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STAR

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Space Administration
Langley Research Center

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- Domestic and foreign dissertations and theses.

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

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

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Subject Divisions

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

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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

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Subject Categories of the Division A. Aeronautics

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

01 Aeronautics (General) 1

02 Aerodynamics 3

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

03 Air Transportation and Safety 8

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 10

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 12

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 13

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 13

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 14

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) 15

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) 16

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

13 Astrodynamics N.A.

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

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

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

15 Launch Vehicles and Space Vehicles 19

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 20

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 21

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 28

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

20 Spacecraft Propulsion and Power 29

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

Subject Categories of the Division C. Chemistry and Materials

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23 Chemistry and Materials (General) 31

24 Composite Materials 33

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

25 Inorganic and Physical Chemistry 38

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

26 Metallic Materials 50

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

27 Nonmetallic Materials 52

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 57

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

29 Materials Processing N.A.

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

Subject Categories of the Division D. Engineering

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

31 Engineering (General) 65

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

32 Communications and Radar 68

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 75

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 83

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 86

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 88

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

37 Mechanical Engineering 93

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

38 Quality Assurance and Reliability 94

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 96

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) 97

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 101

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 101

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 104

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

47 Meteorology and Climatology 108

Includes weather forecasting and modification.

48 Oceanography 113

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) 114

52 Aerospace Medicine 116

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

53 Behavioral Sciences 118

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

54 Man/System Technology and Life Support 121

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) N.A.

60 Computer Operations and Hardware 123

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

61 Computer Programming and Software 123

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

62 Computer Systems 137

Includes computer networks and special application computer systems.

63 Cybernetics 141

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 145

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 146

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

66 Systems Analysis 147

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics N.A.

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) 149

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 150

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

72 Atomic and Molecular Physics 152

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics 155

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

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75 Plasma Physics 166

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

76 Solid-State Physics 166

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

77 Thermodynamics and Statistical Physics 179

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

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General) 179

Includes educational matters.

81 Administration and Management 180

Includes management planning and research.

82 Documentation and Information Science 182

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 202

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy N.A.

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

85 Urban Technology and Transportation 203

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

Subject Categories of the Division J. Space Sciences

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

88 Space Sciences (General) N.A.

89 Astronomy 203

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

90 Astrophysics 213

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 N.A.

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

92 Solar Physics 214

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

93 Space Radiation N.A.

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

Subject Categories of the Division K. General

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99 General 215

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

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Typical Report Citation and Abstract

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 36, AUGUST 17, 1998

01
AERONAUTICS (GENERAL)

19980202133 Office of the Under Secretary of Defense (Acquisitions), Washington, DC USA
The DOD Tactical Aviation Modernization Program
Kaminski, Paul G., Office of the Under Secretary of Defense (Acquisitions), USA; Mar. 05, 1997; 15p; In English
Report No.(s): AD-A339157; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Statement to the House Committee on National Security regarding the DoD Tactical Aviation Modernization Program.
DTIC
Security; Integrity

19980202469 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France
Numerical Unsteady Aerodynamic and Aeroelastic Simulation ***L'Aerodynamique instationnaire numerique et la simulation de l'aeroelasticite***
Numerical Unsteady Aerodynamic and Aeroelastic Simulation; Mar. 1998; 198p; In English; In French; Meeting of the AGARD Structures and Materials Panel, 14-15 Oct. 1997, Aalborg, Denmark; Sponsored by Advisory Group for Aerospace Research and Development, France; Also announced as 19980202470 through 19980202483
Report No.(s): AGARD-R-822; ISBN 92-836-0054-1; Copyright Waived; Avail: CASI; A09, Hardcopy; A03, Microfiche

Two components are required for analysis of dynamic aeroelastic phenomena, a structural finite element model of the vehicle, and an unsteady aerodynamics model; in current practice linear approximations are used for both models. Although structural nonlinearities possibly play a part in some cases of Limit Cycle Oscillation (LCO), the analysis community is generally content with existing structural modeling methods. The need for accurate and user-friendly advanced aerodynamic methods, however, is generally recognized. Control surface buzz, a one degree of freedom aeroelastic phenomenon involving shock oscillation, is an example of a problem not susceptible to analysis using linear aerodynamics. The current practice in industry is to use very conservative rules of thumb in hopes of preventing buzz, or simply to ignore the possibility. Obviously, conservatism introduces unnecessary weight and the discovery of a buzz problem during the test program causes delay and an expensive redesign effort. As computer hardware increases in capability, CFD methods are maturing and becoming available for at least limited use in industry. These methods hold much hope for future improvements in unsteady aerodynamics predictions. More accurate analysis of ordinary flutter in the sub- and supersonic flight regimes as well as the development of transonic analysis methods can result in a reduction of aircraft weight and development cost by reducing the need for conservatism and possibly by eliminating the expense of flutter model testing. Up to the present time, extreme difficulty of use, computational cost and lack of verification against suitable test cases have severely limited use of CFD procedures in industry; codes suitable for analysis of complete aircraft have not been shown to exist. The papers at this Workshop dealt with methods at the leading edge of current technology as applied in industry, and with more advanced methods which are in the development and checkout process. These papers contribute to the expectation that the time is not far removed when industry will be able to make much increased use of advanced unsteady aerodynamics methods.
Author
Unsteady Aerodynamics; Mathematical Models; Finite Element Method; Aeroelasticity; Computational Fluid Dynamics; Navier-Stokes Equation; Three Dimensional Flow; Computerized Simulation; Flutter

19980202697 Naval Postgraduate School, Monterey, CA USA

Decision Support Requirements for the Aviation Maintenance Material Control Officer

Brosch, Bruce W., Naval Postgraduate School, USA; Dec. 1997; 97p; In English

Report No.(s): AD-A341821; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This thesis evaluates Naval Aviation Logistics Command Information System (NALCOMIS) based upon maintenance management information requirements and highlights how NALCOMIS does not support the Maintenance Material Control Officer (MMCO) as an information system. The Automated Maintenance Environment (AME) initiative currently in development will be capable of providing the MMCO with the information needed to improve maintenance management decisions. The overall result will be reduced aircraft lifecycle costs and improved operational availability. A concept of operations at the organizational maintenance level is presented to illustrate the AME concept. The full implementation of AME will have a profound effect on Naval aviation maintenance processes. Recommendations for further research are presented.

