataclysmic variable UX UMa obtained with the Faint Object Spectrograph. Two eclipses each were observed with the G160L grating (covering the ultraviolet waveband) in 1994 August and with the PRISM (covering the near-ultraviolet to near-infrared) in November of the same year. The system was about 50% brighter in November than in August, which, if due to a change in the accretion rate, indicates a fairly substantial increase in Mass accretion by about 50%. The eclipse light curves are qualitatively consistent with the gradual occultation of an accretion disk with a radially decreasing temperature distribution. The light curves also exhibit asymmetries about mideclipse that are likely due to a bright spot at the disk edge. Bright-spot spectra have been constructed by differencing the mean spectra observed at pre- and posteclipse orbital phases. These difference spectra contain ultraviolet absorption lines and show the Balmer jump in emission. This suggests that part of the bright spot may be optically thin in the continuum and vertically extended enough to veil the inner disk and/or the outflow from UX UMa in some spectral lines. Model disk spectra constructed as ensembles of stellar atmospheres provide poor descriptions of the observed posteclipse spectra, despite the fact that UX UMa's light should be dominated by the disk at this time. Suitably scaled single temperature model stellar atmospheres with T(sub eff) approximately equals 12,500-14,500 K actually provide a better match to both the ultraviolet and optical posteclipse spectra. Evidently, great care must be taken in attempts to derive accretion rates from comparisons of disk models to observations. One way to reconcile disk models with the observed posteclipse spectra is to postulate the presence of a significant amount of optically thin material in the system. Such an optically thin component might be associated with the transition region ("chromosphere") between the disk photosphere and the fast wind from the system whose presence has been suggested by Knigge and Drew. In any event, the wind/chromosphere is likely to be the region in which many, if not most, of the UV lines are formed. This is clear from the plethora of emission lines that appear in the mideclipse spectra, some of which appear as absorption features in spectra taken at out-of-eclipse orbital phases.
Author
Accretion Disks; Balmer Series; Cataclysmic Variables; Chromosphere; Photosphere; Stellar Atmospheres; Ultraviolet Absorption; Binary Stars; Ultraviolet Astronomy

19990042059 Oxford Univ., Dept. of Astrophysics, Oxford, UK
Radio-Optical Alignments in a Low Radio Luminosity Sample
Lacy, Mark, Oxford Univ., UK; Ridgway, SUSAn E., Oxford Univ., UK; Wold, Margrethe, Stockholm Observatory, Sweden; Lilje, Per B., Oslo Univ., Norway; Rawlings, Steve, Oxford Univ., UK; Mar. 19, 1999; In English
Contract(s)/Grant(s): NAS5-26555
Report No.(s): OUAST/99/8; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd, Oxford, OX1 3RH, UK), Hardcopy, Microfiche

We present an optically-based study of the alignment between the radio axes and the optical major axes of eight z approximately 0.7 radio galaxies in a 7C sample. The radio galaxies in this sample are approximately 20-times less radio luminous than 3C galaxies at the same redshift, and are significantly less radio-luminous than any other well-defined samples studied to date. Using Nordic Optical Telescope images taken in good seeing conditions at rest-frame wavelengths just longward of the 4000A break, we find a statistically significant alignment effect in the 7C sample. Furthermore, in two cases where the aligned compo-

nents are well separated from the host we have been able to confirm spectroscopically that they are indeed at the same redshift as the radio galaxy. However, a quantitative analysis of the alignment in this sample and in a corresponding 3C sample from HST (Hubble Space Telescope) archival data indicates that the percentage of aligned flux may be lower and of smaller spatial scale in the 7C sample. Our study suggests that alignments on the 50-kpc scale are probably closely related to the radio luminosity, whereas those on the 15 kpc scale are not. We discuss these results in the context of popular models for the alignment effect.
Author
Radio Galaxies; Galactic Evolution; Star Formation; Radio Sources (Astronomy); Radio Spectra

19990042098 Pennsylvania State Univ., Dept. of Astronomy and Astrophysics, University Park, PA USA
Advanced Spectrum Modelling of Accretion Disks for Close Binary Stars
Orosz, J. A., Pennsylvania State Univ., USA; Wade, R. A., Pennsylvania State Univ., USA; January 1999; 3p; In English; Ultraviolet Spectra of CV Accretion Disks with Non-Steady T(r) Laws: Session 103, EUVE Observations and Modeling of X-Ray Sources, Jan. 1999, Austin, TX, USA; Sponsored by American Astronomical Society, USA
Contract(s)/Grant(s): NAG5-3459; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An extensive grid of synthetic mid- and far-ultraviolet spectra for accretion disks in cataclysmic variables has recently been presented by Wade and Hubeny (1998, ApJ, Vol 510, in press). In those models, the disk was assumed to be in steady-state, that is T(sub \rm eff)(r) is specified completely by the mass M(sub \rm wd) and radius R(sub \rm wd) of the accreting white dwarf star and the mass transfer rate dM/dt which is constant throughout the disk. In these models, T(sub \rm eff)(r) \propto r(exp -3/4) except as modified by a cutoff term near the white dwarf. Actual disks may vary from the steady-state prescription for T(sub \rm eff)(r), however, e.g. owing to outburst cycles in dwarf novae (dM/dt not constant with radius) or irradiation (in which case T(sub \rm eff) in the outer disk is raised above T(sub rm steady)). to show how such disks might differ from steady disks, we present a study of models in which power-law temperature profiles T(sub \rm eff)(r) \propto r(exp -\alpha) with \alpha \neq 3/4 are specified. Otherwise, the construction of the models is the same as in the Wade & Hubeny grid, to allow comparison. Both UV spectral energy distributions and appearance of the UV line spectra will be discussed.
Author
Accretion Disks; Binary Stars; Cataclysmic Variables; Dwarf Novae; Energy Distribution; Mass Transfer; Radii; White Dwarf Stars

19990042099 NASA Goddard Space Flight Center, Greenbelt, MD USA
Detailed Mid- and Far- Ultraviolet Model Spectra for Accretion Disks in Cataclysmic Binaries
Wade, Richard A., Pennsylvania State Univ., USA; Hubeny, Ivan, NASA Goddard Space Flight Center, USA; Astrophysical Journal; Dec. 10, 1998; Volume 509, pp. 350-361; In English
Contract(s)/Grant(s): NAG5-1698; NAG5-2125; NAGw-3171; NAG5-3459; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present a large grid of computed far- and mid-ultraviolet spectra (850-2000 A) of the integrated light from steady-state accretion disks in luminous cataclysmic variables. The spectra are tabulated at 0.25 A intervals with an adopted FWHM resolution of 1.0 A, so they are suitable for use with observed spectra from a variety of modern space-borne observatories. Twenty-six different combinations of white dwarf mass M(sub wd) and mass accretion rate dot-m are considered, and spectra are presented for six different disk inclinations i. The disk models are computed self-consistently in the plane-parallel approximation, assuming LTE and vertical hydrostatic equilibrium, by solving simultaneously the radiative transfer, hydrostatic equilibrium, and energy balance equations. Irradiation from external sources is neglected. Local spectra of disk annuli are computed taking into account line transitions from elements 1-28 (H through Ni). Limb darkening as well as Doppler broadening and blending of lines are taken into account in computing the integrated disk spectra. The radiative properties of the models are discussed, including the dependence of ultraviolet fluxes and colors on M(sub wd), dot-m, and i. The appearance of the disk spectra is illustrated, with regard to changes in the same three parameters. Finally, possible future improvements to the present models and spectra are discussed.
Author
Accretion Disks; Cataclysmic Variables; Limb Darkening; Radiative Transfer; Ultraviolet Astronomy; Annuli

19990042100 Texas Univ., Dept. of Astronomy, Austin, TX USA
The Flared Disk in the Dwarf Nova Z Cha
Robinson, E. L., Texas Univ., USA; Wood, Janet H., Keele Univ., UK; Wade, Richard A., Pennsylvania State Univ., USA; Wild Stars in the Old West: ASP Conference Series; 1998; Volume 137, pp. 531-532; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper reports on the recalculation of the maximum-entropy map of the accretion disk in Z Cha during eruption, from an earlier attempt which reported two unusual aspects of the eclipse map: (1) the orbital inclination of Z Cha is 1 = 81 deg point 7 so alpha + i = 89 deg point 7; (2) the run of brightness temperature with radius in the disk was too flat to be consistent with models for steady-state, optically thick accretion disks. From the recalculation, two conclusions are drawn: (1) the accretion disk in Z Cha becomes flared during eruptions and the flare angle is large, 6 degrees; (2) although the derived distribution of brightness temperature with radius is much steeper than before it is still flatter than theoretical distributions. Either the brightness temperature is a poor estimate of the effective temperature or the disk in Z Cha is not in steady state.
CASI
Accretion Disks; Brightness Temperature; Eclipses; Steady State; Ultraviolet Astronomy; Dwarf Novae; White Dwarf Stars

19990042133 Maryland Univ., Astronomy Dept., College Park, MD USA
High Resolution Far-Infrared Studies of Compact Regions in Star-Forming Molecular Clouds
Mundy, Lee G., Maryland Univ., USA; 1998; 5p; In English
Contract(s)/Grant(s): NAG2-1060; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This grant supported the acquisition, analysis and publication of high spatial resolution observations of the far-infrared emission from compact regions of star-forming molecular clouds using the Kuiper Airborne Observatory. We studied regions which are forming stars of low and intermediate mass. In analyzing the data, we utilized radiative transfer codes, incorporating disk models and envelopes, including departures from spherical symmetry. These data, along with data at other wavelengths, were used to probe the distribution of dust temperature and density around young stars and to test theoretical predictions about star formation.
Derived from text
Infrared Radiation; Star Formation; Interstellar Matter; Stellar Envelopes; Molecular Clouds; Herbig-Haro Objects; A Stars; B Stars

19990042134 NASA Ames Research Center, Moffett Field, CA USA
Airborne Astronomy Program
Butner, Harold M., NASA Ames Research Center, USA; [1999]; 7p; In English
Contract(s)/Grant(s): NAG2-1074; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Our understanding about the inter-relationship between the collapsing cloud envelope and the disk has been greatly altered. While the dominant star formation models invoke free fall collapse and r(sup -1.5) density profile, other star formation models are possible. These models invoke either different cloud starting conditions or the mediating effects of magnetic fields to alter the cloud geometry during collapse. to test these models, it is necessary to understand the envelope's physical structure. The discovery of disks, based on millimeter observations around young stellar objects, however makes a simple interpretation of the emission complicated. Depending on the wavelength, the disk or the envelope could dominate emission from a star. In addition, the discovery of planets around other stars has made understanding the disks in their own right quite important. Many star formation models predict disks should form naturally as the star is forming. In many cases, the information we derive about disk properties depends implicitly on the assumed envelope properties. How to understand the two components and their interaction with each other is a key problem of current star formation.
Derived from text
Star Formation; Collapse; Molecular Clouds; Stellar Envelopes; Interstellar Matter; Accretion Disks; Astrophysics; Infrared Astronomy

19990042137 Space Telescope Science Inst., Baltimore, MD USA
Calibration of Post-AGB Supergiants as Standard Extragalactic Candles for HST ***Final Report, 1 Jan. 1995 - 14 Feb. 1998***
Bond, Howard E., Space Telescope Science Inst., USA; 1998; 9p; In English
Contract(s)/Grant(s): NAG5-3912; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This report summarizes activities carried out with support from the NASA Ultraviolet, Visible, and Gravitational Astrophysics Research and Analysis Program. The aim of the program is to calibrate the absolute magnitudes of post-asymptotic-giant-branch (post-AGB or PAGB) stars, which we believe will be an excellent new "standard candle" for measuring extragalactic distances. The reason for this belief is that in old populations, the stars that are evolving through the PAGB region of the HR (Hertzsprung-Russell) diagram arise from only a single main-sequence turnoff mass. In addition, the theoretical PAGB evolutionary tracks show that they evolve through this region at constant luminosity; hence the PAGB stars should have an extremely narrow luminosity function. Moreover, as the PAGB stars evolve through spectral types F and A (en route from the AGB to hot stellar remnants and white dwarfs), they have the highest luminosities attained by old stars (both bolometrically and in the visual band).

Finally, the PAGB stars of these spectral types are very easily identified, due to their large Balmer jumps, which are due to their very low surface gravities.
Derived from text
Astrophysics; Asymptotic Giant Branch Stars; Stellar Evolution; A Stars; F Stars; White Dwarf Stars; Main Sequence Stars; Supergiant Stars

19990042138 Space Telescope Science Inst., Baltimore, MD USA
A Distant, X-Ray Luminous Cluster of Galaxies at Redshift 0.83 ***Final Report, 15 Apr. 1994 - 14 Jun. 1997***
Donahue, Megan, Space Telescope Science Inst., USA; Mar. 08, 1999; 14p; In English
Contract(s)/Grant(s): NAG5-2570; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have observed the most distant (= 0.829) cluster of galaxies in the Einstein Extended Medium Sensitivity Survey (EMSS), with the ASCA and ROSAT satellites. We find an X-ray temperature of 12.3(sup 3.1, sub 2.2) keV for this cluster, and the ROSAT map reveals significant substructure. The high temperature of MS1054-0321 is consistent with both its approximate velocity dispersion, based on the redshifts of 12 cluster members we have obtained at the Keck and the Canada-France-Hawaii telescopes, and with its weak lensing signature. The X-ray temperature of this cluster implies a virial mass approximately 7.4 x 10(exp 14) /h solar mass, if the mean matter density in the universe equals the critical value (OMEGA(sub 0) = 1), or larger if OMEGA(sub 0) is less than 1. Finding such a hot, massive cluster in the EMSS is extremely improbable if clusters grew from Gaussian perturbations in an OMEGA(sub 0) = 1 universe. Combining the assumptions that OMEGA(sub 0) = 1 and that the initial perturbations were Gaussian with the observed X-ray temperature function at low redshift, we show that this probability of this cluster occurring in the volume sampled by the EMSS is less than a few times 10(exp -5). Nor is MS1054-0321 the only hot cluster at high redshift; the only two other z is greater than 0.5 EMSS clusters already observed with ASCA also have temperatures exceeding 8 keV. Assuming again that the initial perturbations were Gaussian and OMEGA(sub 0) = 1, we find that each one is improbable at the is less than 10(exp -2) level. These observations, along with the fact that these luminosities and temperatures of the high-z clusters all agree with the low-z L(sub x) - T(sub x) relation, argue strongly that OMEGA(sub 0) is less than 1. Otherwise, the initial perturbations must be non-Gaussian, if these clusters' temperatures do indeed reflect their gravitational potentials.
Author
Galactic Clusters; Red Shift; X Ray Sources; Disk Galaxies; Stellar Evolution; Cosmology; Astrophysics

19990042217 Leicester Univ., X Ray Astronomy Group, UK
The Next Generation of X-Ray Observatories
Turner, Martin J. L., Editor, Leicester Univ., UK; Watson, Mike G., Editor, Leicester Univ., UK; The Next Generation of X Ray Observatories; 1997; 244p; In English, 10-12 Jul. 1996, Leicester, UK; See also 19990042218 through 19990042244
Report No.(s): XRA97/02; ISBN 0-9530183-0-X; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

During the last 34 years X ray astronomy has become one of the major fields in astrophysics. What we see if we look at the sky in X rays are objects having very high temperatures - millions to billions degrees, or places where very energetic electrons interact with electromagnetic fields. It has turned out that almost all kinds of astrophysical objects emit measurable X ray fluxes. They span enormous ranges in size - from 106 cm for neutron stars to 1,021 cm for clusters of galaxies, in distance - from the moon out to distant quasars, and in luminosity - from 1,016 erg s-1 for comets to 1,046 erg s-1 for luminous quasars. X ray observations provide us with information about the physical conditions in the sources which often cannot be obtained by any other means. Since the early days of X ray astronomy the number of known X ray sources has risen from three (Sun, Sco X-1 and the X ray background) to - 135,000. An enormous amount of interesting astrophysics has been extracted from these data and samples have become available for many object classes which are large enough for systematic bias-free studies. In this meeting we are addressing the future of X ray astronomy in terms of astrophysics, instrumentation and missions. The big question is how to proceed after the next generation of X ray missions which are in an advanced step of preparation and will be available around the year 2000. In the US, and in Europe, there would have been long starvation periods without national, bi- or trilateral projects. At present, the main stream of X ray astronomy is represented by ROSAT and ASCA which are complementary in their capabilities, deep imaging and sensitive spectroscopy, respectively, and serve large observer communities. In addition, there are two more specialized missions - ROSSI XTE and Beppo SAX - addressing timing and broad band observations. The next 3 or 4 years will see an enormous expansion of observational capabilities in X ray astronomy. XMM, AXAF, Spectrum-X and ASTRO-E will provide large gains in collecting power, spectral and angular resolution and observation time. XMM will do better than ROSAT and ASCA together, AXAF will go much deeper than the ROSAT deep surveys, Spectrum-X will allow very high resolution spectroscopy of bright sources as well as polarimetry, and ASTRO-E will perform high resolution spectroscopy of rather faint sources. These

pointed missions will be supplemented by ABRIXAS performing a deep all-sky survey in the full energy bands of AXAF and XMM.
Author
X Ray Astronomy; X Ray Astrophysics Facility; X Ray Sources; Conferences; Imaging Techniques; Time Measurement; Mission Planning; X Ray Spectroscopy; Space Missions

19990042218 Leicester Univ., Dept. of Physics and Astronomy, UK
The Scientific Potential of the Approved Future Missions in X-ray Astronomy
Warwick, R. S., Leicester Univ., UK; The Next Generation of X-Ray Observatories; 1997, pp. 7-14; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The capabilities of the major X ray astronomy missions scheduled for launch over the next five years are briefly reviewed. The new generation of missions will provide high-throughput Charge Coupled Devices (CCD) spectroscopy on sources at X ray flux levels of S(x) approximately is greater than 10 (exp -14) erg cm (exp -2) s (exp -l), source detection down to approximately 100 times fainter limits, spectral imaging at medium (approximately 20”) and high (is less than 1”) spatial resolution and broad-band high resolution (R approximately is greater than 100) X ray spectroscopy for brighter sources. Clearly the portfolio of approved missions provides the yardstick against which any longer term aspirations in X ray astronomy must be assessed.
Author
X Ray Astronomy; Mission Planning; Spacecraft Launching; Space Missions

19990042219 Institute of Astronomy, Cambridge, UK
Prospects for Extragalactic X-ray Astronomy
Fabian, Andy C., Institute of Astronomy, UK; The Next Generation of X-Ray Observatories; 1997, pp. 15-20; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

X ray studies have become an important aspect of extragalactic astronomy. I briefly review here the prospects for extragalactic astronomy, with an emphasis on active galaxies, clusters of galaxies and the X ray background.
Author
X Ray Astronomy; Active Galaxies; Galactic Clusters

19990042220 University Coll., Mullard Space Science Lab., London, UK
NGXO and Galactic X-ray Astronomy
Mason, K. O., University Coll., UK; The Next Generation of X-Ray Observatories; 1997, pp. 21-26; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The requirements for Galactic X ray astronomy are considered in the context of the technology that is likely to be available for a mission that could be flown within ten to fifteen years. I conclude that there is sufficient overlap of requirements between the various subject areas to make the concept of a large general purpose X ray facility a very attractive proposition.
Author
X Ray Astronomy; Astronomical Observatories

19990042221 Osservatorio Astronomico, Palermo, Italy
Prospects for Stellar Coronae Observations
Pallavicini, Roberto, Osservatorio Astronomico, Italy; The Next Generation of X-Ray Observatories; 1997, pp. 27-32; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

A brief summary is given of the current status and future prospects for X ray observations of stellar coronae. The need for high-throughput high-resolution spectroscopy on fainter and more distant objects (e.g. late-type stars in open clusters of different ages, and in star forming regions) is emphasized. A combination of large effective area (A(eff) approximately 10,000 cm(exp 2) at 1 keV) and high spectral resolution (Delta(E) approximately 2 eV at energies is greater than 1 keV and Delta(lambda) approximately 0.03 A at energies is less than 1 keV) on a telescope with HEW approximately 5 arcsec is required to advance significantly beyond the capabilities of future missions like AXAF, XMM and ASTRO-E.
Author
Stellar Coronas; X Rays; Astronomical Observatories; X Ray Sources

19990042222 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA USA

Science Driven Arguments for a 10 Sq. Meter, 1 Arcsecond X-ray Telescope

Elvis, Martin, Harvard-Smithsonian Center for Astrophysics, USA; Fabbiano, Giuseppina, Harvard-Smithsonian Center for Astrophysics, USA; The Next Generation of X-Ray Observatories; 1997, pp. 33-54; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

X ray astronomy needs to set bold, science driven goals for the next decade. Only with defined science goals can we know what to work on, and a funding agency appreciate the need for significant technology developments. To be a forefront science the scale of advance must be 2 decades of sensitivity per decade of time. to be stable to new discoveries these should be general, discovery space, goals. A detailed consideration of science goals leads us to propose that a mirror collecting area of 10 sq.meters with arcsecond resolution, good field of view (>10 arcmin), and with high spectral resolution spectroscopy (R = 1000-10,000) defines the proper goal. This is about 100 times AXAF, or 30 times XMM. This workshop has shown that this goal is only a reasonable stretch from existing concepts, and may be insufficiently bold. An investment of approximately $10 M/year for 5 years in X ray optics technologies, comparable to NASA's investment in ASTRO-E or a SMEX, is needed, and would pay off hugely more than any small X ray mission.

Author

X Ray Astronomy; X Ray Telescopes; X Ray Optics

19990042223 Leicester Univ., Dept. of Physics and Astronomy, UK

Exploiting the XMM Mirror Technology

Willingale, Dick, Leicester Univ., UK; The Next Generation of X-Ray Observatories; 1997, pp. 55-65; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Ten years of R&D on the XMM mirror system have produced a technology with capabilities well beyond the specification required for XMM. Incorporating relatively minor changes and improvements it can provide provide telescope mirrors with a spacial resolution of approximately 5" and collecting areas in excess of 4000 cm(exp 2) at 1 keV for use in the Next Generation of X ray Observatories. With conventional gold reflecting surface the high energy response extends to approximately 15 keV. Using multilayers it is likely that the useful response can be pushed to as high as 60 keV.

Author

X Ray Astronomy; Mirrors; X Ray Telescopes; X Ray Optics; X Ray Spectroscopy; Optical Equipment

19990042224 Space Research Organization Netherlands, Utrecht, Netherlands

Next Generation X-ray Spectrometers

deKorte, Piet A. J., Space Research Organization Netherlands, Netherlands; The Next Generation of X-Ray Observatories; 1997, pp. 67-74; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The development status of high energy resolution, cryogenic, X ray detectors is reviewed in the context of the requirements for a future High Throughput X ray Spectroscopy mission. Future development prospects are discussed.

Author

X Ray Spectrometers; High Resolution; Cryogenics; X Ray Spectroscopy; X Ray Detectors; X Ray Astronomy

19990042228 Leicester Univ., X-Ray Astronomy Group, UK

Future Semiconductor Detectors for X-ray Astronomy

Holland, A. D., Leicester Univ., UK; The Next Generation of X-Ray Observatories; 1997, pp. 99-106; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Current missions for X-ray astronomy, both in-orbit and in production rely heavily on solid state detectors in the instrument payloads. In particular, we are seeing the heyday of the charge coupled device (CCD) as the current generation "ideal detector", which provides imaging and timing information, combined with "Fano-limited" X ray spectroscopic resolution. This "workhorse" detector will provide data from currently planned missions up to the end of the next decade. This paper reviews some solid state detector developments targeted at the needs of future instrumentation for X ray astronomy and indicates the development goals together with current state-of-the-art performance measurements.

Author

Semiconductors (Materials); X Ray Astronomy; X Ray Detectors

19990042230 Nagoya Univ., Dept. of Physics, Nagoya, Japan

Multilayer X-ray Optical Systems for Future X-ray Astronomy Missions

Yamashita, Koujun, Nagoya Univ., Japan; The Next Generation of X-Ray Observatories; 1997, pp. 115-121; In English; See also 19990042217

Contract(s)/Grant(s): MESC-07102007; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The development of multilayers makes it possible to construct a normal incidence soft X ray telescope with high angular resolution and a grazing incidence hard X ray telescope sensitive up to 100 keV using a multilayer supermirror. A multilayer coated grating is also a useful dispersive element with high efficiency and spectral resolution in the Extreme Ultraviolet Radiation (EUV) and X ray region.

Author

X Ray Astronomy; X Ray Telescopes; Space Missions; X Ray Optics

19990042235 Consiglio Nazionale delle Ricerche, Ist. per le Applicazioni Interdisciplinari della Fisica, Palermo, Italy

The EUV/X-ray Astronomy Calibration and Testing Facility at the Osservatorio Astronomico di Palermo 'G. S. Vaiana'

Collura, A., Consiglio Nazionale delle Ricerche, Italy; Barbera, M., Consiglio Nazionale delle Ricerche, Italy; Sciortino, S., Consiglio Nazionale delle Ricerche, Italy; Serio, S., Consiglio Nazionale delle Ricerche, Italy; The Next Generation of X-Ray Observatories; 1997, pp. 153-158; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The X ray Astronomy Calibration and Testing facility (XACT) set-up at the Osservatorio Astronomico di Palermo "G.S. Vaiana" for the development and calibration of instrumentation for Extreme Ultraviolet (EUV)/X ray astronomy, includes a 14 (expandable to 17) meter long stainless-steel vacuum beam line, a 1 meter diameter cylindrical test chamber opening to a class 1000 clean-room, and X ray and EUV sources, detectors and monochromators covering the energy range approximately 0.005-10 keV (wavelength range approximately 1-3000 A). The XACT facility is presently employed in the calibration of the UV/Ion shields of the High Resolution Camera (HRC) on AXAF, in the development of the filters for the EPIC camera on XMM and in the calibration of the JET-X detector. Additions to the basic equipment are planned for the development of cryogenic detectors. A description of the facility can be found at the WWW site: http://www.astropa.unipa.it/XACT/XACT.html

Author

X Ray Astronomy; Extreme Ultraviolet Radiation; Calibrating; X Ray Astrophysics Facility; Test Facilities

19990042236 Tokyo Univ., Inst. of Space and Astronautical Science, Sagamihara, Japan

Future Missions of Japan After ASTRO-E

Inoue, Hajime, Tokyo Univ., Japan; The Next Generation of X-Ray Observatories; 1997, pp. 161-164; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Possible mission concepts of future Japanese X ray astronomy missions after ASTRO-E are described, although they are still under discussion in the X ray astronomy community in Japan.

Author

Mission Planning; X Ray Astronomy; Japan; Space Missions; Astronomical Satellites

19990042237 Leicester Univ., Dept. of Physics and Astronomy, UK

Xeus: An X-ray Observatory for the Post XMM era

Turner, Martin J. L., Leicester Univ., UK; Palumbo, G. G. C., Bologna Univ., Italy; Bleeker, J. A. M., Space Research Organization Netherlands, Netherlands; Hasinger, G., Astrophysikalisches Inst., Germany; Peacock, A., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Truemper, J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; The Next Generation of X-Ray Observatories; 1997, pp. 165-172; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The overall concept and scientific aims of Xeus, a new X ray astronomy mission for the post XMM era, are described. Xeus has three key scientific drivers: the behaviour of matter under strong gravity near the event horizon of black holes; the exploration of the distant high energy universe; and the creation and redistribution of the elements. The essential requirement is to place in orbit an optic of very large aperture and to complement this with imaging and spectroscopic technology which will enable a similar spatial and spectral resolution to be achieved in the X ray band, to that currently available on our best optical telescopes. Emerging technologies in the area of optics and instrumentation are surveyed, and the possible ways of placing such a large instrument in

orbit are discussed. In this latter context, the use of near earth orbit and the infra-structure provided by the Space Station, are considered. Xeus will be implemented in the 2010 time-frame.
Author
X Ray Astronomy; Astronomical Observatories; Space Missions; Mission Planning

19990042238 NASA Goddard Space Flight Center, Greenbelt, MD USA
The High Throughput X-ray Spectroscopy (HTXS) Mission
White, N. E., NASA Goddard Space Flight Center, USA; Tananbaum, H., Smithsonian Astrophysical Observatory, USA; Kahn, S. M., Columbia Univ., USA; The Next Generation of X-Ray Observatories; 1997, pp. 173-189; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The HTXS mission concept combines large effective area (approximately 15,000 sq cm at 1 keV), high spectral resolution (E/Delta(E) approximately 300-3000), and broad energy bandpass (0.25-40 keV and possibly up to 100 keV) by using replicated optics together with a complement of spectroscopic instrumentation including reflection gratings readout by charge-coupled device detectors (CCDs), quantum micro-calorimeters, and cadmium zinc telluride (CZT) or comparable high energy detectors. An essential feature of this concept involves minimization of cost (approximately $350M for development and approximately $500-600M including launches) and risk by building six identical modest satellites to achieve the large area. Current mission and technology studies are targeted towards a new start in the 2002 timeframe, with first launch around 2005-2006. The HTXS mission represents a major advance, providing as much as a factor of 100 increase in sensitivity over currently planned high resolution X ray spectroscopy missions. HTXS will mark the start of a new era when high quality X ray spectra will be obtained for all classes of X ray sources, over a wide range of luminosity and distance. With its increased capabilities, HTXS will address many fundamental astrophysics questions such as the origin and distribution of the elements from carbon to zinc, the formation and evolution of clusters of galaxies, the validity of general relativity in the strong gravity limit, the evolution of supermassive black holes in active galactic nuclei, the details of supernova explosions and their aftermath, and the mechanisms involved in the heating of stellar coronae and driving of stellar winds.
Author
X Ray Spectroscopy; Mission Planning; Space Missions; X Ray Astronomy; Astronomical Spectroscopy; X Ray Detectors

19990042240 Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany
ABRIXAS (A Broad Band Imaging X-ray All Sky Survey)
Truemper, Joachim E., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; The Next Generation of X-Ray Observatories; 1997, pp. 201-202; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

ABRIXAS is a small satellite project carried out in Germany by three institutes; the Astrophysical Institute Potsdam (AIP), the Institute for Astronomy and Astrophysics Tuebingen (IAAT) and the Max Planck Institute for Extraterrestrial Physics (MPE). ABRIXAS means 'A Broad Band Imaging X ray All Sky Survey', and the plan is to survey the whole sky basically in the way ROSAT did. The survey will take 3 years and provide full sky coverage in the energy band approximately 0.4 to 12 keV. The 3 years sensitivity will be comparable to that of the ROSAT all sky survey in the overlapping energy band, viz. at 1 keV. The angular resolution will be better than one arc min.
Author
Sky Surveys (Astronomy); Broadband; Imaging Techniques; X Ray Astronomy; Astronomical Satellites

19990042241 Smithsonian Astrophysical Observatory, Cambridge, MA USA
The Hard X ray Telescope Mission
Gorenstein, Paul, Smithsonian Astrophysical Observatory, USA; The Next Generation of X Ray Observatories; 1997, pp. 203-211; In English; See also 19990042217
Contract(s)/Grant(s): NAG8-1194; NsG-5138; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

The Hard X Ray Telescope (HXT) was selected for study as a possible new intermediate size mission for the early 21st century. Its principal attributes are: (1) multiwavelength observing with a system of focussing telescopes that collectively observe from the UV to over 1 MeV, (2) much higher sensitivity and much better angular resolution in the 10100 keV band, and (3) higher sensitivity for detecting gamma ray lines of known energy in the 100 keV to 1 MeV band. The institutions collaborating in the study are: Smithsonian Astrophysical Observatory, Marshall Space Flight Center, Naval Research Laboratory, Goddard Space Flight Center, Argonne National Laboratory, Danish Space Research Institute, Osservatorio Astronomica di Brera (Merate), and

Centre d'Etudes Spatiale des Rayonnements (Toulouse). The instrumentation includes several grazing incidence double conical telescopes with multilayer coatings that focus up to 100 keV and a single Laue crystal telescope that functions to 1 MeV. The detectors are CCDs, and germanium, and/or CdZnTe position sensitive arrays.
Author
X Ray Telescopes; X Ray Astronomy; Space Missions

19990042243 NASA Goddard Space Flight Center, Greenbelt, MD USA
Prospects for the Next Generation of X-ray Astronomy
Holt, S. S., NASA Goddard Space Flight Center, USA; The Next Generation of X-Ray Observatories; 1997, pp. 221-226; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

This rapporteur contribution attempts to summarize the discussions at this conference in the context of current funding realities.
Author
X Ray Astronomy; Space Missions; Mission Planning

19990042244 Space Research Organization Netherlands, Inst. for Space Research, Utrecht, Netherlands
The Next Generation of X-ray Observatories: Rapporteur Paper
Bleeker, J. A. M., Space Research Organization Netherlands, Netherlands; The Next Generation of X-Ray Observatories; 1997, pp. 227-234; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

Without any doubt, observatories in the X ray band have become a major diagnostic tool in modern astrophysics research. Several presentations at this workshop have highlighted the importance and impact of X ray observations on virtually every conceivable type of astronomical object (recall the ROSAT detections of X rays from comets). A few, more or less randomly picked, examples to demonstrate the breadth of this diagnostic are: -heating and ion/electron temperature equilibration processes in strong, SN-induced, collisionless shocks. -physical interplay between accretion flow and the surface (or event horizon) of degenerate objects. -potential linkage between Seyfert 1 and Seyfert 2 type active galactic nuclei. -evolution of heavy element abundance in intracluster media. It is obvious that substantial progress in all these fields (and others) will be made with the upcoming generation of X ray observatories AXAF (1998), XMM (1999) and Astro-E (2000). For this reason, it is now not so straightforward to reach beyond those, and to advocate a strong NGXO case: to a certain extent we suffer from the "embarrassment of riches". Nevertheless, it is already quite important that we attempt this outreach now for two main reasons: -The next quantum leap in X ray throughput, the equivalent of the presently most "massive" optical or single-dish radio telescopes, still requires a major development in lightweight "conventional" grazing incidence optics. -Fundamentally new approaches to X ray imaging and/or spectroscopy have at least another five to ten years of research and development ahead of them before they are sufficiently mature to be seriously considered for application in a major world-class space facility.
Derived from text
X Ray Astronomy; Astronomical Observatories; Space Missions; Mission Planning

19990042290 Computer Sciences Corp., Astronomy Programs, Baltimore, MD USA
[?]Goddard High Resolution Spectrograph (GHRS) Observations
Dempsey, Robert C., Computer Sciences Corp., USA; Neff, James E., Wien Univ., Austria; Strassmeier, Klaus G., Wien Univ., Austria; Linsky, Jeffrey L., Colorado Univ., USA; Astrophysical Journal; Sep. 15, 1997; 55p; In English
Contract(s)/Grant(s): NAS5-26555; NASA Order S-57788-Z; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Subject headings: stars; chromospheres - binaries; general - stars; late-type - stars; individual; V82,1 Ara stars; rotation -stars' activity - stars; and coronae.
Author
Stars; Coronas; Observation

19990042321 Kitt Peak National Observatory, Tucson, AZ USA
WFPC2 Observations of Star Clusters in the Magellanic Clouds, Report 2, The Oldest Star Clusters in the Small Magellanic Cloud
Mighell, Kenneth J., Kitt Peak National Observatory, USA; Sarajedini, Ata, San Francisco State Univ., USA; French, Rica S., Middle Tennessee State Univ., USA; Aug. 1998; 42p; In English
Contract(s)/Grant(s): NAS5-26555; NASA Order S-67046-F; HF-01077.01-94A

Report No.(s): NOAO-Preprint-813; NRA-95-OSS-16; 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 F45OW (approximately B) and F555W (approximately V) of the intermediate-age populous star clusters NGC 121, NGC 339, NGC 361, NGC 416, and Kron 3 in the Small Magellanic Cloud. We use published photometry of two other SMC populous star clusters, Lindsay 1 and Lindsay 113, to investigate the age sequence of these seven populous star clusters in order to improve our understanding of the formation chronology of the SMC. We analyzed the V vs B-V and M(sub V) vs (B-V)(sub 0) color-magnitude diagrams of these populous Small Magellanic Cloud star clusters using a variety of techniques and determined their ages, metallicities, and reddenings. These new data enable us to improve the age-metallicity relation of star clusters in the Small Magellanic Cloud. In particular, we find that a closed-box continuous star-formation model does not reproduce the age-metallicity relation adequately. However, a theoretical model punctuated by bursts of star formation is in better agreement with the observational data presented herein.

Author

Magellanic Clouds; Star Clusters; Star Formation; Galactic Evolution; Chronology

19990042395 Space Telescope Science Inst., Baltimore, MD USA

Recovery of 29 Second Oscillations in Hubble Space Telescope Eclipse Observations of the Cataclysmic Variable UX Ursae Majoris

Knigge, Christian, Space Telescope Science Inst., USA; Drake, Nick, Southampton Univ., UK; Long, Knox S., Space Telescope Science Inst., USA; Wade, Richard A., Pennsylvania State Univ., USA; Horne, Keith, Saint Andrew's Univ., UK; Baptista, Raymundo, Santa Catarina Univ., Brazil; Astrophysical Journal; May 20, 1998; Volume 499, pp. 429-443; In English

Contract(s)/Grant(s): NAS5-2655; GO-5448; NAGw-3171; GO-3683.01-91A; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Low-amplitude (approximately 0.5%) 29 s oscillations have been detected in Hubble Space Telescope Faint Object Spectrograph eclipse observations of the nova-like cataclysmic variable UX UMa. These are the same dwarf nova-type oscillations that were originally discovered in this system in 1972. The 29 s oscillations are seen in one pair of eclipse sequences obtained with the FOS/PRISM in 1994 November but not in a similar pair obtained with the FOS/GI60L grating in August of the same year. The oscillations in the PRISM data are sinusoidal to within the small observational errors and undergo an approximately - 360' phase shift during eclipses (i.e., one cycle is lost). The amplitudes are highest at pre-eclipse orbital phases and exhibit a rather gradual eclipse whose shape is roughly similar to, although perhaps slightly narrower than, LTX UMa's overall light curve in the PRISM bandpass (2000-8000 A). Spectra of the oscillations have been constructed from pre-, mid, and post-eclipse data segments of the November observations. The spectra obtained from the out-of-eclipse segments are extremely blue, and only lower limits can be placed on the temperature of the source that dominates the modulated flux at these orbital phases. Lower limits derived from blackbody (stellar atmosphere) model fits to these data are is greater than or equal to 95,000 K (is greater than or equal to 85,000 K); the corresponding upper limits on the projected area of this source are all less than 2% of the white dwarf (WD) surface area. by contrast, oscillation spectra derived from mid- eclipse data segments are much redder. Fits to these spectra yield temperature estimates in the range 20,000 K approximately greater T and T approximately less than 30,000 K for both blackbody and stellar atmosphere models and corresponding projected areas of a few percent of the WD surface area. These estimates are subject to revision if the modulated emission is optically thin. We suggest that the ultimate source of the oscillations is a hot, compact region near disk center, but that a significant fraction of the observed, modulated flux is due to reprocessing of the light emitted by this source in the accretion disk atmosphere. The compact source is occulted at orbital phases near mid-eclipse, leaving only part of the more extended reprocessing region(s) to produce the weak oscillations that persist even at conjunction. The highly sinusoidal oscillation pulse shape does not permit the identification of the compact comonent in this model with emission produced by a rotating disturbance in the inner disk or in a classical, equatorial boundary layer. Instead, this component could arise in a bright spot on the surface of the WD, possibly associated with a magnetic pole. However, a standard intermediate polar model can also be ruled out since UX UMa's oscillation period has been seen to change on timescales much shorter than the minimum timescale required to spin up the WD by accretion torques. A model invoking magnetically controlled accretion onto differentially rotating WD surface layers may be viable, but needs more theoretical work.

Author

Accretion Disks; Cataclysmic Variables; Novae; Ultraviolet Astronomy; Binary Stars; Stellar Oscillations; Variable Stars; White Dwarf Stars

90
ASTROPHYSICS

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

19990041159 NASA Marshall Space Flight Center, Huntsville, AL USA
Meteoroids and Meteor Storms: A Threat to Spacecraft
Anderson, B. Jeffrey, NASA Marshall Space Flight Center, USA; Apr. 20, 1999; 16p; In English; VISTA User's Conference, 18-21 Aprl. 1999, Atlanta, GA, USA
Contract(s)/Grant(s): RTOP 632-10-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Robust system design is the best protection against meteoroid damage. Impacts by small meteoroids are common on satellite surfaces, but impacts by meteoroids large enough to damage well designed systems are very rare. Estimating the threat from the normal meteoroid environment is difficult. Estimates for the occasional "storm" are even more uncertain. Common sense precautions are in order for the 1999 Leonids, but wide-spread catastrophic damage is highly unlikely. Strong Leonid showers are also expected in 2000 and 2001, but these pose much less threat than 1999.
Derived from text
Systems Engineering; Meteoritic Damage; Accident Prevention; Meteoroid Concentration; Meteoroids

19990041588 Oxford Univ., Dept. of Astrophysics, Oxford, UK
Towards 4U 1630-47: A Black-Hole Soft X-Ray Transient Odyssey
Kuulkers, Erik, Oxford Univ., UK; 1998; In English; 2nd; Galactic Sources with Relativistic Jets, USA
Report No.(s): OUAST/98/15; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd., Oxford, OX1 3RH, UK), Hardcopy, Microfiche

4U 1630-47 is a black-hole X-ray transient with one of the shortest recurrence times. Despite its regular outburst behaviour little is known about this source. Only recently has attention to this system increased. I discuss there the basic known (X-ray) properties of 4U 1630-47 and report on X-ray and radio observations obtained during its recent outburst, starting in 1998 February. These observations strengthen some of the similarities seen between 4U 1630-47 and the Galactic superluminal sources GRO J1655-40 and GRS 1915+105, and provide the first detection of 4U 1630-47 in the radio. Using an updated outburst ephemeris I predict the next outburst to occur about a week before Chiistmas 1999.
Author
Black Holes (Astronomy); X Rays; Galaxies

19990041728 Oak Ridge National Lab., Physics Div., TN USA
Atomic and molecular supernovae
Liu, Weihong, Oak Ridge National Lab., USA; Dec. 31, 1997; 10p; In English; 2nd; Atomic and Nuclear Astrophysics, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): DE98-005054; ORNL/CP-97164; CONF-971208; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Atomic and molecular physics of supernovae is discussed with an emphasis on the importance of detailed treatments of the critical atomic and molecular processes with the best available atomic and molecular data. The observations of molecules in SN 1987A are interpreted through a combination of spectral and chemical modelings, leading to strong constraints on the mixing and nucleosynthesis of the supernova. The non-equilibrium chemistry is used to argue that carbon dust can form in the oxygen-rich clumps where the efficient molecular cooling makes the nucleation of dust grains possible. For Type Ia supernovae, the analyses of their nebular spectra lead to strong constraints on the supernova explosion models.
NTIS
Supernovae; Atomic Physics; Molecular Dynamics; Stellar Models; Molecules

19990041729 Oak Ridge National Lab., Joint Inst. for Heavy Ion Research, TN USA
Simplifying silicon burning: Application of quasi-equilibrium to (alpha) network nucleosynthesis
Hix, W. R., Oak Ridge National Lab., USA; Thielemann, F.-K., Oak Ridge National Lab., USA; Khokhlov, A. M., Naval Research Lab., USA; Wheeler, J. C., Texas Univ., USA; Dec. 31, 1997; 10p; In English; 2nd; Atomic and Nuclear Astrophysics, 206 Dec. 1997, Oak Ridge, TN, USA
Contract(s)/Grant(s): DE-FG02-96ER-40983; DE-AC05-96OR-22464; NAG5-2888; NSF AST-95-28110; SNSF-20-47252,96
Report No.(s): DE98-005053; ORNL/CP-97176; CONF-971208; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

While the need for accurate calculation of nucleosynthesis and the resulting rate of thermonuclear energy release within hydrodynamic models of stars and supernovae is clear, the computational expense of these nucleosynthesis calculations often force a compromise in accuracy to reduce the computational cost. to redress this trade-off of accuracy for speed, the authors present an improved nuclear network which takes advantage of quasi- equilibrium in order to reduce the number of independent nuclei, and hence the computational cost of nucleosynthesis, without significant reduction in accuracy. In this paper they will discuss the first application of this method, the further reduction in size of the minimal alpha network. The resultant QSE- reduced alpha network is twice as fast as the conventional alpha network it replaces and requires the tracking of half as many abundance variables, while accurately estimating the rate of energy generation. Such reduction in cost is particularly necessary for future generation of multi-dimensional models for supernovae.
NTIS
Combustion; Silicon; Nuclear Chemistry; Synthesis (Chemistry); Numerical Analysis; Nuclear Fusion

19990041791 Helsinki Univ. of Technology, Metsaehovi Radio Observatory, Kylmaelae, Finland
Total Flux Density Variations in Extragalactic Radio Sources, 3, Doppler Boosting Factors, Lorentz Factors and Viewing Angles for Active Galactic Nuclei
Laehteenmaeki, A.; Valtaoja, E.; 1999; 34p; In English
Report No.(s): PB99-135980; HUT-MET-28; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
We have calculated Doppler boosting factors D(var) for a sample of active galactic nuclei (AGN) using total flux density variation monitoring data at 22 GHz and 37 GHz. We compare our Doppler factors with other results and conclude that even if the average D(var) for a class of sources is very similar to all others, the variability Doppler factors for individual objects are more accurate and reliable. An important application of precise Doppler factors is presented, namely calculating the Lorentz factors Gamma and the viewing angles theta of relativistic outflows in AGN. We find that high polarization quasars are the most Doppler boosted objects while low polarization quasars and BL Lac objects are less boosted. The two groups of quasars show different characteristics due to a different combination of the Lorentz factor and the viewing angle rather than either different Gamma or theta alone.
NTIS
Radiant Flux Density; Active Galactic Nuclei; Lorentz Force; Doppler Effect

19990042018 New Mexico Univ., Dept. of Earth and Planetary Sciences, Albuquerque, NM USA
Cluster Particles: A Unique New Class of Asteroid Debris or a Note of Caution?
Rietmeijer, F. J. M., New Mexico Univ., USA; Meteoretics and Planetary Sciences; 1998; Volume 32, No. A108; 1p; In English
Contract(s)/Grant(s): NAG5-4441; NAGw-3626; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Two fragments of particle L2011#21 that were probably incorrectly designated as a cluster article are most likely terrestrial volcanic dust. It is imperative to make unambiguous identifications of cluster Interplanetary Dust Particles (IDP), or in general cluster identifications. Otherwise, it might be argued that L2011#21 with fragments -F1 and -F4 also contained two unique IDP's that are possible evidence for explosive volcanism in asteroids. Explosive volcanism on chondritic asteroids was proposed as a part of basaltic differentiation. A much firmer cluster relationship for L2011#21 needs to be established befoe any claim of asteroidal volcanism preserved in a regolith can be considered seriously based on this putative cluster IDP.
Derived from text
Asteroids; Basalt; Chondrites; Interplanetary Dust; Volcanoes

19990042057 Oxford Univ., Dept.of Astrophysics, Oxford, UK
On the Abundance of Lithium in T Coronae Borealis
Shahbaz, T., Oxford Univ., UK; Hauschildt, P.H., Georgia Univ., USA; Naylor, T., Keele Univ., UK; Ringwald, F., Florida Inst. of Tech., USA; Feb. 17, 1999; In English
Contract(s)/Grant(s): NSF AST-97-20704; NAG5-3018; NAG5-3619
Report No.(s): OUAST/99/6; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd, Oxford, OX1 3RH, UK), Hardcopy, Microfiche
We have obtained high resolution echelle spectroscopy of the recurrent nova T CrB (T Coronae Borealis). We find that the surface lithium abundance in T CrB is significantly enhanced compared to field M giants, where it is not detectable. We offer possible explanations for this in terms of either a delay in the onset of convection in the giant star, enhanced coronal activity due to star-spots or the enhancement of Li resulting from the nova explosion(s).
Author
Novae; White Dwarf Stars; Cataclysmic Variables; Corona Borealis Constellation; Lithium; Giant Stars

19990042058 Oxford Univ., Dept. of Astrophysics, Oxford, UK

The Effective Temperature of Arcturus

Griffin, R. E. M., Oxford Univ., UK; Lynas-Gray, A. E., Oxford Univ., UK; [1996]; In English

Report No.(s): OUAST/99/7; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd, Oxford, OX1 3RH, UK), Hardcopy, Microfiche

We construct an empirical energy distribution for Arcturus from published scans, integrate it to obtain the total flux, and combine the latter with precise interferometric measurements of the limb-darkened angular diameter to derive the effective temperature. We conclude that the best value that can be derived within the framework of the associated assumptions is T(sub eff) = 4290 K +/- 30 K. We then select a grid of model-atmosphere energy distributions by Kurucz and extract T(sub eff)/log g/[Fe/H] by a least-squares fit to the adopted energy distribution. With the value of T(sub eff) already constrained, we could investigate values for the surface gravity and metallicity of Arcturus; our results are log g = 1.9, [Fe/H] = -0.68 and R = 23 solar radius. However, we discuss evidence that relevant grids of models may not contain sufficient opacity.

Author

Stars; Energy Distribution; Atmospheric Models; Radio Astronomy; Radio Sources (Astronomy); Stellar Atmospheres

19990042108 Hughes STX, Inc., Greenbelt, MD USA

The Interaction-Activity Connection

Borne, Kirk D., Hughes STX, Inc., USA; [1996]; 17p; In English

Contract(s)/Grant(s): NAG5-1920; NAG5-26555; NAG5-30960; GO-05410.01-93; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review is presented of the numerous studies that have been undertaken to investigate the likely interaction-activity connection among galaxies. Both observational evidence and theoretical supporting models are reviewed. Some specific examples of ”interactive” galaxies from the author’s own research are presented: (a) the collision-induced AGN (Active Galactic Nuclei) activity in the radio jet source 3C278; and (b) the collision-induced starburst activity in the spectacular ”Cartwheel” ring galaxy. Some comments are offered concerning some of the more promising theoretical investigations that are now taking place. A few words of warning are also offered about the possible misinterpretation of putative collision-induced morphologies among some galaxy samples.