DTIC

Management Information Systems; Aircraft Maintenance; Logistics Management; Military Aviation

19980202964 Bristol Univ., Dept. of Aerospace Engineering, UK

The Aeronautical Journal, Volume 102, Golden Jubilee Issue

Stollery, John L., Editor, Bristol Univ., UK; The Aeronautical Journal; Feb. 1998; ISSN 0001-9240; 55p; In English; Also announced as 19980202965 through 19980202970; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Topics considered in this Golden Jubilee Issue include: (1) Unsteady propeller flows due to turbulence ingestion; (2) Computation, analysis and theory of two-phase flows; (3) Through thickness fatigue failure of fibre-reinforced composites; (4) A 2D Navier-Stokes method for unsteady compressible flow calculations on moving meshes; (5) The feasibility and benefits of dynamic reconfiguration in integrated modular avionics; and (6) Innovative approaches to composite structures.

CASI

Composite Structures; Fiber Composites; Compressible Flow; Navier-Stokes Equation; Avionics; Turbulent Flow; Unsteady Flow; Two Phase Flow; Fatigue Tests; Systems Engineering; Helmet Mounted Displays

19980203127 Naval Postgraduate School, Monterey, CA USA

An Analysis of Depot Level Maintenance for the H-60 Helicopter Under an Integrated Maintenance Concept

Hatcher, Charles S., Jr., Naval Postgraduate School, USA; Sep. 1997; 122p; In English

Report No.(s): AD-A340983; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis examines the depot maintenance processes of naval H-6O helicopters. Budget and political climate issues are discussed. Aircraft Service Period Adjustment (ASPA) deferral rates, Standard Depot Level Maintenance (SDLM) turnaround time, depot maintenance direct labor and material costs, and projected backlog using depot requirements and funding are examined. Data analysis indicates a need for significant process improvements or radical changes to depot processes. The Integrated Maintenance Concept (IMC) will consolidate organizational and depot level maintenance at fleet locations. IMC offers several advantages over traditional depot maintenance methods. Using regression analysis, the direct costs of SDLMs conducted at the Pensacola Naval Aviation Depot from 1987 to 1995 were used to estimate direct costs of depot maintenance based on: aircraft age, the projected level of depot maintenance, and employment (operational versus training). Within the scope of this research, a weak correlation existed between the direct labor costs and aircraft age and employment as explanatory variables; direct material costs showed a higher correlation: for total direct costs, these two variables explained 34.4 percent of the variation. Incorporating additional explanatory variables, such as flight hours prior to SDLM, may improve the model. Finally, recommendations are made to facilitate the transition to Integrated Maintenance, emphasizing data collection requirements and data analysis techniques to better estimate maintenance and funding requirements.

DTIC

Aircraft Maintenance; Data Acquisition; H-60 Helicopter; Operating Costs; Procedures; Management Planning

02
AERODYNAMICS

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

19980202315 Texas Univ., Dept. of Civil Engineering, Austin, TX USA
Tip Flows for Wings and Propellers and their Effect on the Predicted Performance
Kinnas, S. A., Texas Univ., USA; Pyo, S., Texas Univ., USA; Jan. 1998; 44p; In English
Contract(s)/Grant(s): N00014-96-1-0231
Report No.(s): AD-A339151; Rept-98-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Various wake alignment techniques which have been developed in the past for the analysis of noncavitating propellers in uniform inflows are reviewed and some of them are extended in the case of cavitating flows subject to inclined inflows. The effect of the inclined trailing wake geometry on the predicted cavities and blade forces is found to be significant. The effect of the tip vortex detachment location on the shape of the trailing wake and on the pressure distribution on the tip is studied for wings and propeller blades. The local viscous flow inside of the core of a tip vortex is formulated via a parabolic Navier-Stokes approach. Predicted open flow characteristics and unsteady forces acting on the blades of an inclined shaft propeller are compared to those predicted by other methods, as well as those measured in experiments.
DTIC
Propeller Blades; Vortex Shedding; Navier-Stokes Equation; Cavitation Flow; Flow Characteristics; Viscous Flow

19980202470 NASA Langley Research Center, Hampton, VA USA
Calculated viscous and scale effects on transonic aeroelasticity
Edwards, John W., NASA Langley Research Center, USA; Mar. 1998; 11p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A viscous-inviscid interactive coupling method is used for the computation of unsteady transonic flows. A lagextrainment integral boundary layer method is used with a transonic small disturbance potential code to compute the transonic aeroelastic response for two wing flutter models. By varying the modeled length scale, viscous effects may be studied as the Reynolds number per reference chordlength varies. Appropriate variation of modeled frequencies and generalized masses then allows comparison of responses for varying scales or Reynolds number. Two wing planforms are studied: one a four percent thick swept wing and the other a typical business jet wing. Calculations for both wings show limit cycle oscillations at transonic speeds in the vicinity of minimum flutter speed indices.
Author
Transonic Flow; Viscous Flow; Scale Effect; Aeroelasticity; Aerodynamic Stability; Unsteady Aerodynamics; Mathematical Models; Inviscid Flow; Flutter Analysis; Wing Oscillations; Transonic Flutter

19980202471 Dassault Aviation, Saint-Cloud, France
Aeroelasticity and C.F.D. ***Aeoelasticite et C.F.D.***
Petiau, C., Dassault Aviation, France; Stoufflet, B., Dassault Aviation, France; Nicot, Ph., Dassault Aviation, France; Mar. 1998; 16p; In English; In French; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

We present the evolution of the use of CFD methods within our system of aeroelastic analysis (ELFINI). We started from a tool founded on the coupling of a structural Finite Element(FE) model and of an aerodynamic model, based on linear potential theory, empirically calibrated (mainly from flight tests). The linear character of these models allows a very efficient organization of inexpensive calculations (notions of load basis and of aerodynamic basis), sweeping of all of the flight configurations (Mach, altitudes, maneuvers, mass and external store configurations). Presently, keeping the same organization, we use an Euler FE method for the effects of initial shapes and of rigid motions. Now we push our developments in two main directions: non linear methods of direct static and dynamic coupling with aerodynamic models by non linear potential methods and mainly by steady and unsteady FE Euler methods; and linearized Euler methods in the neighborhood of previous non linear static aeroelastic solutions. In conclusion, we evoke the main features of our future organization of aeroelasticity analysis which will be more accurate while remaining affordable.
Author
Aeroelasticity; Computational Fluid Dynamics; Nonlinearity; Linearization; Euler Equations of Motion; Finite Element Method

19980202472 NASA Langley Research Center, Hampton, VA USA

Application of the ENS3DAE Euler/Navier-Stokes Aeroelastic method

Schuster, David M., NASA Langley Research Center, USA; Beran, Philip S., Air Force Inst. of Tech., USA; Huttsell, Lawrence J., Air Force Research Lab., USA; Numerical Unsteady Aerodynamic and Aeroelastic Simulation; Mar. 1998; 11p; In English; Also announced as 19980202469

Contract(s)/Grant(s): F33615-95-D-3214; AF Proj. 0003; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses recent applications of the ENS3DAE computational aeroelasticity method. In particular, it describes aeroelastic and unsteady aerodynamics calculations performed on wings with trailing edge control surfaces. These simulations include the investigation of control reversal for a structurally flexible wing with a deflected control surface, and a static and dynamic analysis of a rigid wing with an oscillating control surface. The two sets of calculations were performed independently on different wings using different grid topologies. The control reversal simulation represents an inviscid Euler static aeroelastic analysis of a thin wing with a rectangular planform. The geometry of this wing makes it suitable for computations using more approximate, inviscid aerodynamics methods. Thus, the results of the present Euler computations are compared with numerical data generated by a validated computational aeroelasticity code which uses a simpler aerodynamic formulation. The second illustrated case involves the simulation of a significantly more complex flowfield and the static and dynamic analyses of this geometry were performed using the viscous Navier-Stokes equation option in ENS3DAE. Results of both the steady and unsteady calculations on this wing are compared with existing experimental data.

Author

Aeroelasticity; Control Surfaces; Navier-Stokes Equation; Unsteady Aerodynamics; Computational Fluid Dynamics; Mathematical Models; Control Simulation

19980202473 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Aeroelasticity, Goettingen, Germany

Aerodynamics for elastically oscillating wings using the virtual grid deformation method

Wegner, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Mar. 1998; 12p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A new, efficient, and precise calculation method for unsteady aerodynamics is presented in this paper. It is called the ”virtual grid deformation” method. The time-dependent grid deformation is observed virtually and without restriction, meaning that this method is also valid for high deflections and large amplitudes, respectively. This method is applicable to the conservation laws of fluid flows which are solved by a finite volume scheme and by a time-stepping procedure. Numerical results of a standard wing in steady and unsteady flow are compared with available measurements.

Author

Unsteady Aerodynamics; Finite Volume Method; Oscillating Flow; Mathematical Models; Unstructured Grids (Mathematics); Conservation Laws; Computational Fluid Dynamics

19980202474 Office National d’Etudes et de Recherches Aerospatiales, Paris, France

Application of linearized Euler Equations to the estimation of flotation *Application des equations d’Euler linearisees a la prevision du flottement*

Mortchelewicz, G. D., Office National d’Etudes et de Recherches Aerospatiales, France; Numerical Unsteady Aerodynamic and Aeroelastic Simulation; Mar. 1998; 8p; Translated in English by Schreiber; In French; Also announced as 19980202469; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The use of linearized Euler equations in the context of harmonic excitations of structural modes makes it possible to calculate the aeroelastic forces in the frequency field at a reduced calculation cost which is well below the cost obtained by the classical method of time simulation using the Euler equations. Numerical examples make it possible to illustrate this approach.

Transl. by Schreiber

Aeroelasticity; Euler Equations of Motion; Linearization; Computerized Simulation; Harmonic Excitation; Structural Stability; Frequency Distribution; Mathematical Models

19980202476 Boeing Co., Long Beach, CA USA

CFD based corrections for linear aerodynamic methods

Baker, Myles L., Boeing Co., USA; Mar. 1998; 12p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the past few years, great strides have been made in the analytical prediction of nonlinear flows using computational fluid dynamics (CFD). Coupled with the exponential growth in computer power, this has made it possible to analytically predict the unsteady aerodynamics and aeroelastic motion of complex configurations in nonlinear flow regimes. Unfortunately, these analy-

ses are extremely costly due to the vast amount of computational effort required to compute the requisite time histories. This computational expense limits the use of these nonlinear aeroelastic tools to special cases, and eliminates them from consideration whenever a large number of conditions must be evaluated. Due to this high cost, the aerodynamic tools used in certification analysis and aeroelastic design optimization are usually based on linear lifting surface theory or panel methods. This paper presents a method to bridge this gap, so that the improved accuracy of the expensive nonlinear aerodynamic/aeroelastic methods can be injected into the economical production-type aeroelastic analyses through corrections to the linear aerodynamics. In contrast to techniques based on multiplicative correction factors, the present technique corrects the linear aerodynamics by removing a component of the pressure distribution from the linear theory, and replacing it with a component computed with a nonlinear method using a concept called ”local equivalence.” This allows a small number of nonlinear analyses to be applied to a large number of aeroelastic analyses. The technique is equally applicable to steady and unsteady aerodynamics. The formulation is such that, if available, steady or unsteady wind tunnel data can also be used in aeroelastic analysis and optimization. The scope of the paper is limited to comparing the results of corrected linear aerodynamics to the available nonlinear data, since many comparisons between nonlinear simulations and experiment are available in the literature. An application of the current technique to the flutter analysis of the AGARD 445.6 wing is shown, along with correlations between direct nonlinear flutter simulations and flutter solutions with corrected aerodynamics.
Author
Computational Fluid Dynamics; Unsteady Aerodynamics; Error Correcting Codes; Flutter Analysis; Flutter; Nonlinearity; Mathematical Models; Unsteady Flow

19980202478 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Aeroelasticity, Goettingen, Germany
Transonic aeroelastic simulation of a flexible wing section
Schulze, Silvio, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Mar. 1998; 20p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Flutter characteristics and results of aeroelastic time response analyses of NACA64010 airfoils oscillating in transonic flow are presented. These solutions were obtained by a newly developed two-dimensional aeroelastic simulation code which is designed in such a manner that the flow and the structure can be modelled independently by using the so-called domain decomposition approach. The coupled field problem is then effectively solved in the time domain by applying a partitioned solution procedure in which the fluid and the structural solvers are executed in an alternating fashion and exchange interface data only at certain time steps. In this study the prediction of the flow field around airfoils in arbitrary motion is based on the solution of the unsteady Euler equations. The structure might either be modelled as a rigid body system or as a more realistic flexible configuration. In this context, the finite element method is used to model elastic effects in the chordwise direction of a typical wing section, thus accounting for more general motions of the airfoil including the fluid structure interaction boundary. The underlying theory is briefly outlined and results are presented for several aeroelastic test cases of varying complexity in the structural model. Both cases with and without control surface are dealt with and the effect of flexibility on the transonic aeroelastic stability behavior is investigated.
Author
Transonic Flow; Unsteady Flow; Flexible Wings; Airfoils; Aeroelasticity; Computerized Simulation; Finite Element Method; Euler Equations of Motion; Dynamic Response; Control Surfaces; Two Dimensional Models; Mathematical Models; Transonic Flutter; Computational Fluid Dynamics