Author

Active Galactic Nuclei; Active Galaxies; Radio Sources (Astronomy); Radio Astronomy; Galactic Radiation; Radio Emission

19990042136 Princeton Univ., NJ USA

Hydrodynamic Stability and Magnetic Reconnection in Disks and Stars ***Final Report, 1 Dec. 1994 - 31 Jan. 1999***

Goodman, Jeremy, Princeton Univ., USA; Kulsrud, Russell, Princeton Univ., USA; Apr. 12, 1999; 8p; In English

Contract(s)/Grant(s): NAG5-2796; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this grant is to study parametric instability. The simplest example of parametric instability is a harmonic oscillator with a periodic modulation of the spring constant. If the modulation frequency is close to twice the natural frequency of the oscillator, the amplitude of oscillation tends to grow exponentially. The growth rate is proportional to the strength of the modulation, but it also depends upon the closeness to resonance of the two frequencies, and upon natural damping rate or ”Q” of the oscillator. Parametric instabilities are very common in physics. A familiar example is a jogger’s ponytail--normally a very strongly damped pendulum, it can be destabilized by the variation in effective gravity during the jogger’s stride. Observation confirms that the period of the pendulum is half that of the jogger’s vertical motion. In astrophysics, parametric instability may occur by external tidal forcing, or by interaction among eigenmodes. In the latter case, an energetic eigenmode may destabilize modes of half its frequency, provided some weak nonlinearity exists to couple them. Under a previous Astrophysical Theory grant (NAGW-2419), the PI discovered a parametric instability of tidally forced disks such as the accretion disks in cataclysmic variables and X ray binaries [2]. The destabilized modes are tightly-wound, incompressible, three-dimensional waves analogous to g-modes and r-modes in stars. Later work has confirmed our analysis [4]. It was hoped that these modes might provide a source of turbulence and angular momentum transport in accretion disks. However, a follow-up investigation of this instability by local numerical simulations, although confirming the analytically estimated growth rates, found negligible angular momentum flux [3]. Other work, partly supported by the ATP, now strongly indicates that the transport mechanism in such disks is magnetohydrodynamic turbulence [6]. Nevertheless, the parametric mechanism may truncate the outer edges of disks in close binaries [2], and it may be important in disks of very low ionization such as protostellar disks, or even cataclysmic-variable disks in quiescence where the MHD mechanism may be ineffective [5]. All analyses up to 1996 were done in a local approximation where the orbital frequency, shear rate, and tidal field were treated as constants. The locally computed growth rate turns out to depend strongly on radius, and it was unclear how to average these local rates to obtain the correct global rate. This is a critical issue for accretion disks in close binaries,

because the local growth rate is comparable to the orbital frequency towards the outer edge of the disk but decreases rapidly inwards. Paper #1 examined this issue in a simplified global model where the destabilizing terms vary with position. We found that the global growth rate is essentially equal to the maximum local rate, provided that the latter is smoothed over a radial range equal to the distance that the destabilized wave propagates at its group speed in one growth time. Thus, in an accretion disk, waves would grow rapidly in the outer parts but would propagate both inwards and outwards at a maximum group speed of order the disk thickness divided by the orbital period.
Derived from text
Magnetic Field Reconnection; Astrophysics; Flow Stability; Harmonic Oscillators; Pendulums; Oscillations

19990042140 Space Telescope Science Inst., Baltimore, MD USA
Planet Forming Protostellar Disks ***Final Report, 1994-1998***
Lubow, Stephen, Space Telescope Science Inst., USA; 1998; 4p; In English
Contract(s)/Grant(s): NAGw-4156; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The main goal of this proposal is to investigate the interaction of young binary stars with surrounding protostellar disks. A secondary objective is to focus on the interaction of young planets with their central stars and surrounding disks.
CASI
Planetary Evolution; Star Formation; Accretion Disks; Protostars; Binary Stars

19990042277 NASA Marshall Space Flight Center, Huntsville, AL USA
Evidence for Neutron Star Formation from Accretion Induced Collapse of a White Dwarf
Paradijis, J. Van, NASA Marshall Space Flight Center, USA; VanDenHeuvel, E. P. J., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Finger, M. H., NASA Marshall Space Flight Center, USA; Lewin, W. H. G., NASA Marshall Space Flight Center, USA; Astronomy and Astrophysics; Jan. 1997; Volume 317, pp. L9-L12; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The orbital parameters of the recently discovered transient burster/pulsar GRO J1744-28 indicate that this system is a low-mass X-ray binary in an advanced stage of its mass transfer, with several tenths of a solar mass already transferred from the donor to the compact star. All neutron stars known to have accreted such an amount have very weak magnetic fields, and this has led to the idea that the magnetic fields of neutron stars decay as a result of accretion. The observation of a strongly magnetized neutron star in GRO J1744-28 then suggests that this neutron star was formed recently as a result of the collapse of a white dwarf during an earlier stage of the current phase of mass transfer. It is shown that this model can consistently explain the observed characteristics of GRO J1744-28. Attractive progenitors for such an evolution are the luminous supersoft X-ray sources detected with ROSAT.
Author
Neutron Stars; Star Formation; Mass Transfer; Stellar Magnetic Fields; X Ray Binaries; Stellar Mass

19990042289 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Large Amplitude IMF Fluctuations in Corotating Interaction Regions: Ulysses at Midlatitudes
Tsurutani, Bruce T., Jet Propulsion Lab., California Inst. of Tech., USA; Ho, Christian M., Jet Propulsion Lab., California Inst. of Tech., USA; Arballo, John K., Jet Propulsion Lab., California Inst. of Tech., USA; Goldstein, Bruce E., Jet Propulsion Lab., California Inst. of Tech., USA; Balogh, Andre, Imperial Coll. of Science and Technology, UK; Geophysical Letters; Dec. 01, 1995; ISSN 0094-8534; Volume 22, No. 23, pp. 3397-3400; In English
Report No.(s): Paper 95GL03179; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Corotating Interaction Regions (CIRs), formed by high-speed corotating streams interacting with slow speed streams, have been examined from -20 deg to -36 deg heliolatitudes. The high-speed streams emanate from a polar coronal hole that Ulysses eventually becomes fully embedded in as it travels towards the south pole. We find that the trailing portion of the CIR, from the interface surface (IF) to the reverse shock (RS), contains both large amplitude transverse fluctuations and magnitude fluctuations. Similar fluctuations have been previously noted to exist within CIRs detected in the ecliptic plane, but their existence has not been explained. The normalized magnetic field component variances within this portion of the CIR and in the trailing high-speed stream are approximately the same, indicating that the fluctuations in the CIR are compressed Alfven waves. Mirror mode structures with lower intensities are also observed in the trailing portion of the CIR, presumably generated from a local instability driven by free energy associated with compression of the high-speed solar wind plasma. The mixture of these two modes (compressed Alfven waves and mirror modes) plus other modes generated by three wave processes (wave-shock interactions) lead to a lower Alfvenicity within the trailing portion of the CfR than in the high-speed stream proper. The results presented in this paper suggest a mecha-

nism for generation of large amplitude B(sub z) fluctuations within CIRS. Such phenomena have been noted to be responsible for the generation of moderate geomagnetic storms during the declining phase of the solar cycle.
Author
Amplitudes; Interplanetary Magnetic Fields; Observation; Solar Wind; Shock Wave Interaction; Magnetic Storms; Coronal Holes

19990042292 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Atmospheric Angular Momentum Fluctuations During 1979-1988 Simulated by Global Circulation Models
Hide, R., Jet Propulsion Lab., California Inst. of Tech., USA; Dickey, J. O., Jet Propulsion Lab., California Inst. of Tech., USA; Marcus, S. L., Jet Propulsion Lab., California Inst. of Tech., USA; Rosen, R. D., Atmospheric and Environmental Research, Inc., USA; Salstein, D. A., Atmospheric and Environmental Research, Inc., USA; Journal of Geophysical Research; Jul. 27, 1997; ISSN 0148-0227; Volume 102, No. D14, pp. 16,423-16,438; In English
Contract(s)/Grant(s): NAS5-32861; NAGw-2615; NSF ATM-92-23164; NSF ATM-96-32559
Report No.(s): Paper 97JD00699; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Changes in major global dynamical phenomena in the Earth's atmosphere are manifested in the time series of atmospheric angular momentum (AAM), as determined directly from meteorological observations and indirectly from geodetic observations of small fluctuations in the rotation of the solid Earth which are proportional to length of day. AAM fluctuations are intimately linked with energetic processes throughout the whole atmosphere and also with the stresses at the Earth's surface produced largely by turbulent momentum transport in the oceanic and continental boundary layers and by the action of normal pressure forces on orographic features. A stringent test of any numerical global circulation model (GCM) is therefore provided by a quantitative assessment of its ability to represent AAM fluctuations on all relevant timescales, ranging from months to several years. From monthly data provided by the Atmospheric Model Intercomparison Project (AMIP) of the World Climate Research Programme, we have investigated seasonal and interannual fluctuations and the decadal mean in the axial component of AAM in 23 AMIP GCMs over the period 1979-1 988. The decadal means are generally well simulated, with the model median value (1.58 x 10(exp 26) kg sq m/s) being only 3.5% larger than the observed mean and with 10 of the models being within 5% of the observed. The seasonal cycle is well reproduced, with the median amplitude of the models' seasonal standard deviations being only 2.4% larger than observed. Half the seasonal amplitudes lie within 15% of the observed, and the median correlation found between the observed and model seasonal cycles is 0.95. The dominant seasonal error is an under- estimation of AAM during northern hemisphere winter associated with errors in the position of subtropical jets. Less robust are the modeled interannual variations, although the median correlation of 0.61 between model simulations and observed AAM is statistically significant. The two El Nino-Southern Oscillation events that occurred during the AMIP decade 1979-1988 have the expected positive AAM anomalies, although the AAM signature of the 1982-1983 event tends to be underestimated and that of the 1986-1987 event overestimated.
Author
Angular Momentum; Atmospheric Models; Atmospheric Circulation; Mathematical Models; Dynamic Characteristics

19990042404 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
RXTE Observation of Cygnus X-1, 1, Spectral Analysis
Dove, James B., Colorado Univ., USA; Wilms, Joern, Tuebingen Univ., Germany; Nowak, Michael A., Colorado Univ., USA; Vaughan, Brian A., California Inst. of Tech., USA; Begelman, Mitchell C., Colorado Univ., USA; Mon. Not. R. Astron. Soc.; Sep. 28, 1998, pp. 1-8; In English
Contract(s)/Grant(s): DARA-50-OR-92054; NAG5-2026; NAG5-3225; NAG5-3310; NSF AST-91-20599; NSF AST-95-29175; NSF INT-95-13899
Report No.(s): ASTRO-PH/9707322-Vol-2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present the results of the analysis of the broad-band spectrum of Cygnus X-1 from 3.0 to 200 keV, using data from a 10 ksec observation by the Rossi X-ray Timing Explorer. The spectrum can be well described phenomenologically by an exponentially cut-off power law with a photon index Gamma = 1.45(+0.01 -0.02) (a value considerably harder 0.02 than typically found), e-folding energy E(sub f) = 162(+9 -8) keV, plus a deviation from a power law that formally can be modeled as a thermal blackbody with temperature kT(sub bb) = 1.2(+0.0 -0.1) keV. Although the 3-30 keV portion of the spectrum can be fit with a reflected power law with Gamma = 1.81 + or - 0.01 and covering fraction f = 0.35 + or - 0.02, the quality of the fit is significantly reduced when the HEXTE data in the 30-100 keV range is included, as there is no observed hardening in the power law within this energy range. As a physical description of this system, we apply the accretion disc corona models of Dove, Wilms & Begelman (1997a) - where the temperature of the corona is determined self-consistently. A spherical corona with a total optical depth pi = 1.6 + or - 0.1 and an average temperature kT(sub c) = 87 + or - 5 keV, surrounded by an exterior cold disc, does provide a good description of the data (X(exp 2 sub red) = 1.55). These models deviate from red the data by up to 7% in the 5 - 10 keV range, and we discuss possible

reasons for these discrepancies. However, considering bow successfully the spherical corona reproduces the 10 - 200 keV data, such ”pboton-starved” coronal geometries seem very promising for explaining the accretion processes of Cygnus X-1.
Author
Accretion Disks; X Ray Astronomy; X Ray Binaries; Radiative Transfer; Coronas

19990042409 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Earth Rotation
Dickey, Jean O., Jet Propulsion Lab., California Inst. of Tech., USA; Global Earth Physics: A Handbook of Physical Constants; 1995, pp. 356-368; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The study of the Earth’s rotation in space (encompassing Universal Time (UT1), length of day, polar motion, and the phenomena of precession and nutation) addresses the complex nature of Earth orientation changes, the mechanisms of excitation of these changes and their geophysical implications in a broad variety of areas. In the absence of internal sources of energy or interactions with astronomical objects, the Earth would move as a rigid body with its various parts (the crust, mantle, inner and outer cores, atmosphere and oceans) rotating together at a constant fixed rate. In reality, the world is considerably more complicated, as is schematically illustrated. The rotation rate of the Earth’s crust is not constant, but exhibits complicated fluctuations in speed amounting to several parts in 10(exp 8) [corresponding to a variation of several milliseconds (ms) in the Length of the Day (LOD) and about one part in 10(exp 6) in the orientation of the rotation axis relative to the solid Earth’s axis of figure (polar motion). These changes occur over a broad spectrum of time scales, ranging from hours to centuries and longer, reflecting the fact that they are produced by a wide variety of geophysical and astronomical processes. Geodetic observations of Earth rotation changes thus provide insights into the geophysical processes illustrated, which are often difficult to obtain by other means. In addition, these measurements are required for engineering purposes. Theoretical studies of Earth rotation variations are based on the application of Euler’s dynamical equations to the problem of finding the response of slightly deformable solid Earth to variety of surface and internal stresses.
Derived from text
Earth Rotation; Research; Earth Axis; Earth Crust; Earth Orientation; Polar Wandering (Geology); Universal Time

91
LUNAR AND PLANETARY EXPLORATION

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

19990041877 Los Alamos National Lab., NM USA
Neutron sensors for locating sites of planetary water deposits
Feldman, W. C.; Fenimore, E. E.; Byrd, R. C.; Wiens, R. C.; Dec. 31, 1998; 4p; In English
Report No.(s): DE99-001274; LA-UR-98-2618; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a six-month, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). This project helped in exploration of the value and feasibility of use of collimated neutron detection methods for improving the sensitivity of neutron spectrometers specifically designed for deep-space missions to detect and identify both present-day deposits of near-surface water ice. The authors believed that this result helped enable a decision to include a Los Alamos- designed neutron sensor as a component of the NASA Mars Global Surveyor-01 Gamma-Ray/Neutron Spectrometer.
NTIS
Neutron Spectrometers; Water; Mars (Planet)

19990042026 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Dynamics from Earth-Based Tracking of the Mars Pathfinder Lander
Folkner, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; Kahn, R. D., Jet Propulsion Lab., California Inst. of Tech., USA; Preston, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; Yoder, C. F., Jet Propulsion Lab., California Inst. of Tech., USA; Standish, E. M., Jet Propulsion Lab., California Inst. of Tech., USA; Williams, J. G., Jet Propulsion Lab., California Inst. of Tech., USA; Edwards, C. D., Jet Propulsion Lab., California Inst. of Tech., USA; Hellings, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; Eubanks, T. M., Naval Observatory, USA; Bills, B. G., NASA Goddard Space Flight Center, USA; Journal of Geophysical Research; Feb. 25, 1997; ISSN 0148-0227; Volume 102, No. E2, pp. 4057-4064; In English
Report No.(s): Paper 96JE02125; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Measurements of Mars' rotational variations can be conducted via Earth-based radio tracking observations of the Mars Pathfinder lander during an extended mission. Two-way range measurements between an Earth tracking station and the lander will enable precise monitoring of the planet's orientation, allowing details of Mars' internal structure and global surface/atmosphere interactions to be determined. An analysis has been performed to investigate the accuracy with which key physical parameters of Mars can be determined using the Earth-based radio tracking measurements. Acquisition of such measurements over one Martian year should enable determination of Mars' polar moment of inertia to 1% or better, providing a strong constraint on radial density profiles (and hence on the iron content of the core and mantle) and on long-term variations of the obliquity, which influences the climate. Variations in Mars length of day and polar motion should also be detectable, and will yield information on the seasonal cycling of carbon dioxide between the atmosphere and the surface.
Author
Carbon Dioxide; Mars (Planet); Polar Wandering (Geology); Planetary Cores; Planetary Mantles

92
SOLAR PHYSICS

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

19990041716 Los Alamos National Lab., NM USA
Surface emissivity and temperature retrieval for a hyperspectral sensor
Borel, C. C.; Dec. 31, 1998; 5p; In English; IEEE international geoscience and remote sensing symposium
Report No.(s): DE99-000617; LA-UR-98-1366; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
With the growing use of hyper-spectral imagers, e.g., AVIRIS in the visible and short-wave infrared there is hope of using such instruments in the mid-wave and thermal IR (TIR) some day. The author believes that this will enable him to get around using the present temperature-emissivity separation algorithms using methods which take advantage of the many channels available in hyper-spectral imagers. A simple fact used in coming up with a novel algorithm is that a typical surface emissivity spectrum are rather smooth compared to spectral features introduced by the atmosphere. Thus, a iterative solution technique can be devised which retrieves emissivity spectra based on spectral smoothness. to make the emissivities realistic, atmospheric parameters are varied using approximations, look-up tables derived from a radiative transfer code and spectral libraries. One such iterative algorithm solves the radiative transfer equation for the radiance at the sensor for the unknown emissivity and uses the blackbody temperature computed in an atmospheric window to get a guess for the unknown surface temperature. by varying the surface temperature over a small range a series of emissivity spectra are calculated. The one with the smoothest characteristic is chosen. The algorithm was tested on synthetic data using MODTRAN and the Salisbury emissivity database.
NTIS
Surface Temperature; Emissivity; Spectra; Sensors

19990041941 Los Alamos National Lab., NM USA
Solar particle events and their radiation threats
Reedy, Robert C., Los Alamos National Lab., USA; Mar. 31, 1998; 7p; In English; 34th; High-Energy Radiation Background in Space, 22-25 Jul. 1997, Snowmass, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-003308; LA-UR-97-4361; CONF-970711; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Energetic particles from the Sun have only been studied in detail during the last three decades. The modern record is good, although the number of the largest solar particle events are very few. The nuclides made by solar energetic particles in lunar rocks have been used to extend the record of these particles (approximately) 10(sup 7) years. The modern and ancient records are similar. By combining both sets of data, it has been inferred that solar particle events much larger than the largest events observed during the last four solar cycles are very rare.
NTIS
Radiation Hazards; Conferences; Solar Physics; Solar Flares; Energetic Particles

19990042139 NASA Ames Research Center, Moffett Field, CA USA
The Structure of the Solar Wind at Large Heliocentric Distances: CIRs and their Successors
Gazis, P. R., NASA Ames Research Center, USA; 1997; 4p; In English
Contract(s)/Grant(s): NCC2-687; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Co-rotating interaction regions (CIRs) and their associated shock pairs are dominant structures in the solar wind between the heliocentric distances of 2 and 8 AU. At larger heliocentric distances, these structures undergo a qualitative change. Shocks decay

to a point where they are often difficult to detect, and may have little influence on the dynamics of the solar wind. Interaction regions spread and merge, though they appear to retain their identity to surprisingly large distances from the Sun. Solar wind and IMF data from the Pioneer 10, Pioneer 11, and Voyager 2 spacecraft were used to conduct a comprehensive survey of CIRs and their successors between heliocentric distances of 1 and 55 AU over the last two solar cycles. The structure of the solar wind varied in a consistent fashion with heliocentric distance. Similar structures were observed at similar heliocentric distances by all three spacecraft during different portions of the solar cycle.
Author
Solar Wind; Solar Cycles; Solar Position; Distance; Geophysics; Earth Planetary Structure

19990042413 NASA Marshall Space Flight Center, Huntsville, AL USA
The Paradox of Filamented Coronal Hole Flow but Uniform High Speed Wind
Suess, Steven T., NASA Marshall Space Flight Center, USA; Parhi, Shyamsundar, NASA Marshall Space Flight Center, USA; Moore, Ronald L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 26 May 1998, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Plumes and rays in coronal holes are nearly radially aligned density striations that follow the ambient magnetic field. They have long been known, but have gained new interest with growing awareness that coronal hole flow is inherently filamentary. In retrospect, filamentary flow should have been no surprise. This is because,Beta much less than 1 in coronal holes inside approximately 10 Solar radius, allowing the flow to be filamentary down to the smallest scale of photospheric magnetic activity. While the magnetic field itself is locally smooth across any height above ca. 50,000 km, SOHO/MDI has shown that the photospheric magnetic field is a complex array of rapidly evolving small bipoles that are constantly emerging, evolving, and cancelling. The resulting activity is manifested in microflares, concentrated in the magnetic network, that produce Impulsive injections at the footpoints of coronal field lines. The uneven distribution of this activity in space and time is the source of coronal hole filamentation. What is surprising is that the radial flow speed also exhibits filamentary structure. It is not well described as smooth, spherically symmetric, diverging flow, but instead ranges from 300 to over 1000 km/s at 5.5 Solar radius among field-aligned filaments like those seen in plumes and rays [Feldman et al., JGR, Dec. 1997]. This is completely unlike the constant high speed solar wind reported beyond 0.3 AU. Consequently, plumes and filamentary structure must be strongly mixed, and the mixing must be far along by 0.3 AU to be consistent with Helios observations. The paradox is what causes the mixing? Existing models of coronal heating and solar wind acceleration hardly address this issue. One possibility we are investigating is the MHD Kelvin-Helmholtz instability, to which the shear between plumes and interplume corona is expected to become unstable at 5-10 Solar radius. This instability can be simulated and followed far into the nonlinear regime and may lead to Alfvenic fluctuations like those seen at 1 AU.
Author
Coronal Holes; Radial Flow; Solar Corona; Solar Wind; Kelvin-Helmholtz Instability; Magnetohydrodynamic Stability; Solar Magnetic Field

93
SPACE RADIATION

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

19990041166 Los Alamos National Lab., NM USA
Expected rates of X-ray flashes from GRBs in ROSAT and preliminary search results
Li, H.; Sun, X.; Fenimore, E. E.; Dec. 31, 1998; 6p; In English; 4th; Huntsville gamma ray bursts
Report No.(s): DE99-000634; LA-UR-98-308; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The recent long (up to days) and relatively bright soft X-ray afterglows from GRBs detected by BeppoSAX raise the possibility of detecting similar events in the ROSAT database. The authors perform detailed calculations on the expected number of ROSAT events based on the extended halo scenario. They use the realistic ROSAT capabilities and the actual exposure time on bright nearby (approximately) 1, and depends on the peak x-ray luminosity. Thus a nondetection of such events from nearby galaxies (within 12 Mpc) can not rule out most of the viable halo models. They also present the preliminary search results from the ROSAT PSPC database.
NTIS
X Rays; Galaxies; Afterglows

19990041932 NASA Marshall Space Flight Center, Huntsville, AL USA

Recent Outbursts from the Transient X-Ray Pulsar Cepheus X-4 (GS 2138 + 56)

Wilson, Colleen A., NASA Marshall Space Flight Center, USA; Finger, Mark H., NASA Marshall Space Flight Center, USA; Scott, D. Matthew, NASA Marshall Space Flight Center, USA; Astrophysical Journal; Jan. 20, 1999; Volume 511, pp. 367-373; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report on X-ray observations of the 66 s period transient X-ray pulsar Cep X-4 (GS 2138+56) with the Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory and with the Rossi X-Ray Timing Explorer (RXTE). Two outbursts from Cep X-4 were observed with BATSE in 1993 June-July and in 1997 July. Pulse frequencies of v = 15.0941 + or - 0.0002 mHz on 1993 June 25 (MJD 49,163) and v = 15.0882 + or - 0.0002 mHz on 1997 July 12 (MJD 50,641) were each measured from 2-day spans of BATSE data near each outburst's peak. Cep X-4 showed an average spin down rate of dot-v = (-4.14 + or - 0.08) x 10(exp -14) Hz s(exp -1) between the 1993 and 1997 outbursts. After BATSE could no longer detect Cep X-4, public observations were performed on 1997 July 18 and July 25 with the Proportional Counter Array (PCA) on RXTE. A pulse frequency of v = 15.088 + or - 0.004 mHz was measured from observations on 1997 July 18 (MJD 50,647). Significant aperiodic noise, with an rms variance of about 18% in the frequency range 0.01 - 1.0 Hz, was observed on both days. Energy- and intensity-dependent pulse shape variations were also seen in these data. Recently published optical observations associate Cep X-4 with a Be companion star. If all four outbursts observed from Cep X-4 are assumed to occur at the same orbital phase, we find that the orbital period is between 23 and 147.3 days.

Author

Companion Stars; Gamma Ray Bursts; Neutron Stars; Pulsars; Binary Stars; X Ray Stars; X Ray Astronomy

19990042027 NASA Goddard Space Flight Center, Greenbelt, MD USA

Gamma Radiation from PSR B1055-52

Thompson, D. J., NASA Goddard Space Flight Center, USA; Bailes, M., Swinburne Univ. of Technology, Australia; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Cordes, J., Cornell Univ., USA; DAmico, N., Osservatorio Astronomico, Italy; Esposito, J. A., NASA Goddard Space Flight Center, USA; Finley, J., Purdue Univ., USA; Hartman, R. C., NASA Goddard Space Flight Center, USA; Hermsen, W., Space Research Organization Netherlands, Netherlands; Kanbach, G., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Kaspi, V. M., Massachusetts Inst. of Tech., USA; Kniffen, D. A., Hampden-Sydney Coll., USA; Kuiper, L., Space Research Organization Netherlands, Netherlands; Lin, Y. C., Stanford Univ., USA; Lyne, A., Nuffield Radio Astronomy Labs., UK; Manchester, R., Commonwealth Scientific and Industrial Research Organization, Australia; Matz, S. M., Northwestern Univ., USA; Mayer-Hasselwander, H. A., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Michelson, P. F., Stanford Univ., USA; Nolan, P. L., Stanford Univ., USA; 1999; 40p; In English

Contract(s)/Grant(s): NAS5-31210; NAG5-1742; NAG5-1605; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The telescopes on the Compton Gamma Ray Observatory (CGRO) have observed PSR B1055-52 a number of times between 1991 and 1998. From these data, a more detailed picture of the gamma radiation from this source has been developed, showing several characteristics which distinguish this pulsar: the light curve is complex; there is no detectable unpulsed emission; the energy spectrum is flat, with no evidence of a sharp high-energy cutoff up to greater than 4 GeV. Comparisons of the gamma-ray data with observations at longer wavelengths show that no two of the known gamma-ray pulsars have quite the same characteristics; this diversity makes interpretation in terms of theoretical models difficult.

Author

Gamma Rays; Data Acquisition; Pulsars; Mathematical Models; Atmospheric Radiation

19990042107 Columbia Univ., Depts. of Astronomy and Physics, New York, NY USA

Hard X-Ray Emission from X-Ray Bursters ***Final Report, 1 Jun. 1997 - 31 May 1999***

Halpern, Jules P., Columbia Univ., USA; Kaaret, Philip, Columbia Univ., USA; Apri 1999; 2p; In English

Contract(s)/Grant(s): NAG5-4633

Report No.(s): CAL-3093; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The scientific goal of this project is to study the hard x-ray emission from x-ray bursters. One target of opportunity observation was made for this investigation during 1997. We obtained 38ks of data on the source 4UI705-44. The project is closely related to "Monitoring x-ray emission from x-ray bursters", and "Long-Term Hard X-Ray Monitoring of X-Ray Bursters."

Derived from text

X Rays; X Ray Binaries; Emission Spectra; X Ray Astronomy

19990042174 Oxford Univ., Dept. of Astrophysics, Oxford, UK

Asymmetries in the Jets of Weak Radio Galaxies

Laing, R. A., Rutherford Appleton Lab., UK; Parma, P., Istituto di Radioastronomia, Italy; deRuiter, H. R., Istituto di Radioastronomia, Italy; Fanti, R., Istituto di Radioastronomia, Italy; Mar. 26, 1999; In English

Contract(s)/Grant(s): CRG-93-1498

Report No.(s): OUAST/99/10; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Astrophysics, Keble Rd, Oxford, OX1 3RH, UK), Hardcopy, Microfiche

We describe a study of the side-to-side asymmetries on kiloparsec scales in the jets of FRI radio galaxies selected from the B2 sample. The basic data are jet surface brightnesses and widths determined by fitting transverse profiles to VLA images at a range of distances from the core. Differences between the jets at a given distance from the nucleus are interpreted as effects of Doppler beaming on intrinsically symmetrical flows and are compared with the model derived for 3C31 by Laing & Bridle (1999) and with simpler variants. The jet/counter-jet brightness ratios where the main jet first brightens are correlated with core prominence, as expected for a relativistic flow. From the distribution of brightness ratios, we infer that jets have a maximum velocity approximately equals 0.9c where they first flare and brighten, but there is also evidence for additional slower material. Deceleration to subrelativistic speeds occurs on scales which increase with radio power. Jets in the majority of sources with luminosities is less than 10(exp 24) W/Hz at 1.4 GHz become essentially symmetrical (and therefore sub-relativistic) within 2 kpc of the core. In more powerful sources, jets which flare within the first 2 kpc become symmetrical by 10 kpc, but a subset of the most luminous objects have jets which remain asymmetrical to larger distances. The point at which the brighter jet flares appears to correspond to a sudden increase in rest-frame emissivity, but the ratio of distances to the flaring point in main and counterjets is anticorrelated with brightness ratio, as expected for a decelerating relativistic flow. Brightness and FWHM ratios are also anticorrelated, an effect which we interpret as a result of Doppler beaming for a flow in which the velocity decreases radially outwards from the jet axis. Jet deceleration by entrainment of external material provides a natural explanation for these velocity gradients. The jet energy flux is roughly consistent with energy supply to the lobes over a source lifetime estimated from spectral-index measurements. Our results are qualitatively consistent with unified models of FRI radio galaxies and BL Lac objects, but require some modifications to the standard picture.

Author

BL Lacertae Objects; Radio Galaxies; Radio Spectra; Radio Astronomy; Galactic Nuclei; Radio Jets (Astronomy)

19990042242 Institute of Physical and Chemical Research, Saitama, Japan

X-ray All Sky Monitor and Gamma-ray Burst Observations for JEM on Space Station

Matsuoka, M., Institute of Physical and Chemical Research, Japan; Kawai, N., Institute of Physical and Chemical Research, Japan; Yoshida, A., Institute of Physical and Chemical Research, Japan; Tokanai, F., Institute of Physical and Chemical Research, Japan; Mihara, T., Institute of Physical and Chemical Research, Japan; Shimizu, H. M., Institute of Physical and Chemical Research, Japan; The Next Generation of X-Ray Observatories; 1997, pp. 213-219; In English; See also 19990042217; Copyright; Avail: Issuing Activity (Leicester Univ., Dept. of Physics and Astronomy, X-ray Astronomy Group, Leicester LE1 7RH, UK), Hardcopy, Microfiche

X ray all sky monitors (ASMs) have played a pioneering role for variable phenomena as well as new transients. This role of the ASM is still necessary for future high energy astrophysics. Now the Japanese Experiment Module (JEM) on the Space Station is really under construction. JEM has an exposed facility for space observations which is scheduled to be operated from 2001. Since JEM goes round every orbit, the ASM might be one of suitable payloads for JEM. The observation of gamma-ray bursts (GRBs) is also suitable for the JEM observational payload. Here we propose an X ray all sky monitor and a GRB observation for JEM. An ASM in the 2000 era will be required to detect weak sources such as active galactic nuclei, while it would be necessary for GRB instruments in the next decade to localize GRBs with high-precision such as approximately 1'.

Author

X Ray Astronomy; Gamma Ray Bursts; Japanese Space Program; Spacecraft Modules; X Rays; Monitors

19990042284 NASA Marshall Space Flight Center, Huntsville, AL USA

A Search for TeV Counterparts to BATSE Gamma-Ray Bursts

Connanughton, V., NASA Marshall Space Flight Center, USA; Akerlof, C. W., NASA Marshall Space Flight Center, USA; Barthelmy, S., NASA Marshall Space Flight Center, USA; Biller, S., NASA Marshall Space Flight Center, USA; Boyle, P., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Apr. 1997; Volume 479, pp. 859; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Intense effort has gone into the observation of optical, radio, and X-ray gamma-ray burst (GRB) counterparts, either simultaneous to the burst or as quasi-steady lingering remnants. Here we report on a similar study at higher energies of 250 GeV and above using ground-based telescopes. The recent technical advances represented by the atmospheric Cherenkov imaging technique (Cawley & Weekes 1995) have opened up the field of gamma-ray astronomy above 250 GeV and raised the possibility that these techniques can be used with excellent fluence sensitivity in exploring the GRB phenomenon. Observations by the Whipple collaboration of nine BATSE positions, one acquired within 2 minutes of the reported BATSE burst time, using coordinates distributed through the BATSE Coordinates Distribution Network (BACODINE) are reported. No evidence of TeV emission is found, and upper limits to the high-energy delayed or extended emission of observed candidates are calculated.
Author
Gamma Ray Astronomy; Imaging Techniques; Radio Bursts; Gamma Ray Observatory; Gamma Ray Bursts

99
GENERAL

19990041803 NASA, Washington, DC USA
Monographs in Aerospace History Series No. 11. Together in Orbit: The Origins of International Participation in the Space Station
Logsdon, John M., George Washington Univ., USA; November 1998; 60p; In English
Report No.(s): NASA-NP-1998-10-244-HQ; NAS 1.83:1998-10-244-HQ; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This essay is a history and analysis of the steps leading to the origins of the space station partnership between the USA and its closest allies. It traces the process that led to the decision to invite other countries to participate in the project and their reasons for accepting that invitation. Not covered in this account are the difficult negotiations during the 1984-1988 period that led first to an initial set of agreements that allowed the prospective partners to work together during the early stages of the space station program and then to the final set of agreements creating the original space station partnership. Also, the 1993 invitation to the Russian Federation to join the original partners is not discussed, nor are the subsequent negotiations to revise the 1988 agreements.
Derived from text
International Space Station; Histories; International Cooperation; European Space Agency

Subject Term Index

A

A STARS, 206, 207
ABSORPTION SPECTRA, 28
ABSTRACTS, 202
ACCEPTABILITY, 23
ACCIDENT INVESTIGATION, 133
ACCIDENT PREVENTION, 214
ACCRETION DISKS, 202, 204, 205, 206, 213, 217, 219
ACCURACY, 4, 79, 81, 83, 85, 107
ACOUSTIC PROPERTIES, 160, 161
ACOUSTIC STREAMING, 57
ACOUSTIC VELOCITY, 2
ACOUSTICS, 160
ACOUSTO-OPTICS, 89
ACTINIDE SERIES, 43
ACTIVE CONTROL, 10, 57
ACTIVE GALACTIC NUCLEI, 203, 215, 216
ACTIVE GALAXIES, 208, 216
ACTUATORS, 56, 65
ADAPTIVE CONTROL, 138, 139, 140
ADAPTIVE OPTICS, 168
ADDITIVES, 64
ADRENERGICS, 127
ADSORPTION, 46, 59
ADVANCED MICROWAVE SOUNDING UNIT, 23, 24, 108, 137
AERIAL PHOTOGRAPHY, 86
AEROACOUSTICS, 161
AERODYNAMIC BALANCE, 77
AERODYNAMIC CHARACTERISTICS, 3, 80, 84
AERODYNAMIC CONFIGURATIONS, 11
AERODYNAMIC DRAG, 13, 81
AERODYNAMIC FORCES, 79, 81
AERODYNAMIC LOADS, 83
AERODYNAMIC NOISE, 160, 161
AERODYNAMIC STABILITY, 2
AERONAUTICAL ENGINEERING, 1, 8
AEROSOLS, 122, 168
AEROSPACE ENGINEERING, 199
AEROSPACE ENVIRONMENTS, 36
AEROSPACE MEDICINE, 128, 129, 132
AEROSPACE SYSTEMS, 3
AEROSPACE TECHNOLOGY TRANSFER, 202
AEROSPACE VEHICLES, 18, 27
AEROSPIKE ENGINES, 9, 25
AFTERGLOWS, 221
AGING (MATERIALS), 43
AGRICULTURE, 92
AIR, 31
AIR FILTERS, 113
AIR POLLUTION, 105, 107, 108, 110, 111, 112
AIR TRAFFIC CONTROL, 4
AIRCRAFT, 108
AIRCRAFT DESIGN, 3, 7, 8, 9
AIRCRAFT LANDING, 4
AIRCRAFT MODELS, 24, 80, 159
AIRCRAFT NOISE, 161
AIRCRAFT PERFORMANCE, 7
AIRCRAFT PILOTS, 133
AIRCRAFT RELIABILITY, 7
AIRCRAFT STRUCTURES, 7, 30
AIRCRAFT WAKES, 1
AIRFIELD SURFACE MOVEMENTS, 4
AIRFOILS, 2
AIRPORTS, 12
ALBUMINS, 28
ALERTNESS, 132
ALGORITHMS, 69, 82, 120, 121, 137, 143
ALIGNMENT, 177
ALPHA PARTICLES, 162
ALTIMETRY, 100
ALUMINIDES, 44
ALUMINUM, 40, 43, 191
ALUMINUM ALLOYS, 40, 42, 45, 63
ALUMINUM COMPOUNDS, 38
AMERICIUM, 44
AMMUNITION, 14
AMORPHOUS MATERIALS, 46, 191
AMPLITUDES, 218
ANALOG TO DIGITAL CONVERTERS, 59
ANALYTIC FUNCTIONS, 134, 155, 157
ANALYTIC GEOMETRY, 158
ANEMOMETERS, 86
ANGULAR DISTRIBUTION, 111
ANGULAR MOMENTUM, 218
ANGULAR RESOLUTION, 88
ANISOTROPY, 71, 156
ANNEALING, 46
ANNUAL VARIATIONS, 102, 117, 124
ANNULI, 158, 205
ANOMALIES, 184
ANTIBODIES, 125
ANTIGENS, 125
APERTURES, 171, 172
APPLICATIONS PROGRAMS (COMPUTERS), 72, 73, 93, 137, 146
APPROXIMATION, 154
APSIDES, 117
ARC WELDING, 92
ARCHITECTURE (COMPUTERS), 139, 141, 144, 149
ARKANSAS, 97
ARMED FORCES, 134
ARMOR, 95
ARRAYS, 85, 136
ARTIFICIAL INTELLIGENCE, 138, 139, 140, 141, 143, 146, 147
ARTIFICIAL SATELLITES, 24
ASBESTOS, 27
ASIA, 112
ASSAYING, 86
ASSEMBLING, 177
ASTEROIDS, 215
ASTRONAUT TRAINING, 18
ASTRONOMICAL OBSERVATORIES, 208, 211, 212
ASTRONOMICAL SATELLITES, 210, 211
ASTRONOMICAL SPECTROSCOPY, 211
ASTRONOMY, 168
ASTROPHYSICS, 206, 207, 217
ASYMMETRY, 37
ASYMPTOTIC GIANT BRANCH STARS, 207
ASYMPTOTIC METHODS, 156
ATLANTIS (ORBITER), 21
ATMOSPHERIC BOUNDARY LAYER, 110, 122
ATMOSPHERIC CHEMISTRY, 89, 107, 114, 121
ATMOSPHERIC CIRCULATION, 108, 112, 113, 121, 218
ATMOSPHERIC COMPOSITION, 89, 106, 107, 112, 113, 117, 123
ATMOSPHERIC MODELS, 113, 121, 137, 168, 216, 218
ATMOSPHERIC MOISTURE, 59, 124
ATMOSPHERIC RADIATION, 108, 122, 222
ATMOSPHERIC TEMPERATURE, 111
ATMOSPHERIC TURBULENCE, 9, 121
ATOMIC PHYSICS, 214
ATTENUATION, 57, 66
AUDIO DATA, 97
AUGMENTATION, 112, 125
AURORAS, 119, 120

AUTOCODERS, 146
AUTOMATA THEORY, 151
AUTOMATIC CONTROL, 83, 139, 147, 182
AUTOMATIC FLIGHT CONTROL, 12
AUTOMATION, 151
AUTOMOBILE ENGINES, 50
AUTONOMOUS NAVIGATION, 12
AUTONOMY, 4, 139, 195
AVAILABILITY, 153
AVALANCHES, 85
AXIAL COMPRESSION LOADS, 95
AXIAL FLOW, 75, 91
AXIAL LOADS, 84
AXIAL STRESS, 81
AXISYMMETRIC FLOW, 68, 181

B

B STARS, 206
BACKSCATTERING, 71, 161, 184
BALLAST (MASS), 51
BALMER SERIES, 204
BARYONS, 162
BASALT, 215
BAYES THEOREM, 153
BEAM INJECTION, 169
BEAM SPLITTERS, 169
BEAMS (RADIATION), 65
BENDING, 80
BENDING VIBRATION, 11
BERNOULLI THEOREM, 157
BERYLLIUM, 38, 180
BETA FACTOR, 187
BIBLIOGRAPHIES, 1, 128, 194
BIDIRECTIONAL REFLECTANCE, 100
BINARY STARS, 204, 205, 213, 217, 222
BIOCHEMISTRY, 130
BIOGEOCHEMISTRY, 106
BIOLOGICAL EVOLUTION, 127
BIOLOGICAL MODELS (MATHEMATICS), 100
BIOMASS, 99, 102
BIOPHYSICS, 103
BIOPOLYMER DENATURATION, 192
BIOSPHERE, 106
BL LACERTAE OBJECTS, 223
BLACK HOLES (ASTRONOMY), 214
BOEING 727 AIRCRAFT, 4
BOILERS, 110
BONDING, 30
BOOSTER ROCKET ENGINES, 18, 26
BORON CARBIDES, 48
BOUNDARIES, 118
BOUNDARY CONDITIONS, 68, 72, 186
BOUNDARY LAYER FLOW, 73, 74
BOUNDARY LAYERS, 2, 112, 119
BOUNDARY LUBRICATION, 50
BRIDGES (STRUCTURES), 151
BRIDGMAN METHOD, 55
BRIGHTNESS TEMPERATURE, 206
BROADBAND, 57, 211
BROMINE, 114
BROMINE COMPOUNDS, 114, 191
BRYOPHYTES, 101, 102
BUCKLING, 95
BUFFETING, 11
BUILDINGS, 110
BUOYS, 124
BURNERS, 111

C

C++ (PROGRAMMING LANGUAGE), 135
CADASTRAL MAPPING, 199
CALIBRATING, 13, 25, 77, 78, 80, 82, 83, 84, 86, 120, 210
CALIFORNIA, 122
CALORIMETERS, 35, 193
CAMERAS, 176
CAMOUFLAGE, 49
CANCER, 128, 130, 131, 152
CANOPIES (VEGETATION), 100
CANYONS, 125
CARBOHYDRATE METABOLISM, 130
CARBON, 37, 42, 101, 102, 114
CARBON DIOXIDE, 37, 52, 55, 101, 106, 220
CARBON DIOXIDE LASERS, 89, 91
CARBON FIBERS, 30
CARBON MONOXIDE, 89
CARBON-CARBON COMPOSITES, 22
CARCINOGENS, 131
CARRIER FREQUENCIES, 59
CATACLYSMIC VARIABLES, 204, 205, 213, 215
CATALYSIS, 37
CATALYSTS, 173
CAVITIES, 90
CELLS (BIOLOGY), 127, 163
CENTRIFUGING, 129
CERAMIC FIBERS, 38
CERAMIC MATRIX COMPOSITES, 29, 38, 47
CERAMICS, 47
CERTIFICATION, 84
CHANNEL FLOW, 70, 71, 72, 73
CHAOS, 159
CHARACTERIZATION, 168
CHARGED PARTICLES, 87
CHELATION, 64
CHEMICAL BONDS, 33
CHEMICAL COMPOSITION, 35, 50
CHEMICAL EFFECTS, 31
CHEMICAL PROPERTIES, 44
CHEMICAL REACTIONS, 37, 58
CHEMICAL REACTORS, 58
CHEMISORPTION, 46
CHONDRITES, 215
CHROMIUM, 44
CHROMOSPHERE, 204
CHRONOLOGY, 96, 213
CIRCADIAN RHYTHMS, 132
CIRCUITS, 62, 66, 151
CIRCULATION DISTRIBUTION, 121
CIVIL AVIATION, 9
CLADDING, 45
CLIMATE, 107
CLIMATE CHANGE, 106, 112
CLIMATOLOGY, 99, 108, 123
CLINICAL MEDICINE, 130, 131
CLOUDS (METEOROLOGY), 120
CLUSTERS, 198
COAL, 110
COATINGS, 49
COEFFICIENTS, 156
COGNITION, 138
COGNITIVE PSYCHOLOGY, 138
COILS, 63
COLLAPSE, 206
COLLISIONLESS PLASMAS, 185
COLLISIONS, 163
COMBUSTION, 3, 110, 111, 215
COMBUSTION CHAMBERS, 26
COMBUSTION PRODUCTS, 27, 34
COMBUSTION STABILITY, 32
COMMAND AND CONTROL, 6, 14
COMMERCE, 148, 195
COMMERCIAL AIRCRAFT, 7, 8, 9
COMMERCIAL SPACECRAFT, 17, 18, 20
COMMUNICATION NETWORKS, 15, 149
COMPACTING, 14
COMPANION STARS, 222
COMPARISON, 74
COMPLEX SYSTEMS, 142
COMPLEX VARIABLES, 155
COMPLEXITY, 156
COMPOSITE MATERIALS, 5, 29, 48, 93, 95
COMPOSITE STRUCTURES, 29
COMPRESSIBLE FLOW, 68, 160
COMPRESSION LOADS, 39
COMPRESSION RATIO, 175

COMPRESSOR BLADES, 75
COMPTON EFFECT, 64
COMPUTATION, 11, 62, 163
COMPUTATIONAL FLUID DYNAMICS, 2, 25, 67, 75
COMPUTATIONAL GRIDS, 72, 186
COMPUTER AIDED DESIGN, 90
COMPUTER AIDED MANUFACTURING, 93
COMPUTER AIDED TOMOGRAPHY, 76
COMPUTER ASSISTED INSTRUCTION, 130
COMPUTER NETWORKS, 13, 148, 149
COMPUTER PROGRAMMING, 141, 144, 145, 147
COMPUTER PROGRAMS, 13, 48, 77, 83, 90, 137, 139, 140, 141, 142, 143, 144, 146, 152, 161, 163
COMPUTER SYSTEMS DESIGN, 138, 140, 146
COMPUTER SYSTEMS PROGRAMS, 135, 147
COMPUTER TECHNIQUES, 142, 163
COMPUTER VISION, 12
COMPUTERIZED SIMULATION, 1, 4, 12, 31, 32, 33, 38, 66, 68, 167
COMPUTERS, 5, 13
CONCENTRATION, 125
CONCURRENT ENGINEERING, 194
CONDUCTION ELECTRONS, 39
CONDUCTIVE HEAT TRANSFER, 185
CONDUCTORS, 61
CONFERENCES, 19, 68, 76, 92, 138, 202, 208, 220
CONFIDENCE LIMITS, 81
CONFIGURATION INTERACTION, 163
CONFINEMENT, 178, 184, 187
CONFORMAL MAPPING, 156, 158
CONGRESSIONAL REPORTS, 122, 147
CONIFERS, 101, 102
CONSCIOUSNESS, 139
CONSERVATION LAWS, 135
CONSOLIDATION, 38
CONSTRUCTION, 87, 155, 181
CONTAMINANTS, 88
CONTAMINATION, 88, 174
CONTINENTAL SHELVES, 124
CONTINUOUS RADIATION, 169
CONTINUUMS, 204
CONTROL, 195
CONTROL SIMULATION, 151
CONTROL SURFACES, 10
CONTROL SYSTEMS DESIGN, 6, 56, 167
CONTROL THEORY, 10, 138, 143
CONTROLLABILITY, 2
CONTROLLED ATMOSPHERES, 126
CONTROLLERS, 143, 159
CONVECTION, 55, 75
CONVECTIVE HEAT TRANSFER, 13, 73
CONVERGENCE, 155
CONVEXITY, 156, 157, 158
COOLING, 133
COORDINATION, 140
COPPER, 42, 43
CORE FLOW, 27, 72
CORE-MANTLE BOUNDARY, 98
CORNEA, 125
CORNER FLOW, 74
CORONA BOREALIS CONSTELLATION, 215
CORONAL HOLES, 218, 221
CORONAS, 212, 219
CORRECTION, 108, 165, 203
CORRELATION, 43
CORROSION TESTS, 45
COSMOLOGY, 207
COST REDUCTION, 52
COSTS, 137
COUNTDOWN, 18
COUNTERS, 85
COUPLED MODES, 69
CRACKS, 94
CRATERING, 42
CREATIVITY, 143
CREEP PROPERTIES, 104
CREEP STRENGTH, 104
CROSS FLOW, 75
CRYOGENIC WIND TUNNELS, 82, 85
CRYOGENICS, 41, 193, 209
CRYSTAL DEFECTS, 192
CRYSTAL GROWTH, 43, 55, 193
CRYSTAL STRUCTURE, 33, 190, 193
CRYSTALLINITY, 42
CRYSTALLIZATION, 28, 192
CRYSTALS, 191
CUBIC LATTICES, 33
CURRENT SHEETS, 117
CURVED PANELS, 29
CYBERNETICS, 138, 139, 140
CYCLES, 117
CYCLIC AMP, 127
CYLINDRICAL BODIES, 91, 171
CYLINDRICAL SHELLS, 94
CYSTEINE, 35

D

DAMAGE, 34, 65
DATA ACQUISITION, 4, 13, 14, 81, 97, 122, 150, 222
DATA BASE MANAGEMENT SYSTEMS, 146, 173, 196, 197, 199
DATA BASES, 1, 13, 23, 74, 97, 123, 128, 129, 150, 179, 197, 198, 200
DATA MANAGEMENT, 99, 198
DATA PROCESSING, 81, 116, 120, 198
DATA REDUCTION, 14
DATA RETRIEVAL, 173
DATA SYSTEMS, 146
DATA TRANSMISSION, 198
DEATH, 128
DECISION MAKING, 61, 194
DECOMPOSITION, 101, 102, 155
DEFECTS, 43, 182
DEFENSE PROGRAM, 17
DEFLECTION, 11
DEFORMATION, 11, 40, 43, 93, 116, 157
DEGRADATION, 34
DELTA WINGS, 11
DEOXYRIBONUCLEIC ACID, 128, 131
DEPLETION, 123
DEPLOYMENT, 105, 151
DEPOSITION, 188
DERIVATION, 96
DESIGN ANALYSIS, 3, 5, 29, 79, 80, 83, 90, 95, 140, 164, 169, 170, 178, 183, 197
DETACHMENT, 177
DETECTION, 85, 108, 112
DETONATION, 94
DEUTERIUM, 173
DEUTERIUM PLASMA, 188
DIABETES MELLITUS, 130
DIAGNOSIS, 130, 152
DIELECTRIC PROPERTIES, 60, 186
DIELECTRICS, 109
DIFFERENTIAL ABSORPTION LIDAR, 89, 124
DIFFERENTIAL EQUATIONS, 135, 157
DIFFUSION, 42
DIGITAL SYSTEMS, 59, 134
DIGITAL TECHNIQUES, 134
DIMENSIONAL ANALYSIS, 142
DIODES, 90
DIRECT NUMERICAL SIMULATION, 1, 31, 32, 33, 68, 69, 70, 72, 73, 74, 160
DISCOVERY (ORBITER), 21
DISCRETE FUNCTIONS, 151
DISEASES, 130
DISK GALAXIES, 207

DISPLACEMENT, 2, 93, 96
DISSIPATION, 33, 71
DISSOCIATION, 162
DISTANCE, 221
DISTORTION, 158, 193
DISTRIBUTED INTERACTIVE SIMULATION, 145
DISTRIBUTED PROCESSING, 131, 194
DISTRIBUTION FUNCTIONS, 94, 157
DIVERTERS, 174, 177
DIVERTORS (FUSION REACTORS), 182, 185
DMSP SATELLITES, 25
DOCUMENTATION, 137
DOMAINS, 156, 158
DOPED CRYSTALS, 191, 193
DOPPLER EFFECT, 59, 215
DOPPLER RADAR, 122, 144
DOSAGE, 112
DRAG, 2
DRAG MEASUREMENT, 84
DROPS (LIQUIDS), 31, 32
DROUGHT, 101
DUNES, 100
DURABILITY, 34
DUST, 203
DWARF NOVAE, 205, 206
DYNAMIC CHARACTERISTICS, 49, 218
DYNAMIC LOADS, 26
DYNAMIC MODELS, 68, 71, 74, 159, 184
DYNAMIC PROGRAMMING, 154
DYNAMIC RESPONSE, 11, 172
DYNAMIC STRUCTURAL ANALYSIS, 6
DYNAMICAL SYSTEMS, 70, 116, 136