19980202479 National Aerospace Lab., Amsterdam, Netherlands
NLR-TUDelft experience in unsteady aerodynamics and aeroelastic simulation applications
Meijer, J. J., National Aerospace Lab., Netherlands; Hounjet, M. H. L., National Aerospace Lab., Netherlands; Eussen, B. J. G., National Aerospace Lab., Netherlands; Prananta, B. B., Technische Hogeschool, Netherlands; Mar. 1998; 21p; In English; Also announced as 19980202469
Contract(s)/Grant(s): NIVR-01904N; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of computational aerodynamic and aeroelastic simulation codes is steadily making progress. Nevertheless these codes are only modestly being accepted by the end-users in industry and other agencies in charge of flutter clearance or aeroelastic responses, in general. Various shortcomings of the current codes can be named which cause the reserve of the end-users. One of them is often unacceptable amount of manpower required for pre- and postprocessing. NLR is developing a numerical aeroelastic simulation environment for applications to civil and fighter-type aircraft, of which a pilot version is in operation. Special attention has been given to the design of user friendly pre and postprocessing. The paper will discuss the motivation of an aeroelastic simulation environment, the status of the NLR AEroelastic SIMulation system, the current research activities, the pre

and postprocessing and future research activities. Several applications will be shown, demonstrating the use to both civil and fighter-type aircraft.
Author
Unsteady Aerodynamics; Aeroelasticity; Computational Fluid Dynamics; Computerized Simulation; Flutter; Three Dimensional Models; Aircraft Models; Mathematical Models; Wing Oscillations; Aerodynamic Characteristics

19980202481 Daimler-Benz Aerospace A.G., Military Aircraft, Munich, Germany
High incidence unsteady aerodynamics for aeroservoelastic predictions
Luber, W., Daimler-Benz Aerospace A.G., Germany; Becker, J., Daimler-Benz Aerospace A.G., Germany; Numerical Unsteady Aerodynamic and Aeroelastic Simulation; Mar. 1998; 16p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The aeroservoelastic stability of a fighter type aircraft is investigated at high angle of attack. The effects of non-linear, incidence dependent unsteady aerodynamic forces of elastic modes and of control surface deflections on the structural coupling are demonstrated for low and high subsonic speeds for different incidences. The difference of open loop frequency response functions calculated with linear and with high angle of attack unsteady aerodynamics documents the necessity of introduction of high incidence effects for aeroservoelastic stability calculations. Non-linear effects are introduced using unsteady pressures of windtunnel experiments on an oscillation model by correcting of theoretical pressures.
Author
Aerodynamic Forces; Aeroservoelasticity; Angle of Attack; Control Surfaces; Unsteady Aerodynamics; Subsonic Speed; Wing Oscillations; Fighter Aircraft; Deflection; Wind Tunnel Models; Wind Tunnel Tests; Computational Fluid Dynamics; Wind Pressure

19980202482 ZONA Technology, Inc., Mesa, AZ USA
A unified unsteady aerodynamic module for aeroelastic and MDO applications
Chen, P. C., ZONA Technology, Inc., USA; Sarhaddi, d., ZONA Technology, Inc., USA; Liu, D. D., Arizona State Univ., USA; Mar. 1998; 14p; In English; Also announced as 19980202469; Sponsored in part by Air force STTR.; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Recent advances in the lifting surface methods are attributed to the possible generalization of the Aerodynamic Influence Coefficient (AIC) method to the Transonic and Hypersonic flight regimes. Thus a unified AIC (UAIC) approach has been developed for aeroelastic/MDO applications in the complete Mach number range. A typical CFD method usually requires CFD/CSD interfacing in a time-domain aeroelastic analysis, while additional grid generation effort is needed in each MDO design cycle. The former procedure is still underdeveloped and the latter could be costly. Free from these procedures, the present UAIC is fully compatible with classical linear aeroelastic matrix equations. Thus, the UAIC approach as an unsteady aerodynamic module can be readily integrated with current standard FEM systems or into a MDO environment, practiced by aerospace industries. Specifically, the present module consists of four major unsteady aerodynamic codes which jointly cover all flight regimes, thereby rendering the module unified for all Mach numbers. First, the capability of the present aerodynamic module will be discussed. Second, the seamless integration of the present aero module with a MDO software ASTROS is properly defined. Third, cases studied for the validation of the integrated aerodynamic module will be presented. These include: supersonic analysis of a swept untapered wing, a fighter wing with transonic flutter constraint and a rectangular wing in roll with control surface reversal. Finally, we will present our concept of computational aeroelasticity in terms of Aeroelasticity Modeling Methodology (AIC methods) and Aeroelasticity Simulation Methodology (CFD methods) from the standpoint of industrial application. We believe that these two methodologies, if their practices follow the proposed global strategy, could compliment each other in achieving further computational expediency and with wider applicability.
Author
Aeroelasticity; Unsteady Aerodynamics; Grid Generation (Mathematics); Transonic Flutter; Control Surfaces; Computational Fluid Dynamics; Computerized Simulation; Mathematical Models; Subroutines; Flutter Analysis; Applications Programs (Computers)

19980202483 Saab Aircraft Co., Flutter and Loads Dept., Linkoeping, Sweden
Experience with unsteady aerodynamics computation for Saab Aircraft
Franzen, Bo, Saab Aircraft Co., Sweden; Nilsson, Bo, Saab Aircraft Co., Sweden; Winzell, Bengt, Saab Aircraft Co., Sweden; Mar. 1998; 12p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Unsteady aerodynamics plays a vital role in the design of an aircraft. Already in the initial phase it is necessary to have reliable estimates of flutter boundaries and to supply information for control system software and hardware. Thus speed and accuracy of

unsteady aerodynamic computation are required. In practice, it is natural to depend mainly on computations based on linear theory. There are situations where speed of computation and accuracy are contradictory, and then one must resort to previous experience and correction strategies. The elastic modern aircraft is becoming more and more aero-servo-elastic. The quality of simulation of the numerous feedback mechanisms is highly dependent on the accuracy of control surface aerodynamics. Moreover, the frequent application of multi-disciplinary optimization puts strong new demands on unsteady aerodynamic accuracy. In this paper, we will show examples of validating experiments and computations, and discuss applications of classical and new methods for real civil and military aircraft.
Author
Unsteady Aerodynamics; Applications Programs (Computers); Control Surfaces; Wing Oscillations; Aeroservoelasticity; Transonic Flutter; Aerodynamic Loads; Mathematical Models; Dynamic Response

19980202965 Bristol Univ., Dept. of Aerospace Engineering, UK
Unsteady propeller flows due to turbulence ingestion
Harden, J. M., Bristol Univ., UK; Lowson, M. V., Bristol Univ., UK; The Aeronautical Journal; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 63-70; In English; Also announced as 19980202964
Contract(s)/Grant(s): EPSRC-GR/J/15407
Report No.(s): Paper-2337; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only
A laser doppler anemometer (LDA) was configured to provide simultaneous 1D velocity readings from two separate points in the contracting flow regime upstream of a 0.63 m diameter model propeller operating under high thrust conditions. Cross-correlations between the velocity signals were used to map the progress of turbulent eddy structures throughout the distortion, even within the highly oscillatory region close to the blades. These measurements were used to provide data on the strength and velocity of the eddies, as well as their average size and shape in two dimensions. The results show both elongation of the turbulent structures in the streamwise direction and distortion along their length, caused by the contracting flow and the high Reynolds stress. Linearized isotropic theory was used to predict the changes in the turbulent kinetic energies, and was found to be accurate for the longitudinal component only.
Author
Propellers; Turbulent Flow; Unsteady Flow; Linearization; Isotropic Turbulence; Isotropic Media; Cross Correlation

19980203040 Iowa State Univ. of Science and Technology, Dept. of Aerospace Engineering and Engineering Mechanics, Ames, IA USA
Atmospheric Probe Model: Construction and Wind Tunnel Tests ***Final Report***
Vogel, Jerald M., Iowa State Univ. of Science and Technology, USA; [1998]; 50p; In English
Contract(s)/Grant(s): NCC2-935
Report No.(s): NASA/CR-1998-208195; NAS 1.26:208195; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The material contained in this document represents a summary of the results of a low speed wind tunnel test program to determine the performance of an atmospheric probe at low speed. The probe configuration tested consists of a 2/3 scale model constructed from a combination of hard maple wood and aluminum stock. The model design includes approximately 130 surface static pressure taps. Additional hardware incorporated in the baseline model provides a mechanism for simulating external and internal trailing edge split flaps for probe flow control. Test matrix parameters include probe side slip angle, external/internal split flap deflection angle, and trip strip applications. Test output database includes surface pressure distributions on both inner and outer annular wings and probe center line velocity distributions from forward probe to aft probe locations.
Author
Wind Tunnel Tests; Probes; Wind Tunnel Models; Scale Models; Pressure Distribution; Velocity Distribution; Ring Wings

19980203116 Dynamic Engineering, Inc., Newport News, VA USA
Flutter Model Technology ***Final Report, 1 Jun. 1996 - 1 Jun 1997***
Busan, Ron, Dynamic Engineering, Inc., USA; Jan. 1998; 62p; In English
Contract(s)/Grant(s): F33601-94-D-4016; AF Proj. 2401
Report No.(s): AD-A340820; WL-TR-97-3074; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Wind tunnel testing of dynamically scaled models plays a key role in assuring that new or modified aircraft will be free of flutter within their flight envelopes. Dynamically scaled models are also widely used in research studies such as active control of aeroelastic response, buffet alleviation, and validation of theoretical or computational methods. This paper summarizes many of the critical design consideration involved with designing and fabricating flutter model hardware once the basic requirements

have been determined. Topics discussed include: spar design, stress skin construction, hinged control surfaces, instrumentation, calibration, load testing, and a case study for supersonic F-22 flutter model components.
DTIC
Wind Tunnel Models; Wind Tunnel Tests; Supersonic Flutter; Flutter Analysis; Flight Envelopes; Dynamic Response; Design Analysis

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.

19980201889 Failure Analysis Associates, Inc., Alexandria, VA USA
Metallurgical Evaluation of a DOT-E6498-2216 Cylinder ***Final Report***
Smith, T. R., Failure Analysis Associates, Inc., USA; Jan. 1997; 64p; In English
Report No.(s): PB98-140692; FAA-DC-FR-97-01-01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report documents a metallurgical examination of a failed aluminum cylinder authorized for the transportation in commerce of specified liquified and nonliquefied compressed gases. The DOT-3AL cylinder, manufactured under exemption DOT-E 6498, was in breathing air service for fire-fighting use. The evaluation included photodocumentation and non-destructive examinations, chemical and mechanical property determination, metallographic sectioning, and fractography.
NTIS
Failure Analysis; Cracking (Fracturing); Mechanical Properties; Compressed Gas; Cylindrical Shells; Metallography

19980201892 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Nuisance Alarms in Aircraft Cargo Areas and Critical Telecommunications Systems: Proceedings of the Third NIST Fire Detector Workshop
Grosshandler, W. L., Editor, National Inst. of Standards and Technology, USA; Mar. 1998; 46p; In English; Nuisance Alarms in Aircraft Cargo Areas and Critical Telecommunications Systems, Mar. 1998, Gaithersburg, MD, USA
Report No.(s): PB98-144538; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The need for faster and more intelligent decision making regarding the presence or absence of a fire threat has become acute in the commercial aircraft and telecommunications industries, both of which have been particularly hard-hit be the cessation of halon production. The drive earlier detection has as a consequence the possibility of increased rate of nuisance alarms; however, there are no accepted standards against which a fire detection system can be operated to assess its immunity to false alarm. A workshop was held at NIST with the main objective to identify physical sources of nuisance alarms that may plague current and emerging fire detection technologies for telecommunications applications and for aircraft cargo areas, to reach consensus on what test methods are appropriate to evaluate a detection system's immunity to false alarm in the presence of physical nuisance sources, and to recommend actions to develop and/or implement these new test methods. The workshop consisted of a number of invited background talks from representatives of the aircraft and telecommunications industries and government agencies. The current state of detector evaluation methodologies was reviewed, along with what has been documented in the open literature regarding the number and sources of nuisance/false alarms in these two applications. This report summarizes the discussions and presents the major findings for each application.
NTIS
Commercial Aircraft; False Alarms; Fires; Air Cargo; Decision Making; Telecommunication; Warning Systems; Detection

19980202332 Federal Aviation Administration, Airport and Aircraft Safety Research and Development, Atlantic City, NJ USA
Fire-Resistant Materials: Research Overview ***Final Report***
Lyon, Richard E., Federal Aviation Administration, USA; Dec. 1997; 23p; In English
Report No.(s): AD-A340649; DOT/FAA/AR-97/99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report provides an overview of the research being conducted by the Federal Aviation Administration (FAA) to develop fire safe cabin materials for commercial aircraft. The objective of the Fire-Resistant Materials program is to eliminate burning cabin materials as a cause of death in aircraft accidents. Long-term activities include the synthesis of new, thermally stable, low fuel value organic and inorganic polymer systems. The synthesis effort is supported by fundamental research to understand poly-

mer combustion and fire resistance mechanisms using numerical and analytic modeling and the development of new characterization techniques.
DTIC
Aircraft Construction Materials; Flammability; Flame Retardants; Commercial Aircraft; Polymers; Composite Materials