E

EARTH (PLANET), 98
EARTH AXIS, 219
EARTH CRUST, 219
EARTH MAGNETOSPHERE, 117
EARTH OBSERVATIONS (FROM SPACE), 24, 89
EARTH OBSERVING SYSTEM (EOS), 137
EARTH ORBITS, 21, 120
EARTH ORIENTATION, 219
EARTH PLANETARY STRUCTURE, 221
EARTH ROTATION, 219
EARTH SURFACE, 99, 111
EARTHQUAKES, 97
ECLIPSES, 204, 206
ECONOMIC ANALYSIS, 17, 20
ECONOMIC DEVELOPMENT, 195
ECOSYSTEMS, 101, 102
EDITING, 199
EDUCATION, 130
EFFECTIVENESS, 11, 86
EFFLUENTS, 104, 112
ELASTIC MEDIA, 115
ELASTIC PROPERTIES, 34, 49
ELASTIC WAVES, 115
ELASTOPLASTICITY, 94
ELECTRIC BATTERIES, 63
ELECTRIC CHARGE, 163
ELECTRIC CONDUCTORS, 61
ELECTRIC DIPOLES, 161
ELECTRIC DISCHARGES, 109
ELECTRIC FIELDS, 91, 187
ELECTRIC POTENTIAL, 62
ELECTRIC POWER PLANTS, 105
ELECTRIC PULSES, 187
ELECTRICAL ENGINEERING, 92
ELECTRICAL IMPEDANCE, 76
ELECTRICAL PROPERTIES, 29
ELECTRO-OPTICS, 168
ELECTROCHEMICAL CORROSION, 45
ELECTROLYSIS, 36
ELECTROLYTES, 36, 63, 64
ELECTROMAGNETIC ACCELERATION, 177
ELECTROMAGNETIC COMPATIBILITY, 61
ELECTROMAGNETIC FIELDS, 60
ELECTROMAGNETIC INTERFERENCE, 65, 116
ELECTROMAGNETIC RADIATION, 60, 176
ELECTRON ACCELERATION, 179
ELECTRON BEAMS, 177
ELECTRON COUNTERS, 25
ELECTRON CYCLOTRON HEATING, 172
ELECTRON EMISSION, 87
ELECTRON IMPACT, 163
ELECTRON PLASMA, 184
ELECTRON PRECIPITATION, 119
ELECTRON SCATTERING, 163
ELECTRON SOURCES, 87
ELECTRON TRANSFER, 172
ELECTRONIC EQUIPMENT, 92
ELECTRONIC MAIL, 60, 139
ELECTRONIC STRUCTURE, 39, 43
ELECTRONS, 30, 185
EMBEDDING, 144
EMBRYOLOGY, 125
EMBRYOS, 125
EMERGENCIES, 12, 197
EMISSION, 105
EMISSION SPECTRA, 179, 222
EMISSIVITY, 111, 220
EMITTERS, 106
ENCLOSURE, 64
ENERGETIC PARTICLES, 220
ENERGY CONVERSION, 106
ENERGY DISSIPATION, 90, 119
ENERGY DISTRIBUTION, 205, 216
ENERGY GAPS (SOLID STATE), 191
ENERGY SPECTRA, 71
ENERGY TECHNOLOGY, 104, 109, 195
ENERGY TRANSFER, 103, 119, 171
ENGINE PARTS, 9, 26
ENTIRE FUNCTIONS, 156
ENVIRONMENT EFFECTS, 20, 107
ENVIRONMENT MANAGEMENT, 123, 194
ENVIRONMENT POLLUTION, 131
ENVIRONMENT PROTECTION, 104
ENVIRONMENTAL MONITORING, 194
ENZYME ACTIVITY, 130
EPINEPHRINE, 127
ERBIUM, 48
EROSION, 100, 151
ERROR ANALYSIS, 57, 81, 82, 154
ESTIMATES, 12
ESTIMATING, 5, 81, 103, 153
EUCLIDEAN GEOMETRY, 134
EULER-LAGRANGE EQUATION, 75
EUROPEAN SPACE AGENCY, 224
EVALUATION, 107, 134
EVAPORATION, 104, 122
EVOLUTION (DEVELOPMENT), 127
EXCIMER LASERS, 48
EXCITATION, 91, 163, 188, 190
EXHAUST EMISSION, 107, 111
EXOBIOLOGY, 126
EXPERIMENT DESIGN, 77, 192
EXPERIMENTATION, 28, 44, 66, 86, 126, 150
EXPERT SYSTEMS, 143, 150
EXPLOSIONS, 51, 94
EXTRACTION, 131, 142
EXTREME ULTRAVIOLET RADIATION, 65, 210
EYE (ANATOMY), 125, 129
EYE MOVEMENTS, 132

F

F STARS, 207
F-14 AIRCRAFT, 25

FABRICATION, 22, 26, 29, 63, 64, 87, 88, 151, 160
FACTORIZATION, 141
FAILURE, 29, 96
FAN BLADES, 160, 161
FANS, 50
FAR ULTRAVIOLET RADIATION, 119
FARADAY EFFECT, 159
FATIGUE (BIOLOGY), 132
FEASIBILITY ANALYSIS, 27, 103, 197
FEEDBACK, 5
FEEDBACK CONTROL, 2, 10, 69, 143, 175
FEEDFORWARD CONTROL, 143
FIBER COMPOSITES, 30, 38, 65
FIBER OPTICS, 87
FIBERS, 27
FIELD OF VIEW, 120
FIELD STRENGTH, 116
FILM COOLING, 9
FILTERGRAMS, 159
FILTRATION, 151
FINANCIAL MANAGEMENT, 194
FINITE DIFFERENCE THEORY, 25, 74, 135
FINITE ELEMENT METHOD, 5, 95
FINITE VOLUME METHOD, 25, 32, 61
FIRES, 3, 113
FIRMWARE, 136, 137
FLAME PROPAGATION, 32
FLAME STABILITY, 33
FLAMMABILITY, 3
FLAPPING, 11
FLAT PLATES, 73
FLIGHT CHARACTERISTICS, 7, 15
FLIGHT CONTROL, 2, 137
FLIGHT CREWS, 132
FLIGHT FATIGUE, 132
FLIGHT MANAGEMENT SYSTEMS, 12
FLIGHT SIMULATION, 10
FLIGHT TESTS, 18, 53, 105
FLORIDA, 97
FLOW DISTRIBUTION, 11, 69, 74, 75
FLOW MEASUREMENT, 11
FLOW STABILITY, 1, 69, 217
FLOW VELOCITY, 75
FLOW VISUALIZATION, 76
FLUID FLOW, 11, 75, 190
FLUOROPOLYMERS, 49
FLUX DIFFERENCE SPLITTING, 11
FOILS (MATERIALS), 169
FORECASTING, 133, 197
FORESTS, 102
FORMULATIONS, 161
FORTRAN, 163
FORWARD SCATTERING, 64
FRACTALS, 157
FRACTURE MECHANICS, 7, 44
FRACTURE STRENGTH, 41
FRACTURING, 44
FREE ELECTRON LASERS, 90
FREE FLOW, 11, 73
FREQUENCIES, 90, 111
FREQUENCY CONVERTERS, 178
FRESNEL LENSES, 56
FRICTION, 43
FRICTION MEASUREMENT, 13
FRIENDSHIP 7, 21
FUEL CELLS, 104, 105
FUEL INJECTION, 72
FUEL PRODUCTION, 53, 58
FULL SCALE TESTS, 3
FUNCTION SPACE, 157
FUNCTIONS (MATHEMATICS), 156
FUSELAGES, 3
FUSION REACTORS, 178, 181, 185, 188

G

GALACTIC CLUSTERS, 207, 208
GALACTIC EVOLUTION, 205, 213
GALACTIC NUCLEI, 223
GALACTIC RADIATION, 216
GALAXIES, 214, 221
GALLIUM, 45
GALLIUM NITRIDES, 33
GAME THEORY, 149
GAMMA RAY ASTRONOMY, 224
GAMMA RAY BURSTS, 222, 223, 224
GAMMA RAY OBSERVATORY, 224
GAMMA RAYS, 222
GAS DETECTORS, 85, 173
GAS DISSOCIATION, 37
GAS JETS, 27
GAS TRANSPORT, 31
GAS TURBINES, 51
GASIFICATION, 105
GENETICS, 125, 127
GEOGRAPHIC INFORMATION SYSTEMS, 199
GEOLOGICAL SURVEYS, 97
GEOLOGY, 97, 98
GEOMETRY, 43
GEOPHYSICS, 98, 221
GIANT STARS, 215
GLASS, 50, 63, 191
GLASS LASERS, 183
GLOBAL POSITIONING SYSTEM, 4, 5, 12
GOVERNMENT/INDUSTRY RELATIONS, 194
GRAINS, 191
GRAPHICAL USER INTERFACE, 145
GRAPHITE, 65
GRAPHITE-EPOXY COMPOSITES, 29
GRAVITATION, 4
GRAVITATIONAL EFFECTS, 55
GRAVITY PROBE B, 87
GREEN, 152
GRID GENERATION (MATHEMATICS), 72, 163, 186
GROUND EFFECT (AERODYNAMICS), 3
GROUND STATE, 190
GROUND TESTS, 13
GROUND TRACKS, 24
GROUND WATER, 97
GULF OF MEXICO, 122, 125

H

HAFNIUM COMPOUNDS, 182
HANDLING EQUIPMENT, 60
HARDWARE, 26, 152
HARMONIC OSCILLATORS, 217
HAZARDS, 34, 51, 150, 201
HEARTHS, 109
HEAT EXCHANGERS, 58
HEAT FLUX, 13
HEAT PIPES, 66
HEAT SOURCES, 14
HEAT TOLERANCE, 133
HEAT TRANSFER, 75, 122, 172
HELICAL FLOW, 66
HELICOPTER CONTROL, 12
HELICOPTER TAIL ROTORS, 8
HELICOPTERS, 12
HELIOTRONS, 184, 185, 187
HELIUM, 43, 46, 173
HELIUM PLASMA, 174
HERBIG-HARO OBJECTS, 206
HETEROGENEITY, 115
HEXAGONS, 158
HIERARCHIES, 147
HIGH FREQUENCIES, 115
HIGH GAIN, 90
HIGH LEVEL LANGUAGES, 144
HIGH POWER LASERS, 90, 91, 174, 181
HIGH PRESSURE, 191
HIGH RESOLUTION, 35, 64, 119, 170, 209
HIGH STRENGTH STEELS, 45
HIGH TEMPERATURE, 29, 40, 85

HIGH TEMPERATURE ENVIRONMENTS, 44
HIGH TEMPERATURE GASES, 14
HILBERT SPACE, 158
HISTOGRAMS, 25
HISTORIES, 224
HOHLRAUMS, 172
HOLLOW CATHODES, 189
HOLOGRAPHY, 60
HOMOGENEOUS TURBULENCE, 71
HOMOTROPY, 158
HOT ELECTRONS, 174
HOT WORKING, 43
HUMAN FACTORS ENGINEERING, 5, 133, 134
HUMAN PERFORMANCE, 154
HUMAN-COMPUTER INTERFACE, 136, 142, 146
HYDROCARBON FUELS, 27
HYDRODYNAMICS, 31
HYDROGEN, 37, 38, 39, 46, 54
HYDROGEN COMPOUNDS, 125
HYDROGEN EMBRITTLEMENT, 44
HYDROGEN SULFIDE, 51
HYDROGRAPHY, 124, 125, 201
HYDROLOGY, 97
HYPERBOLIC FUNCTIONS, 158
HYPERNUCLEI, 162
HYPERONS, 165
HYPERSONIC FLOW, 2
HYPERSONIC NOZZLES, 2
HYPERTEXT, 62
HYPERVELOCITY WIND TUNNELS, 81
HYSTERESIS, 66

I

ICE CLOUDS, 121
ICELAND, 102
IGNITION, 165, 178, 180
IMAGE PROCESSING, 99
IMAGE RECONSTRUCTION, 64
IMAGE RESOLUTION, 170
IMAGING TECHNIQUES, 60, 89, 115, 119, 170, 183, 208, 211, 224
IMBEDDINGS (MATHEMATICS), 158
IMPACT, 95
IMPACT LOADS, 96
IMPEDANCE, 66
IMPLOSIONS, 171
IMPULSES, 14
IMPURITIES, 46
IN-FLIGHT SIMULATION, 18
INCINERATORS, 109
INDEXES (DOCUMENTATION), 128
INDOOR AIR POLLUTION, 110
INDUCTORS, 63
INELASTIC SCATTERING, 88
INEQUALITIES, 158
INERTIAL CONFINEMENT FUSION, 182, 183
INERTIAL FUSION (REACTOR), 185, 186
INFLATABLE STRUCTURES, 56
INFORMATION DISSEMINATION, 199
INFORMATION FLOW, 60, 142, 200, 202
INFORMATION MANAGEMENT, 138, 140, 147, 197, 199
INFORMATION RETRIEVAL, 138, 146, 147, 173, 198, 200
INFORMATION SYSTEMS, 6, 138, 149, 150, 197, 199, 200
INFORMATION TRANSFER, 200
INFRARED ASTRONOMY, 206
INFRARED IMAGERY, 89, 168, 203
INFRARED LASERS, 89, 90
INFRARED RADIATION, 14, 137, 203, 206
INFRARED SIGNATURES, 168
INFRARED SPECTRA, 117
INFRASONIC FREQUENCIES, 97
INHOMOGENEITY, 193
INJECTION, 158, 188
INLET NOZZLES, 161
INSPECTION, 93, 145, 151
INSTALLING, 176
INSTANTONS, 164
INSTRUMENT APPROACH, 5
INSTRUMENT ERRORS, 77, 82
INSULATORS, 47
INSULIN, 130
INTEGERS, 154
INTEGRAL EQUATIONS, 90, 152
INTEGRATED CIRCUITS, 62, 63
INTEGRATORS, 143
INTELLIGENCE, 143
INTERACTIONAL AERODYNAMICS, 161
INTERACTIONS, 100
INTERFACES, 168
INTERFEROMETRY, 108, 168
INTERMETALLICS, 38
INTERMITTENCY, 73
INTERNAL COMBUSTION ENGINES, 50
INTERNAL FLOW, 72
INTERNAL PRESSURE, 95
INTERNATIONAL COOPERATION, 224
INTERNATIONAL SPACE STATION, 17, 21, 224
INTERNATIONAL TRADE, 200
INTERNET RESOURCES, 200
INTERNETS, 62, 136, 145, 148, 197, 200
INTERPLANETARY DUST, 215
INTERPLANETARY MAGNETIC FIELDS, 218
INTERPLANETARY TRAJECTORIES, 202
INTERPOLATION, 11
INTERSTELLAR EXTINCTION, 203
INTERSTELLAR MATTER, 206
INTERSTITIALS, 192
INTRUSION, 149
INVARIANCE, 158
INVARIANT IMBEDDINGS, 156
INVERSIONS, 161
INVISCID FLOW, 2, 69
IODINE COMPOUNDS, 191
ION ACCELERATORS, 165
ION BEAMS, 42, 182
ION CURRENTS, 64
ION IMPLANTATION, 43
ION PROPULSION, 117
ION SOURCES, 41
ION TEMPERATURE, 172
IONIZATION, 162
IONS, 85
IRIDIUM, 164
IRON, 42, 46
IRON ALLOYS, 44
IRON COMPOUNDS, 45
IRRADIATION, 42
ISOMORPHISM, 155
ISOTOPE EFFECT, 47
ISOTROPIC TURBULENCE, 70
ISOTROPY, 115
ITERATION, 155

J

JAHN-TELLER EFFECT, 50
JAPAN, 210
JAPANESE SPACE PROGRAM, 223
JAVA (PROGRAMMING LANGUAGE), 131, 142, 145
JET CONTROL, 69
JET ENGINE FUELS, 51
JET FLOW, 69
JET MIXING FLOW, 69
JOINTS (JUNCTIONS), 29
JOURNALS, 134

K

K-EPSILON TURBULENCE MODEL, 70
KELVIN-HELMHOLTZ INSTABILITY, 221
KERNEL FUNCTIONS, 147
KEROSENE, 27, 51
KINETIC EQUATIONS, 118
KINETICS, 192, 193
KNOWLEDGE BASED SYSTEMS, 138, 143, 146, 150
KNOWLEDGE REPRESENTATION, 147
KRYPTON 85, 96

L

LABORATORIES, 122, 185, 186
LAMINAR FLOW, 2
LAMINATES, 168
LANDFILLS, 104
LANDSAT 4, 99
LANGEVIN FORMULA, 70
LANTHANUM, 104
LANTHANUM OXIDES, 50
LARGE EDDY SIMULATION, 32, 33, 68, 70, 71, 72, 74
LASER BEAMS, 89, 91, 182
LASER DAMAGE, 49, 174
LASER DOPPLER VELOCIMETERS, 67
LASER FUSION, 91, 185, 186
LASER GUIDE STARS, 168
LASER OUTPUTS, 49
LASER PLASMAS, 180
LASER TARGETS, 180, 182
LASER WELDING, 90
LASERS, 75, 90, 91, 171, 182, 183
LATENT HEAT, 105
LAUNCH VEHICLES, 21, 52
LAUNCHING, 18
LAUNCHING PADS, 16
LAUNCHING SITES, 15, 17
LEAF AREA INDEX, 103
LEAKAGE, 173
LEAST SQUARES METHOD, 77
LENS ANTENNAS, 60
LEUKEMIAS, 150
LIABILITIES, 194
LIBRARIES, 146
LIE GROUPS, 70
LIFE SUPPORT SYSTEMS, 19, 54
LIGHT (VISIBLE RADIATION), 103
LIGHT BEAMS, 169, 182
LIGHT WATER REACTORS, 45
LIGHTNING, 108
LIMB DARKENING, 205
LINE SPECTRA, 124, 203
LINEAR ACCELERATORS, 165
LINEAR EQUATIONS, 135
LINEAR PROGRAMMING, 95, 149
LINEAR SYSTEMS, 95, 99, 186
LIPSCHITZ CONDITION, 159
LIQUID FUELS, 51
LIQUID HYDROGEN, 55
LIQUID PHASES, 51
LIQUID ROCKET PROPELLANTS, 58
LIQUID WASTES, 196
LIQUIDS, 31, 164
LITHIUM, 215
LITHIUM ALLOYS, 41
LITHIUM NIOBATES, 43
LITHIUM SULFUR BATTERIES, 64
LITHOGRAPHY, 65
LOADS (FORCES), 29, 96
LOCAL AREA NETWORKS, 145
LOCAL THERMODYNAMIC EQUILIBRIUM, 116, 117
LONG DURATION SPACE FLIGHT, 52, 54
LORENTZ FORCE, 215
LOW ASPECT RATIO, 184
LOW COST, 17, 18
LOW TEMPERATURE, 63, 85
LUMINESCENCE, 50
LUMINOSITY, 203
LUMPING, 96
LUNAR ENVIRONMENT, 36
LUNAR EXPLORATION, 36
LUNAR RESOURCES, 36, 54
LUNAR SURFACE, 54
LYSOZYME, 192, 193

M

MACHINE LEARNING, 139, 140
MACHINE TOOLS, 57
MAGELLANIC CLOUDS, 213
MAGNESIUM OXIDES, 173
MAGNETIC CLOUDS, 119
MAGNETIC EFFECTS, 189
MAGNETIC FIELD RECONNECTION, 189, 217
MAGNETIC FIELDS, 61, 118, 159, 178
MAGNETIC FLUX, 159
MAGNETIC INDUCTION, 30
MAGNETIC ISLANDS, 185
MAGNETIC SIGNATURES, 159
MAGNETIC STORMS, 119, 218
MAGNETIC SURVEYS, 97
MAGNETIC VARIATIONS, 119
MAGNETIZATION, 193
MAGNETO-OPTICS, 159
MAGNETOHYDRODYNAMIC FLOW, 177
MAGNETOHYDRODYNAMIC STABILITY, 183, 184, 221
MAGNETOHYDRODYNAMIC WAVES, 183
MAGNETOHYDRODYNAMICS, 118, 179, 181, 183, 184, 188
MAGNETOPAUSE, 117, 118
MAGNETRONS, 189
MAGNIFICATION, 94
MAIN SEQUENCE STARS, 207
MAINTENANCE, 8
MAMMARY GLANDS, 130
MAN ENVIRONMENT INTERACTIONS, 97, 107
MANAGEMENT ANALYSIS, 194
MANAGEMENT INFORMATION SYSTEMS, 199
MANAGEMENT PLANNING, 92, 194
MANEUVERABILITY, 24
MANGANESE OXIDES, 50, 193
MANIPULATORS, 183
MANNED MARS MISSIONS, 36, 52, 53, 54, 58, 59
MANNED SPACE FLIGHT, 19, 21, 36, 52
MANUALS, 165
MANUFACTURING, 178
MAPPING, 57
MARINE METEOROLOGY, 112
MARS (PLANET), 36, 52, 58, 59, 106, 219, 220
MARS ATMOSPHERE, 36, 52, 53, 54, 55, 58, 59, 106
MARS ENVIRONMENT, 36, 106
MARS EXPLORATION, 36, 37, 52, 53, 54, 59
MARS MISSIONS, 37, 55
MARS PROBES, 52, 54, 58, 59
MARS SAMPLE RETURN MISSIONS, 54, 58, 59, 106
MARS SURFACE, 52
MARS SURFACE SAMPLES, 54
MARSHLANDS, 101
MASS SPECTROSCOPY, 96
MASS TRANSFER, 204, 205, 217
MATHEMATICAL MODELS, 24, 31, 32, 33, 43, 44, 55, 68, 69, 70, 71, 72, 73, 74, 78, 80, 82, 83, 94, 96, 99, 100, 108, 131, 150, 153, 195, 218, 222
MATHEMATICS, 134
MATRICES (MATHEMATICS), 77
MATRIX MATERIALS, 29
MATRIX METHODS, 88
MAXWELL EQUATION, 61

MEAN SQUARE VALUES, 77
MEASURE AND INTEGRATION, 154
MEASUREMENT, 81, 92
MEASURING INSTRUMENTS, 57, 79, 122
MECHANICAL DRIVES, 171
MECHANICAL PROPERTIES, 41, 48
MELTING, 48
MELTS (CRYSTAL GROWTH), 55, 98
MEMBRANE STRUCTURES, 127
MERCURY MA-6 FLIGHT, 21
MEROMORPHIC FUNCTIONS, 157
MESOSCALE PHENOMENA, 118
MESOSPHERE, 116, 117
METAL AIR BATTERIES, 103
METAL BONDING, 30
METAL COATINGS, 44, 170
METAL FOAMS, 40
METAL FOILS, 30
METAL HYDRIDES, 42
METAL IONS, 35
METAL PLATES, 177
METAL POWDER, 38
METAL SURFACES, 39
METALLIZING, 191
METEORITIC DAMAGE, 214
METEOROID CONCENTRATION, 214
METEOROIDS, 214
METEOROLOGICAL PARAMETERS, 123
METEOROLOGICAL RADAR, 122
METEOROLOGICAL SERVICES, 122
METEOROLOGY, 97, 123
METHANE, 37, 51, 105
METHYL COMPOUNDS, 114
METROLOGY, 92
MEXICO, 110
MICROCHANNEL PLATES, 170
MICROCHANNELS, 58
MICROCLIMATOLOGY, 133
MICROCOMPUTERS, 198
MICROGRAVITY, 25, 55, 125, 190
MICROPROCESSORS, 136
MICROSTRUCTURE, 30, 40, 42, 43, 92
MICROWAVE ANTENNAS, 60
MICROWAVE EMISSION, 111
MICROWAVE EQUIPMENT, 23
MICROWAVES, 91
MIGRATION, 39
MILITARY HELICOPTERS, 8
MILITARY TECHNOLOGY, 200
MILLIMETER WAVES, 120
MINERALS, 98, 124
MINIATURE ELECTRONIC EQUIPMENT, 63
MINIATURIZATION, 63
MINKOWSKI SPACE, 156
MIR SPACE STATION, 21
MIRRORS, 169, 170, 209
MISSION PLANNING, 54, 58, 170, 208, 210, 211, 212
MIXED OXIDES, 45
MIXING LAYERS (FLUIDS), 33
MODAL RESPONSE, 94
MODELS, 23, 26, 62, 95, 96, 144, 145
MODULES, 181
MOISTURE, 44
MOISTURE CONTENT, 120, 124
MOLECULAR ABSORPTION, 38
MOLECULAR CLOUDS, 206
MOLECULAR DIFFUSION, 98
MOLECULAR DYNAMICS, 191, 214
MOLECULAR GASES, 120
MOLECULAR STRUCTURE, 127, 193
MOLECULES, 214
MONITORS, 223
MONTE CARLO METHOD, 62, 88, 94, 135, 154, 167
MORPHOLOGY, 40, 42, 192
MOTOR VEHICLES, 134
MULTIMEDIA, 62
MULTIPROCESSING (COMPUTERS), 148
MULTIPROGRAMMING, 148
MULTIVARIATE STATISTICAL ANALYSIS, 82, 83
MUONS, 165
MUSCLES, 127
MUSCULOSKELETAL SYSTEM, 127, 132

N

NANOSATELLITES, 22
NANOSTRUCTURES (DEVICES), 30
NARROWBAND, 90, 167
NASA PROGRAMS, 199
NATIONAL AEROSPACE PLANE PROGRAM, 2
NATURAL GAS, 51
NATURAL LANGUAGE PROCESSING, 146
NAVIER-STOKES EQUATION, 2, 33, 68, 73, 74
NAVY, 86
NEAR FIELDS, 60
NEAR INFRARED RADIATION, 90
NEODYMIUM, 191
NEODYMIUM ISOTOPES, 63
NEODYMIUM LASERS, 90
NETWORK ANALYSIS, 5
NEURAL NETS, 99, 131, 150, 151, 152
NEUTRAL PARTICLES, 154, 175, 178
NEUTRON COUNTERS, 86
NEUTRON RADIOGRAPHY, 67
NEUTRON SCATTERING, 67
NEUTRON SOURCES, 166, 167
NEUTRON SPECTRA, 167
NEUTRON SPECTROMETERS, 88, 219
NEUTRON STARS, 217, 222
NEUTRONS, 85, 176
NICKEL ALLOYS, 42
NICKEL COMPOUNDS, 38
NICKEL OXIDES, 47
NITROGEN, 134
NITROGEN DIOXIDE, 112
NITROGEN OXIDES, 108, 112
NOISE PREDICTION, 160, 161
NOISE PREDICTION (AIRCRAFT), 161
NOISE PROPAGATION, 160
NONDESTRUCTIVE TESTS, 93
NONEQUILIBRIUM FLOW, 2
NONINTRUSIVE MEASUREMENT, 67
NONLINEAR SYSTEMS, 5
NONLINEARITY, 115, 156, 181
NORMAL DENSITY FUNCTIONS, 112
NORTHERN HEMISPHERE, 123
NOTCHES, 94
NOVA LASER SYSTEM, 174
NOVAE, 204, 213, 215
NOZZLE FLOW, 9
NOZZLELESS ROCKET ENGINES, 72
NUCLEAR CHEMISTRY, 215
NUCLEAR ENGINE FOR ROCKET VEHICLES, 27
NUCLEAR FUSION, 173, 215
NUCLEAR INTERACTIONS, 164
NUCLEAR REACTIONS, 165
NUCLEAR REACTORS, 166
NUCLEAR RESEARCH, 186
NUCLEAR WEAPONS, 200
NUCLEATION, 42, 43
NUMERICAL ANALYSIS, 215

O

OBJECT-ORIENTED PROGRAMMING, 143, 146, 149
OBSERVATION, 201, 212, 218
OCCUPATIONAL DISEASES, 132
OCEAN CURRENTS, 100, 114
OCEAN DYNAMICS, 124
OCEAN SURFACE, 114
OCEANOGRAPHIC PARAMETERS, 124
OCEANOGRAPHY, 97
ON-LINE SYSTEMS, 145, 153, 200
OPACITY, 197

OPENINGS, 95
OPERATING TEMPERATURE, 66
OPERATIONS RESEARCH, 155
OPTICAL EQUIPMENT, 65, 91, 169, 170, 177, 181, 209
OPTICAL FIBERS, 169
OPTICAL FILTERS, 167
OPTICAL PROPERTIES, 43
OPTICAL RADAR, 122, 136
OPTICAL THICKNESS, 121
OPTIMIZATION, 69, 151
ORBITAL MANEUVERS, 14
ORBITAL MECHANICS, 202
ORBITAL SERVICING, 17
ORBITALS, 201
ORGANIC COMPOUNDS, 49
ORGANIZATIONS, 79
ORGANOMETALLIC COMPOUNDS, 33
OSCILLATIONS, 117, 217
OSCILLATORS, 24
OSMOSIS, 28
OUTGASSING, 173
OXIDATION, 34
OXIDES, 42, 48
OXIDIZERS, 58
OXYGEN, 109, 116
OXYGEN ATOMS, 116
OXYGEN ISOTOPES, 47
OXYGEN PRODUCTION, 37, 54
OXYGEN SUPPLY EQUIPMENT, 54
OZONE, 107, 112, 113, 114, 116, 117, 123
OZONE DEPLETION, 27, 114, 121

P

PAINTS, 34, 50, 134
PANCREAS, 130
PANELS, 14
PARALLEL PROCESSING (COMPUTERS), 135, 144, 198
PARAMETERIZATION, 69
PARTIAL DIFFERENTIAL EQUATIONS, 159
PARTICLE EMISSION, 111
PARTICLE MOTION, 32
PARTICLE PRODUCTION, 166
PARTICLE SIZE DISTRIBUTION, 110, 121
PARTICLE SPIN, 162
PARTICLES, 163, 188
PARTICULATES, 110, 111, 112
PARTONS, 162
PASSIVITY, 104
PATTERN RECOGNITION, 142
PAYLOAD INTEGRATION, 15
PAYLOADS, 15, 18, 54
PEAT, 101
PELLETS, 188
PENDULUMS, 217
PENETRATION, 95
PERFORMANCE PREDICTION, 96, 105
PERFORMANCE TESTS, 4, 23, 24, 84, 88, 103, 122, 134, 136
PERIODIC FUNCTIONS, 152
PERIODIC VARIATIONS, 61
PEROVSKITES, 47, 193
PERSONNEL, 126, 131
PERTURBATION, 69
PETROLEUM PRODUCTS, 51, 105
PHOSPHATES, 63
PHOSPHORS, 48
PHOTOABSORPTION, 180
PHOTOCHEMICAL REACTIONS, 33, 89, 112, 113, 116
PHOTOELECTRON SPECTROSCOPY, 39
PHOTOLUMINESCENCE, 48
PHOTOLYSIS, 116
PHOTON BEAMS, 87
PHOTON DENSITY, 101
PHOTONS, 96, 165
PHOTONUCLEAR REACTIONS, 165, 174
PHOTOSPHERE, 204
PHOTOSYNTHESIS, 101, 102
PHOTOVOLTAIC CELLS, 106
PHYSICS AND CHEMISTRY EXPERIMENT IN SPACE, 53, 58
PHYSIOLOGICAL EFFECTS, 128
PHYSIOLOGY, 132
PIGMENTS, 103
PILOT INDUCED OSCILLATION, 2
PILOT PERFORMANCE, 132
PILOTLESS AIRCRAFT, 7
PINNING, 45
PITCHING MOMENTS, 11
PIXELS, 87
PLANETARY CORES, 220
PLANETARY ENVIRONMENTS, 36
PLANETARY EVOLUTION, 217
PLANETARY MANTLES, 220
PLANT DESIGN, 105, 181
PLASMA CONTROL, 175, 179, 183, 184, 185, 187, 188
PLASMA CURRENTS, 179, 189
PLASMA DIAGNOSTICS, 174, 187
PLASMA ETCHING, 104
PLASMA HEATING, 188
PLASMA INTERACTIONS, 119
PLASMA JETS, 178
PLASMA OSCILLATIONS, 187
PLASMA PHYSICS, 187
PLASMA PRESSURE, 177
PLASMA SHEATHS, 182, 189
PLASMA WAVES, 118, 176, 184
PLASMA-ELECTROMAGNETIC INTERACTION, 176
PLASMA-PARTICLE INTERACTIONS, 176
PLASMAS (PHYSICS), 163, 179, 180, 185, 187
PLASTICS, 162
PLATES (STRUCTURAL MEMBERS), 182
PLUMES, 25, 112
PLUTONIUM, 43, 44
PLUTONIUM OXIDES, 45
POINT SOURCES, 163
POLAR REGIONS, 121
POLAR WANDERING (GEOLOGY), 219, 220
POLARONS, 190
POLICIES, 20, 200
POLLUTION CONTROL, 110, 111
POLLUTION MONITORING, 105, 194
POLLUTION TRANSPORT, 27, 108
POLYATOMIC MOLECULES, 162
POLYCHLORINATED BIPHENYLS, 113
POLYCYCLIC AROMATIC HYDROCARBONS, 131
POLYETHYLENES, 162
POLYGONS, 158
POLYSTYRENE, 48
POLYURETHANE RESINS, 34
POLYVINYL CHLORIDE, 162
POSITION (LOCATION), 193
POSITIVE IONS, 35
POTENTIAL THEORY, 156
POWER CONDITIONING, 22, 183
PRECIPITATION (METEOROLOGY), 124
PRECISION, 147
PREDICTION ANALYSIS TECHNIQUES, 10, 99, 160
PREFLIGHT OPERATIONS, 16
PREMIXED FLAMES, 32
PREPREGS, 30
PRESERVING, 129
PRESSURE EFFECTS, 73
PRESSURE GRADIENTS, 9
PRESSURE MEASUREMENT, 28, 50
PRETREATMENT, 125
PRIMERS, 34

PRINCIPAL COMPONENTS ANALYSIS, 25
PROBABILITY THEORY, 67, 94, 150, 154
PROBLEM SOLVING, 147
PROCEDURES, 60, 153
PRODUCT DEVELOPMENT, 16, 22, 83, 140, 148
PROPANE, 31
PROPELLANTS, 27, 53, 58, 91
PROPELLER NOISE, 161
PROPULSION, 27
PROPULSION SYSTEM CONFIGURATIONS, 50
PROPULSION SYSTEM PERFORMANCE, 9, 50
PROSTATE GLAND, 131
PROTECTION, 201
PROTEIN CRYSTAL GROWTH, 28, 190, 192, 193
PROTEIN METABOLISM, 127
PROTEIN SYNTHESIS, 127
PROTEINS, 28, 127, 128
PROTOCOL (COMPUTERS), 62
PROTON IRRADIATION, 46, 167
PROTOSTARS, 217
PROTOTYPES, 82, 83, 88, 134, 142, 151
PROVING, 116, 141, 151, 156
PSYCHOMOTOR PERFORMANCE, 132
PULSARS, 222
PULSED LASERS, 44, 174
PULSES, 61, 166
PURIFICATION, 129, 134
PYROLYSIS, 37

Q

QUANTUM CHROMODYNAMICS, 164
QUANTUM MECHANICS, 30
QUASARS, 203
QUERY LANGUAGES, 146

R

RADAR TARGETS, 60
RADIAL FLOW, 9, 221
RADIAL VELOCITY, 67
RADIANT FLUX DENSITY, 215
RADIATION DAMAGE, 110, 117
RADIATION DISTRIBUTION, 161
RADIATION DOSAGE, 110, 126
RADIATION EFFECTS, 31
RADIATION HAZARDS, 220
RADIATION MEASUREMENT, 108
RADIATION PROTECTION, 126
RADIATIVE HEAT TRANSFER, 25
RADIATIVE TRANSFER, 100, 205, 219
RADII, 205
RADIO ASTRONOMY, 171, 203, 216, 223
RADIO BURSTS, 224
RADIO EMISSION, 203, 216
RADIO FREQUENCIES, 63
RADIO FREQUENCY DISCHARGE, 37
RADIO GALAXIES, 203, 205, 223
RADIO JETS (ASTRONOMY), 223
RADIO SOURCES (ASTRONOMY), 205, 216
RADIO SPECTRA, 205, 223
RADIO WAVES, 116
RADIOACTIVE DECAY, 165
RADIOACTIVE ISOTOPES, 112
RADIOACTIVE MATERIALS, 44
RADIOACTIVE WASTES, 44, 162, 196
RADIOMETERS, 108, 120
RADON ISOTOPES, 110
RAMAN SPECTRA, 179
RANDOM WALK, 153, 154
RARE EARTH COMPOUNDS, 47
RAYLEIGH-RITZ METHOD, 70
REACTING FLOW, 32, 33, 68
REACTION KINETICS, 31, 107
REACTOR CORES, 166
REACTOR DESIGN, 185
REACTORS, 59, 91
REAL TIME OPERATION, 15, 108, 140, 144, 169
RECEIVERS, 23, 116
RECOVERABLE SPACECRAFT, 17
RECTANGLES, 158
RED SHIFT, 207
REDUCTION (CHEMISTRY), 54
REEFS, 100
REFINING, 142
REFLECTANCE, 100
REFRACTIVITY, 51
RELATIONAL DATA BASES, 146
RELIABILITY, 197
RELIABILITY ANALYSIS, 154, 197
REMOTE CONTROL, 88
REMOTE SENSING, 60, 99, 100, 102, 103, 111, 120, 124, 167, 201
REMOTE SENSORS, 107, 122
REMOTELY PILOTED VEHICLES, 7
REPLICAS, 169, 191
REPRODUCTION (BIOLOGY), 125
REQUIREMENTS, 7
RESEARCH, 11, 24, 27, 35, 43, 46, 87, 90, 103, 107, 116, 118, 194, 219
RESEARCH AND DEVELOPMENT, 58, 127, 195, 202
RESEARCH FACILITIES, 185, 186
RESEARCH MANAGEMENT, 92, 201
RESEARCH VEHICLES, 155
RESONANT VIBRATION, 5
RESOURCE ALLOCATION, 12
RESPIRATION, 101, 102
RETARDING, 57
RETURN TO EARTH SPACE FLIGHT, 52, 53, 54, 58
REUSABLE LAUNCH VEHICLES, 17, 18
REYNOLDS AVERAGING, 73
REYNOLDS STRESS, 73
RIEMANN MANIFOLD, 155, 157
RISK, 51, 151
ROBOT DYNAMICS, 151
ROBOTICS, 151
ROBOTS, 151
ROBUSTNESS (MATHEMATICS), 78
ROCKET ENGINE DESIGN, 9
ROCKET ENGINES, 26
ROCKET EXHAUST, 27
RODS, 164
ROLLERS, 14
ROTATION, 50, 99
ROTORS, 161
RUNWAYS, 13

S

SAFETY, 13, 27, 35
SAMPLING, 113, 129, 153, 154
SANDS, 100
SATELLITE ATTITUDE CONTROL, 146
SATELLITE COMMUNICATION, 59, 149
SATELLITE IMAGERY, 102
SATELLITE INSTRUMENTS, 137
SATELLITE OBSERVATION, 102
SATELLITE-BORNE INSTRUMENTS, 122
SCALARS, 166
SCALE EFFECT, 29
SCALE MODELS, 50
SCALING LAWS, 68, 71, 171, 178, 179
SCHEDULING, 140, 148
SCIENTIFIC VISUALIZATION, 128
SCORING, 154
SEA ICE, 137
SEA WATER, 114
SEARCHING, 147
SEASONS, 101
SECONDARY FLOW, 9
SECURITY, 60, 131, 148, 200
SEISMIC WAVES, 115

SELECTIVE SURFACES, 108
SELF ORGANIZING SYSTEMS, 138, 147, 159
SEMANTICS, 144
SEMICONDUCTORS (MATERIALS), 30, 46, 209
SEMISPAN MODELS, 80, 84
SENSITIVITY, 151, 173
SENSORS, 220
SEPARATED FLOW, 10
SET THEORY, 155, 157
SEWAGE TREATMENT, 109
SHALE OIL, 131
SHEAR LAYERS, 69
SHELLS (STRUCTURAL FORMS), 95
SHIELDING, 65
SHIPS, 51, 86
SHOCK TESTS, 65
SHOCK TUBES, 84
SHOCK WAVE INTERACTION, 2, 68, 74, 75, 218
SHOT NOISE, 62
SIGNAL PROCESSING, 23, 59
SILICA GLASS, 174
SILICIDES, 47
SILICON, 29, 63, 87, 192, 215
SILICON CARBIDES, 29, 34
SILICON DIOXIDE, 182
SILVER, 43
SIMILARITY THEOREM, 71, 157
SIMULATION, 23, 55, 90, 108, 118, 172, 184, 188
SIMULATORS, 24
SINGLE CRYSTALS, 42, 92
SINGLE STAGE TO ORBIT VEHICLES, 6, 16, 17
SKY SURVEYS (ASTRONOMY), 211
SLEEP, 132
SLUDGE, 109
SMOKE, 86
SOBOLEV SPACE, 156
SODIUM, 35
SODIUM CHLORIDES, 134
SOFTWARE DEVELOPMENT TOOLS, 140, 146
SOFTWARE ENGINEERING, 77, 136, 138, 140, 141, 142
SOFTWARE RELIABILITY, 141
SOFTWARE REUSE, 140
SOILS, 101, 102
SOLAR ARRAYS, 105
SOLAR CELLS, 104
SOLAR CORONA, 221
SOLAR CYCLES, 221
SOLAR ENERGY, 104
SOLAR FLARES, 220
SOLAR MAGNETIC FIELD, 221
SOLAR PHYSICS, 220
SOLAR POSITION, 221
SOLAR SYSTEM, 54
SOLAR THERMAL PROPULSION, 26, 56
SOLAR WIND, 118, 119, 218, 221
SOLID ELECTROLYTES, 104
SOLID PROPELLANT ROCKET ENGINES, 26
SOLID STATE LASERS, 169
SOLIDIFICATION, 92
SOLIDS, 96
SOOT, 32
SOUND DETECTING AND RANGING, 97
SOUND FIELDS, 160
SOUND WAVES, 160
SOUTHERN HEMISPHERE, 112
SPACE CHARGE, 185
SPACE COMMERCIALIZATION, 17, 18, 19, 20, 21
SPACE DEBRIS, 201
SPACE ERECTABLE STRUCTURES, 56
SPACE FLIGHT, 18
SPACE LAW, 20
SPACE MISSIONS, 18, 87, 169, 170, 208, 210, 211, 212
SPACE PLASMAS, 176
SPACE SHUTTLE MAIN ENGINE, 91
SPACE SHUTTLES, 17, 18
SPACE STATIONS, 55
SPACE STORAGE, 37
SPACE TOURISM, 19, 20, 21
SPACE TRANSPORTATION, 19, 20, 21
SPACE TRANSPORTATION SYSTEM, 17, 20, 21
SPACE TRANSPORTATION SYSTEM FLIGHTS, 18
SPACE-TIME FUNCTIONS, 166
SPACEBORNE EXPERIMENTS, 56, 126, 190
SPACECRAFT CHARGING, 23
SPACECRAFT CONSTRUCTION MATERIALS, 64
SPACECRAFT DESIGN, 20
SPACECRAFT ENVIRONMENTS, 126
SPACECRAFT LAUNCHING, 15, 208
SPACECRAFT MAINTENANCE, 137
SPACECRAFT MODULES, 223
SPACECRAFT RADIATORS, 22
SPACECRAFT REENTRY, 52
SPACECREWS, 18, 19, 21
SPALLATION, 166
SPATIAL DISTRIBUTION, 112, 124
SPECKLE INTERFEROMETRY, 93
SPECTRA, 220
SPECTRAL EMISSION, 117
SPECTROMETERS, 87, 165
SPECTRUM ANALYSIS, 25
SPHEROMAKS, 179, 187
SPOT WELDS, 92
SPRAY CHARACTERISTICS, 31
STABILITY, 63, 193
STABILITY DERIVATIVES, 79, 81
STABILITY TESTS, 2, 81
STANDARD MODEL (PARTICLE PHYSICS), 164
STANDARDIZATION, 79
STAR CLUSTERS, 213
STAR FORMATION, 205, 206, 213, 217
STARS, 212, 216
STATE ESTIMATION, 69
STATISTICAL ANALYSIS, 12, 78, 81, 131, 153
STATISTICS, 153
STATORS, 161
STEADY STATE, 206
STEELS, 45
STELLAR ATMOSPHERES, 204, 216
STELLAR CORONAS, 208
STELLAR ENVELOPES, 204, 206
STELLAR EVOLUTION, 207
STELLAR MAGNETIC FIELDS, 217
STELLAR MASS, 204, 217
STELLAR MODELS, 214
STELLAR OSCILLATIONS, 213
STELLAR SPECTRA, 203
STELLARATORS, 181
STENCIL PROCESSES, 149
STIFFNESS, 26
STOCHASTIC PROCESSES, 69
STORAGE, 86
STORAGE TANKS, 105
STRAIN GAGE BALANCES, 76, 77, 79, 80, 81, 82, 83, 84, 85
STRAIN GAGES, 78, 79, 85
STRAIN HARDENING, 39, 94
STRAIN MEASUREMENT, 79
STRATOSPHERE, 107, 114, 116, 123
STRESS ANALYSIS, 96
STRESS CORROSION CRACKING, 40
STRESS INTENSITY FACTORS, 94
STRESS-STRAIN RELATIONSHIPS, 94
STRIP MINING, 201
STRONGLY COUPLED PLASMAS, 179
STRONTIUM COMPOUNDS, 50
STRUCTURAL ANALYSIS, 22, 35
STRUCTURAL BASINS, 110
STRUCTURAL DESIGN, 8, 26, 94
STRUCTURAL FAILURE, 7

STRUCTURAL RELIABILITY, 94
SUBROUTINE LIBRARIES (COMPUTERS), 196
SUBSTRATES, 47
SUBSTRUCTURES, 94, 95
SULFUR, 163
SUMMER, 112
SUNSPOTS, 159
SUPERCOMPUTERS, 200
SUPERCONDUCTIVITY, 193
SUPERGIANT STARS, 207
SUPERNOVA 1987A, 174
SUPERNOVAE, 32, 214
SUPERSONIC COMBUSTION RAMJET ENGINES, 2, 75
SUPERSONIC FLOW, 74
SUPERSONIC JET FLOW, 160
SUPERSONIC TRANSPORTS, 9
SUPERSONIC WIND TUNNELS, 83
SUPPORT SYSTEMS, 38, 148
SURFACE COOLING, 9
SURFACE DEFECTS, 29, 46
SURFACE FINISHING, 182
SURFACE LAYERS, 42
SURFACE PROPERTIES, 41, 94, 99
SURFACE ROUGHNESS, 180
SURFACE TEMPERATURE, 112, 220
SURFACE TREATMENT, 41
SURFACE WATER, 97, 114
SURGERY, 129
SURVIVAL, 150
SYNCHRONISM, 8
SYNTHESIS (CHEMISTRY), 35, 37, 46, 215
SYNTHETIC APERTURE RADAR, 102
SYSTEM IDENTIFICATION, 140
SYSTEMS ANALYSIS, 95, 140, 153
SYSTEMS ENGINEERING, 6, 8, 16, 138, 140, 145, 147, 197, 214
SYSTEMS INTEGRATION, 6, 15, 16, 105, 138, 199
SYSTEMS SIMULATION, 144
SYSTEMS STABILITY, 69

T

TABLES (DATA), 35, 97
TAIL ASSEMBLIES, 11
TANKS (CONTAINERS), 51
TAPERING, 57
TARGETS, 164
TECHNOLOGY ASSESSMENT, 22, 62, 103, 110
TECHNOLOGY TRANSFER, 79, 195, 200
TECHNOLOGY UTILIZATION, 21, 22, 96, 194, 202
TECTONICS, 116
TELECOMMUNICATION, 59
TELEMETRY, 6
TELESCOPES, 167, 171, 183
TEMPERATURE CONTROL, 108
TEMPERATURE DEPENDENCE, 112
TEMPERATURE DISTRIBUTION, 172
TEMPERATURE EFFECTS, 78, 129, 180
TEMPERATURE MEASUREMENT, 50, 112
TEMPERATURE PROFILES, 172
TEMPORAL DISTRIBUTION, 124
TENSILE STRESS, 39
TERBIUM COMPOUNDS, 38
TERRAIN, 124
TEST FACILITIES, 13, 210
TETRAHEDRONS, 163
TEXTURES, 40, 104
THEMATIC MAPPERS (LANDSAT), 99
THERMAL ANALYSIS, 22, 23
THERMAL CONDUCTIVITY, 134, 185
THERMAL CYCLING TESTS, 24
THERMAL DIFFUSION, 98
THERMAL ENERGY, 105
THERMAL INSULATION, 6
THERMAL NOISE, 62
THERMAL PROTECTION, 6
THERMAL STABILITY, 51
THERMAL VACUUM TESTS, 56
THERMODYNAMIC EFFICIENCY, 22
THERMODYNAMIC PROPERTIES, 65, 88, 179
THERMODYNAMICS, 179
THERMOMECHANICAL TREATMENT, 40
THERMONUCLEAR REACTIONS, 32, 188
THERMOPHOTOVOLTAIC CONVERSION, 106
THERMOSPHERE, 120
THICK FILMS, 49
THIN FILMS, 48, 106, 108
THREE DIMENSIONAL FLOW, 2
THREE DIMENSIONAL MODELS, 1, 31, 108
TIDES, 100
TIME DOMAIN ANALYSIS, 115
TIME FUNCTIONS, 28
TIME MEASUREMENT, 208
TIME SERIES ANALYSIS, 102, 125, 159
TIME TEMPERATURE PARAMETER, 41
TIN COMPOUNDS, 191
TOKAMAK DEVICES, 171, 172, 173, 174, 175, 176, 178, 179, 181, 182, 188
TOPOGRAPHY, 100, 116, 201
TOPOLOGY, 74, 134
TOROIDAL PLASMAS, 183, 185, 188
TORQUE, 80
TORUSES, 158, 180
TOW MISSILES, 27
TOXICITY, 34
TRACE ELEMENTS, 106, 107
TRACERS, 188
TRAINING SIMULATORS, 18
TRAJECTORY ANALYSIS, 27
TRAJECTORY OPTIMIZATION, 184
TRANSFER ORBITS, 14
TRANSITION FLOW, 72, 73
TRANSITION METALS, 47
TRANSLATING, 99
TRANSMISSIONS (MACHINE ELEMENTS), 8
TRANSMITTANCE, 49
TRANSONIC FLOW, 2, 10
TRANSONIC FLUTTER, 10
TRANSONIC WIND TUNNELS, 80, 82, 84
TRANSPLANTATION, 130
TRANSPORT AIRCRAFT, 10
TRANSPORT THEORY, 55, 181
TRANSPORTATION NETWORKS, 12, 143
TRANSURANIUM ELEMENTS, 162
TRAVELING WAVE TUBES, 66
TRENDS, 114
TROPICAL REGIONS, 112
TROPOSPHERE, 89, 108, 112, 113, 117
TU-144 AIRCRAFT, 84
TUBES, 57
TUNGSTEN, 46
TUNING, 89
TUNNEL JUNCTIONS, 193
TURBINE PUMPS, 91
TURBULENCE MODELS, 2, 68, 72, 73, 74
TURBULENT COMBUSTION, 31, 32, 33, 68
TURBULENT DIFFUSION, 68, 70, 121
TURBULENT FLAMES, 32, 33, 68
TURBULENT FLOW, 33, 68, 69, 70, 72, 73
TURBULENT HEAT TRANSFER, 31
TURBULENT JETS, 33, 69, 75, 160
TURBULENT MIXING, 31, 33
TURBULENT WAKES, 1, 74