19980202334 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Briefing Report to the Honorable Ike Skelton, Ranking Minority Member, Committee on National Security, House of Representatives. Military Aircraft Safety: Serious Accidents Remain at Historically Low Levels
Mar. 1998; 13p; In English
Report No.(s): AD-A340751; GAO/NSIAD-98-95BR; B-279205; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Flight mishaps involve an y reportable damage to an aircraft that is preparing to fly, in flight, or completing a landing. Flight mishaps are classified by DOD according to the severity of resulting injury or property damage. Class A mishaps involve damage of $1 million or more, a destroyed aircraft, or a fatality or permanent total disability. The remaining classes of mishaps are distinguished primarily by their loss value and severity of injury: Class B accidents involve damage ranging from $200,000 to less than $1 million, permanent partial disability, or inpatient hospitalization of five or more people; Class C accidents involve damage ranging from $10,000 to less than $200,000 or a lost time injury; and Class D accidents involve damage of less than $10,000. Our review focused on Class A flight mishaps only. DOD requires that all mishaps be investigated so that causes can be identified and corrective actions taken to prevent future occurrences. Service safety centers play a key role in * maintaining aviation mishap statistics, establishing safety policies, disseminating safety information, reviewing mishap investigation reports, tracking recommendations, and performing safety studies. In addition, the safety centers analyze trends to identify potential safety hazards.
DTIC
Congressional Reports; Aircraft Safety; Military Aircraft; Aircraft Accidents

19980203117 Marine Aviation Weapons and Tactics Squadron 1, Yuma, AZ USA
Qualitative Assessment Report. Portable Flight Planning Software (PFPS), *Sep. 1997 - Feb. 1998*
Barr, Robert S., Marine Aviation Weapons and Tactics Squadron 1, USA; Sampson, Matthew T., Marine Aviation Weapons and Tactics Squadron 1, USA; Feb. 25, 1998; 65p; In English
Report No.(s): AD-A340821; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
With the exponential increase in computer capabilities in the last ten years, the Department of Defense and the Department of the Navy (DoN) has sought to equip Navy and Marine forces with more capable and compact Automated Mission Planning Systems (AMPS). Despite these efforts, there currently is no single AMPS which satisfies the AMPS requirements for all DoN aircraft. There are, however, numerous AMPS's being employed to fill the shortfall. One interim fix being explored by DoN is Portable Flight Planning Software (PFPS). PFPS is a PC based AMPS, developed by the Air Force and Georgia Tech Research Institute, which presents the Combat Flight Planning Software (CFPS) interactive time, distance, heading, and fuel card and the Falcon View mapping toolkit simultaneously. Other capabilities include the ability to interface with digital maps, imagery, terrain elevation data and aeronautical flight information files. Upon request from PMA 233, a Qualitative Assessment (QA) of PFPS was conducted by Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) during Weapons and Tactics Instructor (WTI) Course 1-98. Approximately forty experienced aviators from the Marine Corps and Air Force participated in the assessment. The assessment consisted of classroom training, computer lab, and self-paced study. Respondent opinions were captured in a single survey administered three times during the course. Respondents were surveyed on their background information, their computer and AMPS experience, the adequacy of PFPS training received, the difficulty of using PFPS Human Machine Interfaces (HMI), the adequacy of PFPS documentation, the compatability of PFPS with various mission planning requirements, the reliability of PFPS, the maintainability of PFPS, and the tactical impact and time savings realized while using PFPS.
DTIC
Computer Programs; Flight Plans; Mission Planning

19980203142 Army Aeromedical Research Lab., Fort Rucker, AL USA
The Role of Protective Visors in Injury Prevention During U.S. Army Rotary-Wing Aviation Accidents *Final Report*
Reynolds, Barbara S., Army Aeromedical Research Lab., USA; Rash, Clarence E., Army Aeromedical Research Lab., USA; Colthirst, Paul M., Army Aeromedical Research Lab., USA; Ledford, Melissa H., Army Aeromedical Research Lab., USA; Mora, John C., Army Aeromedical Research Lab., USA; Jan. 1998; 28p; In English
Contract(s)/Grant(s): Proj-30162787A879
Report No.(s): AD-A341285; USAARL-98-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Visors their associated flight helmets are considered Aviation Life Support Equipment (ALSE). The role of visors is to reduce the frequency and severity of facial injuries. to investigate this role, the Army aviation accident database from the U.S. Army Safety Center, Fort Rucker, Alabama, and the ALSE Retrieval Program (ALSERP) database from the U.S. Army Aeromedical Research Laboratory, Fort Rucker, Alabama, were investigated for visor related accident data. In addition, a review of past analyses of head and facial rotary-wing accident data was conducted. The findings support the premise that visors, when properly deployed, play a major role in reducing the frequency and severity of facial injuries.
DTIC
Aerospace Medicine; Helmets; Life Support Systems

19980203197 Federal Aviation Administration, Atlantic City, NJ USA
A Field Study of Transponder Performance in General Aviation Aircraft ***Final Report***
Talotta, Micholas J., Federal Aviation Administration, USA; Dec. 1997; 43p; In English
Report No.(s): AD-A341592; DOT/FAA/CT-97/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report documents the results of a field study conducted to sample the technical health of transponders carried by General Aviation (GA) aircraft currently operating in the National Airspace System (NAS).
DTIC
General Aviation Aircraft; Flight Tests; Air Traffic Control

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.

19980202291 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Multilateration on Mode S and ATCRBS Signals at Atlanta's Hartsfield Airport
Wood, M. L., Massachusetts Inst. of Tech., USA; Bush, R. W., Massachusetts Inst. of Tech., USA; Jan. 08, 1998; 154p; In English
Contract(s)/Grant(s): DTFA01-93-Z-02012
Report No.(s): AD-A340609; ATC-260; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The ATC community is seeking a way to obtain aircraft ID and improved surveillance on the airport movement area. Surface radars provide good surveillance data, but do not provide ID, may not cover the whole movement area, and suffer from false reflection targets and performance degradations in rain. This report describes an evolutionary technique employing multilateration, TCAS technology, and existing ATCBI transponders to provide the desired surface surveillance information. Five mutilateration receiver-transmitters (RTs) based on TCAS units, and a central multilateration computer processor were procured and installed on the highest available buildings on the perimeter of the north side of Atlanta's Hartsfield airport. The resulting coverage was such that there was a 93% probability that a multilateration position would be computed on a given Mode S short squitter emitted from a target at a randomly selected position on the movement area. Multilateration was performed on ATCRBS targets using replies elicited by whisper shout methods originally developed for TCAS. Measurements showed that whisper shout was successful in de garbling targets that were in close proximity on the movement area. The probability of obtaining an ATCRBS multilateration position in a given one second interval depended on the number of whisper shout interrogations transmitted. The equipment required over 10 interrogations per target per second to obtain per second multilateration update rates on two typical targets of 58% and 83% respectively. This less than anticipated performance was primarily due to the inefficient whisper shout interrogation technique that was used in the tested equipment.
DTIC
Air Traffic Control; Surveillance; Transponders; Radar Beacons

19980202414 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Improved Mathematical Modeling for GPS Based Navigation
Nardi, Salvatore, Air Force Inst. of Tech., USA; Mar. 1998; 144p; In English
Report No.(s): AD-A342014; AFIT/GE/ENG/98M-01; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This thesis is concerned with the development of new closed form GPS position determination algorithms that work in the presence of pseudorange measurement noise. The mathematical derivation of two closed form algorithms, based on stochastic modeling and estimation techniques, is presented. The algorithms provide an estimate of the GPS solution parameters (viz., the

user position and the user clock bias) as well as the estimation error covariance. The experimental results are analyzed by comparison to the baseline results from the conventional Iterative Least Squares (ILS) algorithm. In typical GPS scenarios, the closed form algorithms are extremely sensitive to noise, making them unsuitable for stand-alone use; however, they perform very well at estimating horizontal position parameters in ground-based pseudolite planar array scenarios where the ILS algorithm breaks down due to poor geometry. For typical scenarios, the use of a supplementary algorithm is required to refine the solution. Thus, the derivation of two supplementary algorithms is presented; the first based on a maximum likelihood approach and the second uses a Kalman like update approach. Both supplementary algorithms produce results comparable to the ILS results, but the Kalman update approach is preferred. The advantages introduced by the closed form, supplemented by the Kalman update, algorithm are: (1) The capability to estimate its estimation error covariance, and (2) The potential for computational efficiency due to the closed form nature of the solution.
DTIC
Mathematical Models; Global Positioning System; Navigation; Maximum Likelihood Estimates; Planar Structures; Algorithms

19980202917 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
GPS Heading Determination Using Short Antenna Baselines
Vinnins, Michael, Defence Research Establishment Ottawa, Canada; Gallop, Lloyd D., Defence Research Establishment Ottawa, Canada; Apr. 1997; 61p; In English
Report No.(s): AD-A341662; DREO-TN-98-001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Defence Research Establishment Ottawa has completed an exploratory investigation into the use of GPS as a method of heading determination for an in-ice Arctic surveillance sensor, known as an ice-pick sonobuoy, dropped from a surveillance aircraft into the ice cover of the Canadian high Arctic. The parameters within which the system was to function included operation above a latitude of 80 degrees north with a bearing accuracy of better than 5 degrees. Due to the small diameter of the sonobuoy, the investigation was to center on the use of extremely short antenna baseline separations; 10 cm, if achievable, as well as the use of inexpensive, off-the-shelf receivers of small size and low power consumption.
DTIC
Sonobuoys; Arctic Regions; Radio Interferometers

19980203014 Civil Aeromedical Inst., Oklahoma City, OK USA
Cockpit Integration of GPS: Initial Assessment-Menu Formats and Procedures ***Final Report***
Wreggit, Steven S., Civil Aeromedical Inst., USA; Marsh, Delbert K., II, Civil Aeromedical Inst., USA; Mar. 1998; 24p; In English
Report No.(s): AD-A341122; DOT/FAA/AM-98/9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A popular portable Global Positioning System (GPS) unit (Megellan EC-lOX), representative of this class of devices, was examined for its usability by general aviation pilots. Nine private pilots participated in the experimentation, which was accomplished in three phases: familiarization and training, usability testing, and post-experiment debriefing. During familiarization and training, participants were asked to study flow diagrams representing GPS interface logic, observed a demonstration of the unit's features and procedures, and then were allowed to practice with the unit until they could demonstrate proficiency. During the usability testing phase, participants performed 37 GPS-related tasks requiring waypoint setting, GPS navigation, and general GPS-data entry and retrieval. Findings from videotape, questionnaire, and debriefing data indicated that a number of menu structures interfered with the pilots' successful entry of data, editing of stored data, and activation of functions. For example, one source of confusion resulting in excess button presses was the need to deactivate the flight plan before any editing could be done. Recommendations are made for defining the form of the interface structure in this class of devices, including: A given function should be consistently assigned to one button, feedback should be consistent and meaningful, and an "undo" or "back" function would be a very useful way to decrease the number of button presses required by this interface.
DTIC
Global Positioning System; Cockpits; Aircraft Instruments

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.

19980202682 Naval Postgraduate School, Monterey, CA USA
Classification Analysis of Vibration Data from SH-60B Helicopter Transmission Test Facility
Anderson, Gregory L., Naval Postgraduate School, USA; Sep. 1997; 78p; In English
Report No.(s): AD-A340978; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The U.S. Navy is currently evaluating an integrated diagnostic system for its rotary wing aircraft. The system is referred to as the Health Usage and Monitoring Systems (HUMS). The program's objective is to develop an automated diagnostic system that can identify mechanical faults within the power train of helicopters using vibration analysis. This thesis uses data provided by the Helicopter Transmission Test Facility at the Naval Air Warfare center, Trenton, New Jersey. The goal of this thesis is to conduct data analysis to identify a fault within the helicopter test transmission using a tree-structured model. Prior to conducting tree analysis, an attempt is made to reduce the amount of data by principal component analysis. All statistical analysis was completed with S-Plus Software.
DTIC
Vibration; Data Acquisition; Statistical Analysis; Dynamic Structural Analysis; Data Reduction; Computer Aided Design

19980202706 Institute for Human Factors TNO, Soesterberg, Netherlands
Remotely Controlled Flying Aided by a Head-Slaved Camera and HMD ***Final Report***
deVries, S. C., Institute for Human Factors TNO, Netherlands; Padmos, P., Institute for Human Factors TNO, Netherlands; Dec. 08, 1997; 23p; In Dutch; In English
Report No.(s): AD-A341256; TNO-TM-97-B024; TDCK-TD-97-0261; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Military use of Unmanned Aerial Vehicles (UAVs) is gaining importance. Video cameras in these devices are often operated with joysticks and their image is displayed on a CRT. In this experiment, the simulated camera of a simulated UAV was slaved to the operator's head movements and displayed using a Helmet Mounted Display (HMD). The task involved maneuvering a UAV along a winding course marked by trees. The influence of several parameters of the set up (HMD optics, Field of View (FOV), image lag, monocular vs. stereoscopic presentation) on a set of flight handling characteristics was assessed. to enable variation of FOV and to study the effect of the HMD optics, a simulated HMD image consisting of a head slaved window (with variable FOV), was projected on a screen. One of the FOVs, generated in this way, corresponded with the FOV of the real HMD, enabling a comparison. The results show that the simulated HMD yields a significantly better performance than the real HMD. Performance with a FOV of 17 deg is significantly lower than with 34 or 57 deg. An image lag of 50 ms, typical of pan and tilt servo motor systems, has a small but significant influence on steering accuracy. Monocular and stereoscopic presentation did not result in significant performance differences.
DTIC
Cameras; Remote Control; Helmet Mounted Displays; Pilotless Aircraft; Field of View; Head Movement; Unmanned Spacecraft