TWO DIMENSIONAL MODELS, 73, 107, 116
TWO PHASE FLOW, 76

U

ULTRASONICS, 44
ULTRAVIOLET ABSORPTION, 204
ULTRAVIOLET ASTRONOMY, 204, 205, 206, 213
ULTRAVIOLET FILTERS, 119
UNDERWATER ACOUSTICS, 161
UNIVERSAL TIME, 219
UNIVERSITIES, 195
UNIX (OPERATING SYSTEM), 62
UNMANNED SPACECRAFT, 52
UNSTEADY AERODYNAMICS, 10
UNSTRUCTURED GRIDS (MATHEMATICS), 163
URANIUM COMPOUNDS, 38, 42
URBAN PLANNING, 201
URINE, 129, 134
UROLOGY, 129
USER REQUIREMENTS, 148

V

VACANCIES (CRYSTAL DEFECTS), 44
VACUUM, 62, 172
VACUUM CHAMBERS, 84, 88
VACUUM SYSTEMS, 173
VALVES, 94
VAPOR PHASES, 51
VAPORIZING, 31
VARIABILITY, 102, 117, 123, 124
VARIABLE STARS, 213
VECTOR ANALYSIS, 74
VEGETATION, 201
VEHICLES, 86
VELOCITY DISTRIBUTION, 69, 71, 75
VELOCITY MEASUREMENT, 169
VERTICAL DISTRIBUTION, 113
VESTIBULES, 126
VIBRATION, 8, 24, 57, 93
VIBRATION DAMPING, 56, 57
VIBRATION EFFECTS, 81
VIBRATION TESTS, 22
VIDEO SIGNALS, 86
VISCOELASTIC DAMPING, 5
VISCOELASTICITY, 5
VISCOPLASTICITY, 94
VISCOUS FLOW, 25
VOLCANOES, 215
VOLCANOLOGY, 116
VORTEX ALLEVIATION, 1
VORTEX BREAKDOWN, 11
VORTICES, 1, 75
VORTICITY, 112
VULNERABILITY, 61

W

WAKES, 75
WALL FLOW, 74
WALLS, 175
WARFARE, 4
WASTE DISPOSAL, 162
WASTE TREATMENT, 196
WATER, 134, 219
WATER BALANCE, 97
WATER CURRENTS, 124
WATER HEATING, 104
WATER RESOURCES, 36
WATER TREATMENT, 97
WATER VAPOR, 59, 67, 116, 117, 120, 122, 124
WAVE ATTENUATION, 66
WAVE EQUATIONS, 118
WAVE FRONTS, 167
WAVE INTERACTION, 100, 115, 184
WAVE PROPAGATION, 66, 115
WAVE-PARTICLE INTERACTIONS, 176
WAVEGUIDES, 63, 108
WAVELET ANALYSIS, 99
WEATHER, 99, 101
WEATHER STATIONS, 112
WEIGHT (MASS), 64
WEIGHT INDICATORS, 76, 77, 78, 80, 83, 84
WEIGHT MEASUREMENT, 84, 92
WEIGHTLESSNESS, 126
WELDED JOINTS, 90, 92
WHITE DWARF STARS, 205, 206, 207, 213, 215
WIDE ANGLE LENSES, 88
WIND MEASUREMENT, 122, 123
WIND TUNNEL APPARATUS, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85
WIND TUNNEL MODELS, 80, 81, 84
WIND TUNNEL TESTS, 3, 76, 84
WINGS, 3
WINTER, 112, 123
WOOD, 111
WORK-REST CYCLE, 132
WORLD WIDE WEB, 145, 147

X

X RAY ANALYSIS, 190
X RAY ASTRONOMY, 35, 87, 169, 170, 202, 208, 209, 210, 211, 212, 219, 222, 223
X RAY ASTROPHYSICS FACILITY, 208, 210
X RAY BINARIES, 202, 217, 219, 222
X RAY DETECTORS, 87, 88, 209, 211
X RAY DIFFRACTION, 191
X RAY IMAGERY, 170
X RAY OPTICS, 169, 170, 209, 210
X RAY SOURCES, 207, 208
X RAY SPECTROMETERS, 35, 209
X RAY SPECTROSCOPY, 35, 208, 209, 211
X RAY STARS, 222
X RAY TELESCOPES, 209, 210, 212
X RAYS, 31, 208, 214, 221, 222, 223
X-33 REUSABLE LAUNCH VEHICLE, 6, 9, 15, 16, 17, 18, 26
X-34 REUSABLE LAUNCH VEHICLE, 3

Y

YAG LASERS, 90
YBCO SUPERCONDUCTORS, 47
YTTERBIUM ISOTOPES, 63
YTTRIUM-ALUMINUM GARNET, 106

Z

ZEEMAN EFFECT, 108
ZETA PINCH, 189
ZINC, 103
ZIRCALOYS (TRADEMARK), 39
ZIRCONIUM OXIDES, 36

Personal Author Index

A

Abbaschian, Reza, 55
Abe, Takao, 91
Aber, J. D., 101
Adams, Mitzi L., 159
Adams, N. A., 74
Agena, S., 28
Akerlof, C. W., 223
Akgun, Mehmet A., 96
Akiyama, R., 183, 187
Albers, R., 43
Albers, R. C., 43
Albrecht, Timothy W., 12
Alestalo, Pekka, 158
Allan, Graham R., 167
Allen, Dale, 107
Allen, S. L., 175
Allen, T. H., 44
Allison, L., 114
Allman, Mark, 61
Allott, R., 179
Amiranoff, F., 179
Anderson, B. Jeffrey, 214
Anderson, C. A., 94
Anderson, James W., 156
Angelberger, C., 32
Ankeny, L. A., 141
Antunes, Mauro Antonio Homem, 100
Aparicio, Manuel, IV, 139
Arballo, John K., 217
Archer, Myla, 151
Archuleta, J. I., 46
Arendt, P. N., 47
Arko, A. J., 39
Arliey, Dan, 139
Arnett, D., 173
Arzoni, R. J., 27
Ash, R., 36
Asplund, M. C., 33
Assadi, Mahyar, 29
Auflick, J. L., 154
Austin, M. E., 175

B

Bacalski, C. F., 48
Badet, Laurent, 82
Baggerly, K., 154
Baggett, J., 72
Baggett, Timothy, 59
Bailes, M., 222
Baird, R. S., 54
Baity, F. W., 171
Bajaj, R., 39
Baker, R. A., 105
Baldwin, C. A., 45
Ball, T., 100
Balogh, Andre, 217
Band, L. E., 101
Baptista, Raymundo, 203, 204, 213
Barbee, T. W., 168
Barbera, M., 210
Barclay, Rebecca O., 199
Barlow, Philip R., 148
Barnes, C. W., 171, 176, 180
Barnett, A., 123
Barona, C. R., 53
Barrett, Joyce E., 125
Barth, Jane L., 64
Barthelmy, S., 223
Barton, J. S., 102
Bassetti, F., 149
Bassham, Christopher B., 130
Bateman, J. E., 87
Bateman, J. E., 62
Batha, S., 177
Batistoni, P., 176
Bazzaz, A. M., 101
Beach, R. J., 90
Beaman, Robert G., 22
Beaudoin, A. J., 42
Beck, J. B., 171
Beck, J. Robert, 131
Becker, J. D., 43
Begelman, Mitchell C., 218
Behl, Wishvender K., 63, 64
Behnia, M., 73
Beiu, V., 150, 151
Bekey, I., 18
Bell, M. G., 188
Bell, R. E., 188
Bellisario, L. M., 100
Bencic, Timothy J., 50
Benner, Steve, 22
Berchem, Jean, 118
Bergers, W. W., 34
Berggren, R. R., 183
Berk, H. L., 188
Bernhardt, A. F., 63
Berquist, B. M., 39
Berry, David, 149
Bertsch, D. L., 222
Bewley, T., 69
Bhardwaj, A., 100
Bhat, B. N., 41
Bi, Ru-Chang, 190
Bibeau, C., 191
Biddle, R. S., 85
Bilham, Roger, 116
Biller, S., 223
Billon, Horace, 95
Bills, B. G., 219
Birmingham, William P., 194
Birnir, B., 30
Bishop, A., 30
Bitteker, L. J., 42
Blacic, J., 36
Blacic, M. J., 48
Blair, B. R., 51
Blanchard, W., 177
Bleeker, J. A. M., 210, 212
Blint, R., 31
Blotz, A., 164
Blundell, Katherine M., 202
Blunt, D. M., 8
Boatner, L. A., 92
Boccippio, Dennis J., 111
Bocian, D. F., 103
Bodeker, Dan A., III, 26
Boedo, J. A., 176
Boege, S., 182
Boersma, B. J., 69
Boggon, Titus J., 190
Bogle, David, 28
Bogue, Rodney K., 9
Bonca, J., 190
Bond, Howard E., 206
Bonnet, Pierre, 61
Boonmee, C., 162
Booth, C. H., 192
Booth, David, 34
Booth, Dennis, 83
Bordallo, H. N., 38
Borel, C., 43
Borel, C. C., 220
Borne, Kirk D., 216
Boser, B. E., 63
Bossert, J. E., 109, 123
Bourret, S. C., 85
Boyd, Mark A., 143
Boyle, P., 223
Bradley, P. A., 180

Brand, John H., II, 149
Brase, J., 167
Braswell, William D., 108
Bratkovich, T. E., 59
Brauchman, Gregory J., 2
Braunstein, Jeffrey, 43
Bravenec, R., 172
Brereton, S. J., 186
Bridge, K. Y., 126
Bridges, F., 192
Brittnacher, M., 119
Brittnacher, M. J., 118, 119
Brock, C., 26
Brooks, N. H., 176
Brosha, E. L., 192
Browell, E. V., 113
Browell, Edward V., 112, 124
Brown, Andrew M., 94
Brown, David C., 140
Brown, G. W., 42
Brown, R. C., 104
Brozowski, Laura A., 66
Bruce, L. L., 126
Bruckner, A. P., 36
Brueck, S., 104
Brunner, Dominik, 111
Bubier, J. L., 100
Budge, K. G., 134
Budny, R., 181, 188
Bui, T. P., 26
Burch, J. L., 116
Burdg, H., 194
Burke, M. G., 40
Burrell, K. H., 175
Busath, J., 173
Busch, G. E., 89
Bush, C. E., 188
Bushe, W. K., 32, 33
Busker, R. W., 34
Bussing, T. R. A., 59
Butler, Dan, 22
Butner, Harold M., 206
Byrd, R. C., 219

C

Cabot, W., 70, 72
Cadarete, Bruce S., 133
Cadirola, Martin, 122
Caffrey, M. P., 136
Cahill, David M., 78
Cain, A. B., 69
Caldwell, S. E., 180
Calhoun-Senghor, Keith, 19
Callis, R. W., 176
Cameron, Andrew R., 6
Canfield, Dennis V., 128
Carati, D., 72, 73
Carere, Angelo, 130
Carlstrom, T. N., 178
Carnevale, G. F., 1
Carreras, B. A., 178
Carroll, P., 100
Cash, Webster, 170
Cavalieri, Donald J., 137
Cavitt, R. E., 148
Cederwall, R. T., 108
Cernicek, M., 197
Chai, M., 64
Chakravarthy, S., 146
Champagne, N. J., 152
Chan, Heang-Ping, 152
Chan, Larry, 7
Chandra, S., 117
Chang, C. H., 190
Chang, L. Aron, 120
Chapa, Michael J., 2
Charles, P. A., 202
Chaturvedi, Arvind K., 128
Chau, A., 64
Chau, L. F., 35
Chayen, Naomi E., 190
Chen, P. S., 41
Chen, S. R., 40
Chen, Y., 181, 188
Cheng, C. Z., 118, 188
Cherry, John D., 6
Cheung, Mark K., 66
Cheyer, Adam, 136
Chikaraishi, H., 184
Chiu, H. K., 173
Chrien, R. E., 172, 180
Christensen, F. E., 169
Christy, John R., 108
Chu, Martha I., 137
Chua, D., 119
Chubb, Donald L., 106
Chung, B. W., 36
Cisneros, A., 137
Cissom, R. D., 15
Citterio, O., 169
Ciucci, A., 72
Clancy, S. P., 141
Clark, E. L., 179
Clark, L. D., 106
Clayton, C., 179
Click, D. R., 37
Cohen,, 189
Cohen, R., 181
Cohn, Stephen E., 99
Colchin, R. J., 175
Colebank, James E., 23
Collier, J. L., 179
Collins, Daniel L., 149
Collins, L., 168
Collura, A., 210
Colonius, T., 69, 160
Conconi, P., 169
Conder, K., 47
Connanughton, V., 223
Connolly, J. F., 87
Conrad, Gary W., 125
Cook, A. W., 33
Cook, Stephen A., 17
Cooper, B. R., 44
Cooper, F., 164
Cooper, J., 103
Corby, Nigel, 80
Cordes, J., 222
Corey, J. A., 58
Corrigan, D., 92
Cort, B., 44
Costello, J. T., 180
Cotanch, S. R., 165
Cottet, Georges-Henri, 71
Cottrell, S. P., 165
Court, J. D., 166
Cox, D., 154
Cox, Joseph F., 43
Crawford, Dawn M., 49
Crebelli, Riccardo, 130
Crill, P. M., 100, 101
Critchlow, T., 127
Croft, W. B., 198
Crooks, Richard S., 77
Crouch, J., 110
Cuenot, B., 31
Cummings, Russell M., 7
Curley, M., 43
Currier, R., 36

D

Dabke, Padmanabh, 140
DAbreton, P., 113
DAmbrosio, Joseph, 194
DAmico, N., 222
Danaila, I., 69
Dangor, A. E., 179
Daniel, Walter K., 105
Danilin, M. Y., 116
Danno, Minoru, 91
Danson, C., 180

Danson, C. N., 179
Dardis, L., 180
Darrow, D. S., 183
daSilva, Arlindo, 99
Daube, B. C., 101
Davis, Chad J., 10
Davis, Douglas D., 112
Davis, K., 149
Day, Adrian J., 80
Day, R. D., 38
Dayton, James A., Jr., 65, 66
De Yoreo, J. J., 178
deAlmeidaPrado, Antonio Fernando Bertachini, 14
DeBoo, J. C., 172
Decker, Keith S., 140
Deffenbaugh, D. M., 52
deGroh, Henry C., III, 55
Dejus, R. J., 90
deKorte, Piet A. J., 209
Dellin, T. A., 62
DeLombard, Richard, 24
Demoz, Belay, 122
Dempsey, Robert C., 212
Denning, Peter J., 143
deOliveiraeSouza, Marcelo Lopes, 14
DePaula, R., 47
Derbyshire, G. E., 87
deRuiter, H. R., 223
Derzon, M. S., 189
Deslarzes, K. J. P., 96
Devault, J. E., 151
DeVolder, B., 27
Diab, R. D., 113
Dickerson, R. M., 38
Dickey, J. O., 218
Dickey, Jean O., 219
Dicus, D. A., 165
Didion, Jeffrey R., 64
DiMarco, S. F., 124
Dinges, David F., 132
Dinh, T., 36
Djaoui, A., 179
Doane, J. L., 176
Dobson, D. R., 87
Dogget, N., 127
Domar, Yngve, 156
Domaradzki, J. A., 68
Donahue, Megan, 207
Dong, Jun, 190
Donohoe, R. J., 103
Doshi, R., 36
Dove, James B., 218
Dowden, P. C., 47
Drake, Nick, 213
Drska, L., 162
Dubois, T., 68
Dunham, M. E., 136
Duranlioglu, Ilker, 141
Durbin, P., 72, 73
Durbin, P. A., 72
Durrant, T. C., 54
Dynkin, Evsey, 155

E

Eads, Bradley R., 60
Ebbers, C. A., 90
Eckert, D., 78
Eddy, J. A., 106
Edwards, C. B., 179
Edwards, C. D., 219
Egami, T., 50
Egolfopoulos, F., 32
Ehernberger, L. J., 9
Ejiri, A., 183
Eliasson, Bengt, 176
Elsen, R., 118, 119
Elsner, R. F., 170
Elvis, Martin, 209
Emanuel, M., 90
Emery, C. A., 123
Emery, J., 162
Engberg, Robert, 56
Engler, O., 45
English, R. E., 178
Eriksson, Anders I., 23
Escarsega, John A., 49
Esposito, J. A., 222
Eubanks, T. M., 219
Evans, D. A., 97
Evans, Keith, 122
Evans, M. E., 153
Evans, T. M., 135, 153
Eversman, Walter, 160
Ewald, Bernd, 78, 79, 82
Eye, K., 194
Eyink, G. L., 70

F

Fabbiano, Giuseppina, 209
Fabian, Andy C., 208
Fairbank, W. M., 96
Falkenstein, Z., 109
Fan, S.-M., 101
Fanti, R., 223
Farassat, F., 161
Farnham, M., 196
Farris, Mark, 161
Farrow, R. C., 87
Fauth, F., 47
Favorito, Rocky A., 144
Feldman, W. C., 219
Fenimore, E. E., 219, 221
Fennell, J. F., 116
Fenske, Matthew T., 64
Ferguson, P. D., 166
Ferguson, Thomas V., 66
Ferrare, Richard, 122
Ferreira, L. F. Vieira, 28
Ferri, Aldo A., 94
Ferziger, J. H., 31
Fillingim, M. O., 119
Finger, M. H., 217
Finger, Mark H., 222
Finley, J., 222
Finn, J. E., 52
Finsterle, S., 141
Fishman, G. J., 217, 223
Fleming, James, 139
Flesia, Cristina, 121
Fletcher, Lyn E., 51
Flintoff, P., 179
Folkner, W. M., 219
Foltyn, S. R., 47
Fonseca, J. C., 26
Fonte, P., 85
Ford, J.J., 153
Ford, Jason, 151
Forslund, D. W., 131
Forsyth, Graham F., 8
Foster, Donald L., 64
Foster, Everett, 7
Foster, J. P., 40
Foster, Windred A., Jr., 26
Fragola, Joseph R., 196
Frankel, Julius, 43
Frankie, B., 54
Franklin, D. G., 39
Franklin, Stanley, 139
Fraser, G. W., 170
Freeman, H. JoAnne, 7
French, Rica S., 212
Freund, J., 68
Freund, J. B., 69, 160
Friedel, F., 45
Friedman, A., 185
Friedman, H. W., 168
Fristedt, Knut, 80
Fritzsch, Bernd, 126
Froidevaux, L., 123
Frolking, S., 101
Frolking, S. E., 100

Frolking, Steve, 101
Fu, G. Y., 181, 188
Fuijkschot, Pieter Herman, 80
Fujisawa, A., 183, 187
Fujiwara, M., 183, 184
Furey, M. J., 49
Furrer, A., 47

G

Gagnon, Todd A., 143
Gaier, James R., 64
Galdrikian, B., 30
Gallegos, G. M., 112
Galli, G., 29
Gamble, Beth, 7
Gamble, G. I., 85
Garcia, M., 177
Garimella, Suresh V., 55
Garner, F. A., 46
Garofalo, A. M., 175
Garstang, M., 113
Garvin, J. B., 102
Gavel, D., 167
Gavel, D. T., 168
Gavrilov, E. M., 131
Gazis, P. R., 220
George, J. E., 131
Germain, Barry W., 75
Germann, T. C., 191
Germany, G. A., 118, 119
Gerritse, K., 35
Ghigo, M., 169
Gibson, B. F., 161
Ginsparg, P., 164
Glascoe, J., 112
Glendinning, S. G., 173
Glickstein, S. S., 67
Goldsmith, John, 122
Goldstein, Bruce E., 217
Gooch, J. P., 110
Goodman, Jeremy, 216
Gorbushin, Anton R., 84
Gordon, Andrew, 144
Gordon, D., 179
Gordon, Elspeth, 190
Gorelenkov, N., 188
Gorenstein, Paul, 211
Goto, M., 183
Gottmann, M., 54
Goulden, M. L., 101
Grace, K. M., 108
Graewe, Eberhard, 78, 82
Graham, P., 162
Grasz, E., 181
Grasz, E. L., 91, 177
Graziano, Thomas, 149
Green, S. T., 52
Greenfield, C. M., 172, 175
Grenoble, Ray W., 14
Grey, Jerry, 21
Griffin, R. E. M., 216
Grimes, Gary R., 142
Griner, Jim, 61
Groebner, R. J., 175
Grover, M. R., 36
Groves, J. R., 47
Grumbine, S. K., 37
Grunwald, D., 148
Gu, Xing-Ruo, 78
Guinzburg, A., 91
Guinzburg, Adiel, 66
Guo, Kaike, 80
Guo, W., 94
Gupta, R., 164

H

Habib, S., 164
Hack, K., 116
Haftka, Raphael T., 96
Hagyard, Mona J., 159
Hahn, H. A., 154
Hall, C. E., 143
Hall, D. K., 102
Hall, J. H., 141
Hall, S., 153
Halpern, Jules P., 222
Hamilton, M. L., 46
Hamlet, Ronald E., 144
Hammack, Lonnie P., 198
Hammer, A. H., 34
Han, Qingyuan, 121
Hanrahan, R. J., 41, 42
Hansen, C. S., 96
Hansen, J., 112
Hansink, M., 173
Hanson, J. E., 116
Hara, Lauro Tsutomu, 199
Harley, N. H., 110
Harris, T., 194
Harrison, M. R., 105
Harriss, R. C., 101
Hartley, Tom T., 135
Hartman, R. C., 222
Hartvig, Sven Kristian, 113
Harty, R., 126
Hartz, Robert H., 198
Hasinger, G., 210
Hastings, J., 163
Hauschildt, P.H., 215
Havela, L., 38
Hawley, M. E., 42
Haworth, D., 31, 68
Hawryluk, R. J., 177
Hayashi,, 105
Hayashi, T., 188
Hayden, J. S., 63
He, De-Xin, 78
Heflin, M. B., 5
Hellings, R. W., 219
Helliwell, John R., 190
Helsby, W. I., 87
Hendler, James, 147
Hensley, D. K., 43
Hermsen, W., 222
Herzenberg, C. L., 197
Hess, Kenneth R., 150
Hesselink, Lambertus, 74
Hewitt, C. J., 89
Hewwitt, D., 186
Hibbard, R. L., 178
Hickey, E. E., 126
Hide, R., 218
Hilburger, Mark W., 95
Hill, D., 174
Hill, K. W., 188
Hillard, G. B., 116
Hilstad, M. O., 36
Hinkley, Jeffrey A., 30
Hirata, G. A., 48
Hirvonen, Taavi M., 60
Hix, W. R., 214
Ho, Christian M., 217
Hoang, Triem, 66
Hochberg, J., 153
Hodel, A. S., 143
Hoffer, J. K., 180
Hogan, W., 185
Hoh, J., 162
Holback, Bengt, 23
Holeman, Ernie, 25
Holland, A. D., 209
Hollinger, Richard, 34
Holloran, Michael, 3
Holmberg, D. G., 12
Holroyd, R. A., 30
Holt, S. S., 212
Holtrop, K. L., 173
Homer, L., 202
Honea, E. C., 63, 90
Honein, A., 68, 74
Honkanen, S., 108

Hooper, E. B., 179, 186
Hoover, R. C., 47
Horne, Keith, 203, 204, 213
Hossain, M., 151
Houck, J. E., 110
Houser, Paul R., 99
Houstis, Elias N., 147
Howe, S. D., 27
Hrovat, Kenneth, 24
Hu, W., 116
Hua, Xin-Hou, 157
Huang, Yen-Min, 139
Hubeny, Ivan, 203, 204, 205
Huber, Alan C., 25
Hudson, W. B., 151
Hufnagel, Klaus, 77, 82
Huhns, Michael N., 140
Hung, J. Y., 143
Hung, Mien-Chie, 128
Huntingdon, S., 180
Hurley, J. P., 38
Hurst, P., 181
Hurst, P. A., 177
Hyde, R. A., 171

I

Iaccarino, G., 72
Ichinose, Masaru, 116
Ida, K., 184, 187
Idei, H., 184, 187
Iguchi, H., 184, 187
Ikeda, Tetsuya, 91
Ikezi, H., 176
Ila, D., 43
Imagawa, S., 184
Inamori, Koji, 116
Inoue, Hajime, 210
Inoue, N., 184
Isakov, A., 48
Ishida, Haku, 131
Isler, R. C., 176
Isobe, M., 184, 187
Itoh, K., 184, 187
Ivaniouchenkov, Yu, 85

J

Jackson, D. R., 152
Jacob, R., 143
Jacobson, L. A., 40
Jardim, Helder, Lages, 201
Jefferson, D. C., 5
Jeker, Dominique, 111
Jenkins, P. P., 53
Jette, M. A., 148
Ji,, 189
Ji, X., 162
Jiminez, J., 71
Jochens, A. E., 124
Johnson, J. R., 118
Johnson, James E., 53
Johnson, K. R., 52, 53, 57
Johnson, L. C., 176
Johnson, Michael A., 22
Johnson, S., 194
Johnston, Norman J., 14, 30
Joiner, Joanna, 99
Jones, Gavin L., 155
Jones, J. W., 107
Jones, O. C., 75
Jones, R. Dan, 23
Joo, H., 67
Jordan, C. W., 148
Joshi, Anupam, 147
Joslyn, C., 195
Jovanovic, M. S., 184
Joy, M. K., 170
Joyce, J. J., 39
Joyce, Marilyn, 132
Juanero, K. J., 52, 53
Juutinen, Petri, 159

K

Kaaret, Philip, 222
Kado, S., 184, 187
Kaelin, B., 115
Kahn, R. D., 219
Kahn, S. M., 211
Kajdas, C., 49
Kaldeich-Schuermann, Brigitte, 55
Kalitzin, G., 72
Kaltenbach, K. W., 49
Kammenzind, B. F., 39
Kammeyer, Mark E., 81
Kanbach, G., 222
Kandil, Osama A., 10, 11
Kandola, Ornulf, 4
Kane, J., 173
Kang, B. S., 44
Kang, H. S., 178
Kanipe, F., 199
Kanno, Ryutaro, 185
Kaplan, D. I., 53
Kapper, R., 23
Karlmann, P. B., 53, 57
Kaspi, V. M., 222
Kasza, K., 105
Kattan, Michael W., 131, 150
Katz, E. S., 4
Katz, Lawrence C., 133
Kawai, N., 223
Kawata, S., 162
Kaya, Tarik, 66
Keithley, C., 110
Kelley, R. L., 35
Kellman, A. G., 173
Kennedy, Vincent, 149
Kent, S., 13
Kerschberg, Larry, 138
Khlopenkov, K., 184, 187
Khokhlov, A. M., 214
Khoo, Wai G., 154
Kiang, Richard K., 98
Kilcoyne, S. H., 165
Kilic, H. S., 162
King, P. J. C., 165
Kingston, Gina, 145
Kinsey, J. E., 172
Kise, C. D., 47
Kito, T., 54
Kluever, C., 116
Knauer, Andreas, 1
Kniffen, D. A., 222
Knigge, Christian, 204, 213
Knight, Bryon, 43
Knowlton, W. B., 192
Ko, M. K. W., 116
Ko, Malcolm K. W., 106, 113, 120
Kocks, U. F., 40
Kodiyalam, Srinivas, 95
Kohlberg, Ira, 60
Kohyama, A., 184
Koike, Matoke, 111
Kolomiets, A. V., 38
Kondo, K., 187
Kondo, T., 184
Kondo, Yutaka, 107, 111
Korb, C. Laurence, 121
Korneev, V. A., 114, 115
Kory, Carol L., 65, 66
Korzekwa, D. A., 42
Kosmidis, C., 162
Koumoutsakos, P., 68
Kouveliotou, C., 217
Kozyr, A., 114
Krainak, Michael A., 167
Kraus, H., 193
Krause, T., 162
Kreyns, P. H., 39
Krivoruchenko, Vladimir S., 76
Krol, D., 63

Krueger, S. K., 108
Krulewich, D. A., 57
Kruse, Hans, 61
Krushelnick, K., 179
Ku, Jentung, 66
Kubo, S., 184, 187
Kuehnel, V., 38
Kuhl, Christopher A., 53
Kuhn, Jonathan, 22
Kuijpers, W. C., 34
Kuiper, L., 222
Kulsrud, Russell, 216
Kumar, Ashok, 34
Kuramoto, H., 187
Kurth, W. S., 116
Kuulkers, Erik, 214
Kwei, G. H., 50, 192

L

LaBelle, R. D., 96
Lacorre, P., 47
Lacy, Mark, 202, 203, 204
Laehteenmaeki, A., 215
Lafleur, P. M., 100
Lagutin, Vyacheslav I., 84
Laing, R. A., 223
Lait, L. R., 26
Lamarque, Thierry, 93
Land, J. L., 92
Landis, G. A., 53
Langley, A. J., 162
Langley, D. L., 109
Langner, D. G., 86
Langowsky, Claudia, 9
Lapenta, C. C., 15
Lapygin, Vladimir I., 84
Lassiter, John, 56
Laube, J., 18
Lautenschlager, Peter, 190
Law, Ron D., 82
Lawson, A. C., 44
Lazaros, A., 184
Le, Calvin D., 60
Lear, G. R., 36
Ledingham, K. W. D., 162
Lee, Kenneth Y., 56, 57
Lee, S., 187
Lehto, Olli, 134
Leigh, John S., Jr, 129
Lele, S. K., 1, 160
LeMoigne, Jacqueline, 99
Lesher, C. E., 98
Levin, Daniel, 84
Lewin, W. H. G., 217
Lewis, C. L. S., 180
Lewis, G. K., 26
Lewis, M. W., 96
Li, H., 221
Li, L., 146
Lieberman, Henry, 147
Lien, F. S., 72
Lilje, Per B., 204
Limpouch, J., 162
Lin, Y. C., 222
Lindsey, J. S., 103
Linsky, Jeffrey L., 212
Lipa, John A., 86
Lippert, Espen, 90
Liska, R., 135, 162
Liu, Shaw C., 112
Liu, Weihong, 214
Lockwood, Mary Kae, 17
Loewenstein, M., 26
Loftus, Joseph P., Jr., 201
Logan, G., 164
Logsdon, John M., 224
Lohr, J., 176
Long, Knox S., 203, 204, 213
Lopez, R. E., 116
Lopez-Puertas, M., 117
Lopez-Puertas, Manuel, 115
Lord, J. S., 165
Lorenzo, Carl F., 135
Louca, D., 50
Loughran, C. J., 105
Lubow, Stephen, 217
Luce, R. E., 196
Luce, T. C., 171
Ludewig, H., 163
Lue, Yvonne, 137
Luhmann, J. G., 116
Lummerheim, D., 119
Lynas-Gray, A. E., 216
Lyne, A., 222

M

Ma, William, 158
MacDonald, A., 196
MacDowell, A. A., 190
MacEwen, S. R., 40
Machavariani, G. Y., 191
Macintosh, B., 168
MacPhee, A., 180
Maddux, Gary A., 145
Maggio, Gaspare, 196
Mahesh, K., 74
Maingi, R., 175, 178
Makarov, Nikolai, 156
Malba, V., 63
Malka, G., 179
Malka, V., 179
Malone, John B., 138
Maloy, S. A., 46
Maluckov, A., 184
Manceau, R., 73
Manchester, R., 222
Mankins, J., 18
Mannebach, Donald M., 23
Manney, G. L., 123
Marathe, M. V., 143
Marchello, Joseph M., 14
Marchetti, A. A., 166
Marcotte, Andrew, 132
Marcus, S. L., 218
Margevicius, R. W., 40
Marian, F. M., 85
Marker, T. R., 3
Marks, Christopher G., 150
Markus, T., 137
Marsh, A. S., 87
Martin David, 136
Martin, J. B., 116, 126
Martin, J. L., 58
Martineau, R. L., 94
Marzwell, Neville, 20
Mason, K. O., 208
Massey, Steven J., 10
Matousek, P., 28
Matsui, H., 184
Matsuoka, K., 183, 187
Matsuoka, M., 223
Matuska, W., 172
Matz, S. M., 222
Matzen, M. K., 189
Max, C. E., 168
Mayer-Hasselwander, H. A., 222
Mazzoleni, F., 169
McCanny, T., 162
McCaughey, J. H., 100
McClellan, K. J., 47, 48
McClure, T., 194
McClure, Wallace, 19
McComas, David, 146
McCrillis, R. C., 110
McEachern, R., 182
McElroy, M. B., 114
McGarity, John O., 25
McGhee, J. M., 153
McGlynn, Robert D., 66
McGuinness, C., 180
McIllece, David M., 144

McKittrick, J., 48
McMurtry, W., 199
McPherson, Kevin M., 24
Medarde, M., 47
Meegan, C. A., 223
Meighan, O., 180
Melfi, Harvey, 122
Melton, T. L., 15
Messier, Bernadette C., 30
Mica, Joseph A., 22
Michelson, P. F., 222
Michlitsch, K. J., 174
Mighell, Kenneth J., 212
Mihara, T., 223
Milam, D., 49
Miles, Jonathan J., 89
Milewski, J. O., 26, 89
Miller, M. A., 52
Miller, M. C., 85
Miller, Nancy, 132
Miller, Thomas L., 17
Miller-VanWieren, Leila, 157
Minami, T., 187
Minda, David, 158
Minh, N. Q., 36
Mioduszewski, P. K., 178
Mitarai, O., 184
Mizuguchi, Naoki, 188
Mlynczak, M. G., 117
Mlynczak, Martin G., 115
Modena, A., 179
Mohd-Yusof, J., 68
Mohseni, K., 160
Moin, P., 160
Molina-Paris, C., 166
Moloney, C., 180
Montanez, P., 163
Montesanti, R. C., 178
Montgomery, K., 36
Montgomery, Ronald W., 129
Moore, B., 106
Moore, Ronald L., 221
Moore, T., 101
Moore, T. R., 100
Moore, Thomas C., Sr., 84
Morales, L., 39
Moran, Douglas, 136
Moran, Manuel, 157
Moran, Scott J., 25
Morel, J. E., 153, 163
Morita, S., 187
Morris, R. N., 45
Morzinski, J. A., 154
Moser, R., 72
Moskowitz, S. E., 50
Mosteller, R. D., 166
Motojima, O., 184
Motter, Mark A., 158
Mourant, J., 48
Moyer, R. A., 176
Mueller, P. J., 54
Mukhopadhyay, Vivek, 10
Mule, Peter, 64
Mundy, Lee G., 206
Munger, J. W., 101
Muraida, Daniel J., 142
Muroga, T., 184
Murphy, T. J., 183
Muscatello, T., 54
Mustaleski, T. M., 89
Mutikainen, R., 87
Mutschlecner, J. P., 97
Myer, L. R., 115
Myers, G., 127
Mynick, H. E., 180

N

Naaman, O., 191
Nagel, K., 143
Nagy, George R., 23
Najjar, F., 72
Najmudin, Z., 179
Nakagawara, Van B., 129
Nakajima, Noriyoshi, 185
Nakotte, H., 38
Naylor, T., 215
Neeley, D., 179
Neff, James E., 212
Negaard, Gordon, 5
Neuman, A. D., 48
Neumeier, J. J., 192
Newell, Reginald E., 112
Newman, P. A., 26
Newton, M., 183
Nicoud, F., 72
Niemeyer, J. C., 32
Nihei, K. T., 115
Nishimura, S., 187
Niven, W. A., 148
Noda, T., 184
Nolan, P. L., 222
Noor, Ahmed K., 138
Noort, D., 35
Norton, M., 49
Norvig, Peter, 139
Nowak, A., 127
Nowak, Michael A., 218
Nowlin, W. D., 124
Nurre, Joseph H., 142

O

O, 3
Oberlack, M., 70
ODell, S. L., 170
Oefelein, J., 31
Oertel, J. A., 183
Ogbuji, Linus U. J. T., 34
Ohdachi, S., 187
Ohyabu, N., 184
Okajima, S., 162
Okamoto, Masao, 185
Okamura, S., 183, 184, 187
Oliveira, A. S., 28
Oliver, B. M., 46
Olivier, S. S., 168
Olson, J. R., 56
ONeil, D., 18
ONeil, Daniel A., 19
Ong, E. T., 36
Ooi, A., 73
Orlandi, P., 1, 68
Orosz, J. A., 205
ORourke, R., 180
Osakabe, M., 187
Osborne, T. H., 175
Ottens, Brian P., 88
Ou, J. J., 63
Oudenhujzen, A. J. K., 133
Ovacik, L., 75
Owen, L. W., 178

P

Pace, Scott, 19
Padmore, H. A., 190
Pallavicini, Roberto, 208
Palumbo, G. G. C., 210
Pamadi, Bandu N., 2
Panchenko, Ivan N., 76, 77
Pantazis, John A., 25
Paradijis, J. Van, 217
Pardo-Carrion, Juan R., 111
Parekh, D., 68
Parhi, Shyamsundar, 221
Parker, A. W., 28
Parks, G. K., 118, 119
Parma, P., 223
Parsons, D. K., 163
Pasternak, M. P., 191
Patel, F. D., 63
Patel, J. R., 190

Paulsen, Avelina Q., 125
Pawel, S. J., 45
Payne, S. A., 63, 191
Peacock, A., 210
Peery, J. S., 134
Peffers, M. S., 126
Peng, W. X., 162
Perry, A. J., 42
Peskov, V., 85
Peterman, Robert B., 142
Peters, T. A., 58
Petrovic, J. J., 47
Petty, C. C., 171
Pfister, Lenny, 111
Phillips, T., 174
Picard, R., 154
Pickering, Kenneth, 107
Pickering, Kenneth E., 111
Piland, W., 19
Pinelli, Thomas E., 199
Pines, D., 24
Pitcher, E. J., 166
Pitts, Andrew, 144
Platero, M., 48
Plichta, Edward J., 63
Poinsot, T., 31, 32
Poker, D. B., 43
Polansky, Lubomir, 82
Polk, M., 134
Pollak, Randall D., 23
Pommerenke, Christian, 156
Ponce, D., 176
Ponsardin, Patrick L., 124
Poot, C. A., 34
Popovic, S., 36
Porter, G., 179
Porter, J. E., 97
Portree, Davis S. F., 201
Potthast, Lothar, 190
Powell, Orval A., 75
Powell, Richard W., 17
Preses, J. M., 30
Preston, R. A., 219
Prigent, Catherine, 111
Prince, Frank A., 17
Principe, Jose C., 158
Puga-Lambers, M., 41
Purdy, Andrew P., 33
Pusey, Marc, 28
Pyburn, Bradley L., 86

Q

Quade, Matthias, 77
Quinlan, D., 149

R

Rachner, Michael, 51
Rahotgi, N. K., 37
Ramsey, B. D., 85
Randel, William J., 120
Rapp, D., 37, 58
Rappaport, Carl S., 19
Rappaz, M., 92
Ratliff, J. E., 53
Rawlings, Steve, 202, 203, 204
Reams, C. A., 197
Reardon, B. J., 38
Rebstock, R., 79
Ree, F. H., 178
Reed, D. T., 162
Reedy, Robert C., 220
Reid, R. O., 124
Reilly, S. D., 37
Reisner, J. M., 123
Remelius, D. K., 89
Remington, B. A., 173
Remsing, L. M., 97
Repko, W. W., 165
Rettig, C. L., 172
Reveillon, J., 31
Rey, Jose-Manuel, 157
Rice, John R., 147
Richards, P. G., 119
Ridgway, Susan E., 204
Rietmeijer, F. J. M., 215
Rilee, Michael L., 22
Ringel, M., 84
Ringwald, F., 215
Ripberger, C. T., 107
Roberts, P., 123
Roberts, Paul W., 79
Robinson, E. L., 205
Robinson, R. A., 88
Robinson, S. H., 136
Rocco, Evandro Marconi, 14, 24, 202
Rocha, Andre C., 156
Rock, Stephen M., 11
Rodrigues, Flavia Beatriz Vasconcellos, 145
Rodriguez, Jose, 120
Rodriquez, J. M., 116
Rodriquez, Jose M., 113
Rogers, M. M., 70, 73
Rogers, T., 19
Rohde, S., 158
Romero, R. S., 48
Rose, L. R. F., 94
Rosen, R. D., 218
Rosenberger, F., 192
Rosenberger, Franz, 193
Ross, M. N., 26
Rossow, William B., 111
Roulet, N. T., 100
Rouse, Marshall, 29
Rowell, Larry, 21
Roy, M., 104
Rozenberg, G. K., 191
Rozsnyai, B., 197
Ruby, D. S., 104
Ruedy, R., 112
Ruetsch, G. R., 31, 32
Runley-vanGurp, R. A., 35
Russell, C. T., 116
Russell, G. J., 166
Russell, James M., III, 115
Russell, P. E., 38
Rutten, Rene G. M., 203, 204
Rutzky, Lynne P., 130
Ryutov, D. D., 189

S

Sachet, L. L., 92
Safinya, C., 127
Sagara, A., 184
Salstein, D. A., 218
Salvati, M., 179
Sander, Stanley P., 113
Sanders, G. B., 53
Sanders, Gerald B., 58
Santala, M., 179
Santee, M. L., 123
Santos, Marciel Silva, 100
Sanuki, H., 187
Sarajedini, Ata, 212
Sarkisov, S., 43
Sarrao, J., 39
Sasao, M., 187
Sato, M., 112
Sato, T., 183, 184
Sato, Tetsuya, 188
Satow, T., 184
Savages, K., 101
Scarborough, W. K., 47
Scardino, Peter T., 131
Schaffer, M. J., 176
Scheiman, D. A., 53
Schiferl, D., 98
Schissel, D. P., 172
Schmitt, E. H., 177
Schneider, H. R., 114
Schneider, M. A., 36
Schneider, M. P., 15
Schoeberl, M. R., 26

Schultz, A., 38
Schwantje, R., 136
Schwartz, A. J., 40
Schwarz, R. B., 46
Schwemmer, Geary, 122
Sciortino, S., 210
Sciretta, M. S., 133
Scott, B. L., 37
Scott, C. A., 165
Scott, Courtney, 113, 120
Scott, Courtney J., 106
Scott, D. Matthew, 222
Scovel, C., 153
Sedman, C. B., 110
Seidel, Jonathan, 9
Selkirk, Rennie B., 111
Sell, W., 49
Seller, P., 62
Serio, S., 210
Serlemitsos, Peter J., 169
Shahbaz, T., 215
Shaikh, W., 180
Shanabarger, R. M., 45
Shankland, T. J., 98
Shariff, K., 1
Sharma, P. K., 37
Sheliak, J. D., 180
Shell, Elaine M., 137
Sheridan, P., 26
Sheta, Essam F., 11
Shevchenko, O. A., 90
Shi, John J., 25
Shia, R.-L., 116
Shia, Run-Lie, 106, 120
Shimada,, 89
Shimazutsu, Hiroaki, 91
Shimizu, A., 187
Shimizu, H. M., 223
Shires, T. M., 105
Shishkin, A. A., 184
Shrouf, K., 108
Sickafus, K. E., 46
Siddons, D. Peter, 190
Sigurosson, O., 102
Silk, Eric, 22
Simm, David E., 22
Simmons, J. E., 87
Simmons, M. R., 177
Simpson James E., 55
Simpson, Chris, 203
Singh, M., 28
Singh, Munindar, 139
Singhal, R. P., 162
Sinor, M., 162
Sjoedin, Tord, 156
Skoric, M. M., 184
Smeenk, J., 104
Smith, C. K., 126
Smith, D. J., 162
Smith, David R., 56, 57
Smith, F. W., 94
Smith, G. S., 127
Smith, L. C., 102
Smith, N. S. A., 31
Smitherman, David, 19
Sneiderman, Gary, 105
Snell, Edward H., 190
Snorre, Prytz, 63
Sobieszczanski-Sobieski, Jaroslaw, 95
Sommer, W. F., 46
Soreide, David, 9
Spann, J. F., Jr., 118, 119
Spataro, M., 13
Spencer, John, 20
Spencer, Roy W., 108
Speth, J. A., 90
Spill, E. J., 87
Spivack, R. N., 194
Spottswood, Stephen M., 29
Sridhar, K. R., 54
Staebler, G. M., 172
Staehelin, Johannes, 111
Stalker, J. R., 109, 123
Stallmer, E., 19
Standish, E. M., 219
Stanek, P. W., 40
Stanton, Robert J., 7
Starnes, James H., Jr., 95
Steenman, Daryl G., 59
Steinfeld, G., 104
Stenchikov, Georgiy, 107
Stephen, Mark A., 167
Stephenson, L. D., 34
Stephenson, R., 87
Stevens, M. F., 43
Stewart, J. E., 86
Stojanoff, Vivian, 190
Stolz, S., 74
Stout, M. G., 40
Strait, E. J., 175
Strand, Douglas J., 93
Strassmeier, Klaus G., 212
Strom, D. J., 126
Strueder, L., 87
Stuber, John, 149
Sudo, S., 187
Suess, Steven T., 221
Sun, X., 221
Suni, I., 87
Sutton, D. J., 101
Suyker, A. E., 100
Swenson, F. J., 172
Swift, G. W., 56
Swift, W., 119
Symons, D. M., 40
Sze, Nien Dak, 107, 113
Sze, R. C., 48

T

Taday, P. F., 162
Takagi, S., 187
Takahashi, C., 187
Takeyasu, N., 180
Talcott, Carolyn, 144
Tanaka, Jiro, 91
Tanaka, K., 187
Tanaka, S., 184
Tananbaum, H., 211
Tannehill, J. C., 2
Tatarakis, M., 179
Tayal, S. S., 163
Taylor, J., 65
Taylor, R. D., 191
Tcheng, Ping, 76, 83
Terai, T., 184
Teramoto, T., 162
Thielemann, F.-K., 214
Thode, L., 27
Thomas, T., 153
Thompson, A. C., 190
Thompson, A. M., 113
Thompson, Andrew W., 190
Thompson, Anne M., 107, 111
Thompson, D. C., 89
Thompson, D. J., 222
Thompson, J. D., 39
Tiegs, P. E., 110
Tieszen, S., 73
Tighe, Thomas R., 3
Tiwari, S. N., 14
Todo, Y., 183
Todosow, M., 163
Toi, K., 187
Tokanai, F., 223
Toor, P. M., 93
Topol, David A., 160
Townsend, Dan, 7
Towrie, M., 28
Tripp, John S., 76, 81, 83
Trkula, M., 36
Trouve, Arnaud, 32
Truemper, J., 87, 210
Truemper, Joachim E., 211

Trugman, S. A., 190
Truszkowski, Walter F., 22
Tsurutani, Bruce T., 217
Tubbs, D. L., 171
Tukia, Pekka, 157
Turcu, I. C. E., 180
Turgut, Altan, 161
Turner, David, 122
Turner, Martin J. L., 207, 210
Tyson, P. D., 113
Tzallas, P., 162

U

Ugiansky, G. M., 92
Urbatsch, T. J., 135

V

Vaeisaelae, Jussi, 158
Vajracharya, S., 148
Valtaoja, E., 215
Van Patten, P. G., 103
vanBragt, F. J., 65
VanDenHeuvel, E. P. J., 217
vanHam, N. H. A., 27
Vasco, C., 71
Vasilyev, O. V., 70
Vasilyev, Oleg V ., 71
Vaughan, Brian A., 218
Vaughn, J. R., 126
Vekilov, P. G., 192
Vekilov, Peter G., 193
Verma, S. B., 100
Vervisch, L., 31
Vervisch, Luc, 32
Verzicco, R., 68
Vescio, N., 107
Veynante, D., 32
Viehweger, G., 79
Vinokurov, N. A., 90
Vishik, M., 75
Vos, H. B., 79
Voter, A. F., 191
Vu, Nicole T., 128
Vuskovic, L., 36

W

Waas, Anthony M., 95
Waddington, J. M., 100
Wade, M. R., 175
Wade, R. A., 205
Wade, Richard A., 203, 204, 205, 213
Waganaar, W. J., 42
Wahlund, Jan-Erik, 23
Wallace, Karilynne, 61
Wallace, R., 173
Walsh, Joanne L., 96
Walter, K., 43
Wang,, 189
Wang, C. H., 94
Wang, L., 30
Wang, Ludong, 158
Wang, M., 73
Wang, S. L., 162
Wang, Ten-See, 25
Wang, X., 101
Wareing, T. A., 153, 163
Warwick, R. S., 208
Watanabe, K. Y., 184
Watanabe, Tomo-Hiko, 188
Waters, J. W., 123
Watkins, J. G., 37
Watkins, M. M., 5
Watson, Mike G., 207
Webb, F. H., 5
Wedin, Lars, 23
Wegeng, Robert S., 58
Weiland, Mattias, 74
Weinacht, D. J., 166
Weisenstein, Debra K., 106, 113
Weisskopf, M. C., 170
Welch, Ronald M., 121
Wells, Diane C., 125
Wendelberger, J. R., 153
Wendroff, B., 135
Wenz, T. R., 86
Wernli, Heini, 111
West, Edward A., 159
West, G., 164
Wheeler, J. C., 214
Whitaker, R. W., 97
White, N. E., 211
Whiteman, David, 122
Whiting, G. J., 100
Whitman, P., 49
Wiens, R. C., 219
Wigneron, Jean-Pierre, 111
Wildzunas, Robert M., 133
Wilen, Saul B., 142
Wiliams, David W., 12
Wilkinson, F., 28
Williams, E. K., 43
Williams, J. D., 59
Williams, J. G., 219
Williams, J. M., 97
Williams, Kevin W., 4
Williams, R. S., Jr., 102
Willingale, Dick, 209
Willott, Chris J., 202
Wills, C. J., 127
Wilms, Joern, 218
Wilson, Colleen A., 222
Wilson, D. C., 180
Wilson, D. F., 45
Wilson, J. C., 26
Wilt, David M., 106
Wilton, D. R., 152
Winckelmans, G., 72
Winckelmans, G. S., 70
Winthrop, Michael F., 155
Wise, Stacy, 122
Withrow, S. P., 41
Wix, S., 199
Wofsy, S. C., 101
Wold, Margrethe, 204
Wolfenstine, Jeff, 64, 104
Wolff, Howard, 20
Womeldorf, C. A., 12
Wong, H., 177
Wood, B. P., 42
Wood, Janet H., 205
Wood, Kathryn J., 129
Worrall, D. R., 28
Wray, A., 70
Wray, A. A., 70
Wright, Frank L., 81
Wu, J. J., 58
Wu, K. Chauncey, 96
Wu, Z., 182

X

Xavier, Alexandre Candido, 102

Y

Yager, Thomas J., 13
Yakuma, S. C., 91
Yamanishi, H., 184
Yamashita, Koujun, 210
Yamazaki, K., 184
Yan, Jun-Ren, 83
Yang, Chung-Chun, 157
Yang, P., 104
Yang, Runhua, 99
Yang, Zhi, 11
Yocke, M. A., 123
Yoder, C. F., 219
Yong, Tan C., 168
Yoshida, A., 223
Yoshimura, Y., 187

Young, D., 63
Young, Lawrence R., 19
Young, R. B., 126

Z

Zagalsky, Peter F., 190
Zaidi, S., 104
Zaragoza, G., 117
Zavorine, Ilya, 99
Zerkle, D., 27
Zewari, Wahid, 56, 57
Zhang, Chao-Hui, 155
Zhang, Ying-Pei, 83
Zhao, Y., 98
Zhao, Yongjing, 111
Zhou, D. K., 117
Zhou, Daniel K., 115
Zielinski, Alexander, 60
Ziemke, J. R., 117
Zocco, T., 43
Zubrin, R., 54
Zumberge, J. F., 5
Zurek, R. W., 123
Zwan, Allen, 77