19980202716 Army Aviation Technical Test Center, Fort Rucker, AL USA
Methodology Investigation: RAH-66 Comanche Aircraft Survivability Equipment (ASE) Virtual Proving Ground (VPG) Risk Reduction ***Final Report, May 1996 - Sep. 1997***
Fralish, Vince, Army Aviation Technical Test Center, USA; Mar. 1998; 17p; In English
Report No.(s): AD-A341227; Rept-7-CO-M97-AVD-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the RAH-66 Comanche Aircraft Survivability Equipment (ASE) Virtual Proving Ground (VPG) risk reduction methodology investigation is to develop a method that will allow an ASE system to be tested before it is installed onto the airframe. The goal is to develop a computer model of a generic ASE sensor that the user can configure to match the exact characteristics of the sensor to be integrated onto the airframe. The computer model would allow the user to place the sensor onto a high fidelity model of any airframe. The model will perform obscurance mapping to determine if any airframe components will interfere with operation of the ASE sensor.
DTIC
Procedures; Aircraft Survivability; Computerized Simulation; Aircraft Equipment

06
AIRCRAFT INSTRUMENTATION

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

19980202304 Air Force Research Lab., Sensors Directorate, Wright-Patterson AFB, OH USA
FY 1998 Avionics Technology Area Plan ***Final Report, 1 Oct. 1997 - 30 Sep. 1998***
Jan. 1998; 43p; In English
Contract(s)/Grant(s): AF Proj. 9993
Report No.(s): AD-A339148; AFRL-SN-WP-TR-1998-1000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Vision for the 21st Century Air Force outlines the air and space core competencies which support the national security strategy, the successful pursuit of which requires the continued superiority of our aerospace systems. The widening variety of Air Force missions challenges these systems to be increasingly flexible, timely, and precise in their application. Wright Laboratory's Avionics Directorate is meeting this modernization challenge: Developing affordable avionics technology for superior global awareness, precision engagement, and full dimensional protection for America's air and space forces.
DTIC
Avionics; Armed Forces (USA); Aerospace Systems

19980202969 Bristol Univ., Dept. of Aerospace Engineering, UK
The feasibility and benefits of dynamic reconfiguration in integrated modular avionics
Johnson, D. M., Bristol Univ., UK; Omiecinski, T. A., Bristol Univ., UK; Golden Jubilee; Special Issue to Commemorate the 50th Anniversary of the Department of Aerospace Engineering, Bristol University; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 99-105; In English; Also announced as 19980202964
Report No.(s): Paper-2265; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Integrated modular avionics has been proposed as a means of reducing avionics development and operating costs, by standardization of avionics hardware and non-application-specific software. With the introduction of integrated modular avionics, there is the possibility of dynamically reconfiguring available resources, to preserve the most critical functions, when failures occur. This paper examines the feasibility of dynamic reconfiguration within the system architectures proposed by ARINC 651 and assesses the potential benefits. The analysis shows that at least two of the architectures proposed by ARINC 651 are well suited to reconfiguration and that although there are certification problems that must be considered, these problems do not appear intractable. Significant benefits, in terms of reduced redundancy, improved availability and higher levels of safety can potentially be obtained. The paper also shows that reconfiguration is only required locally, within a cabinet, and that large benefits are still obtainable even with relatively small cabinet sizes. This reduces the complexity and cost of any reconfiguration scheme and increases flexibility so that any reconfiguration scheme developed can be easily adapted to differing aircraft requirements. The development of an autonomous reconfiguration scheme, in which individual modules determine their own function is particularly attractive, as it can offer reduced susceptibility to common mode failure, and provides fault tolerance within the reconfiguration process itself.
Author
Feasibility Analysis; Avionics; Modularity; Systems Engineering; Systems Integration; Configuration Management; Computer Systems Programs; Dynamic Programming; Architecture (Computers)

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.

19980201920 Army Research Lab., Aberdeen Proving Ground, MD USA
Viscous Damping in the Drive Train of a Gas Turbine Engine ***Final Report, Apr. - Nov. 1997***
Korjack, T. A., Army Research Lab., USA; Mar. 1998; 29p; In English
Report No.(s): AD-A339051; ARL-TR-1622; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Overdamping that is common to a single degree of freedom damped linear vibratory system was extended to multidegree of freedom damped linear system, viz., a drive train situated in a typical gas turbine. Inequalities involving the mass, damping and

stiffness parameters were derived to form a system with a free response which is overdamped in each respective node. A general method to be employed in establishing the design parameters for designing systems to be overdamped in each mode has been identified for purposes of analysis, and the method was utilized to a four degree of freedom model of a drive train in a gas turbine engine with a new look at a solution methodology for overdamping considerations. This technique or method for eliminating oscillations in n-degree of freedom lumped parameter systems by increasing the amount of viscous damping in the system has been illustrated by using actual data.
DTIC
Gas Turbines; Viscous Damping; Gas Turbine Engines; Design Analysis; Tanks (Combat Vehicles)

19980202508 Naval Postgraduate School, Monterey, CA USA
Measurement of Synchronous Forces and Flow Non-Uniformity in an Axial Compressor
Cuellar, Alvaro A., Naval Postgraduate School, USA; Dec. 1997; 89p; In English
Report No.(s): AD-A342761; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Time resolved pressure measurements on a compressor case were acquired for several uniform and non-uniform tip clearances. High frequency response pressure transducers were placed at several axial locations near the second stage axial rotor on the outer casing of an Allison C-250 compressor. Data were acquired at several fixed time intervals. The amplitude of the blade to blade variations and once per revolution static pressure distributions on the case were recorded for an as is compressor. The synchronous forces due to possible imperfections were determined using a high hub tip ratio assumption.
DTIC
Gas Turbines; Axial Flow Turbines; Mass Flow; Static Pressure; Turbocompressors

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.

19980202477 Air Force Research Lab., Wright-Patterson AFB, OH USA
Investigation of buffet load alleviation on a scaled F-15 twin tail model
Huttsell, L. J., Air Force Research Lab., USA; Tinapple, J. A., Air Force Research Lab., USA; Weyer, R. M., Aeronautical Systems Div., USA; Mar. 1998; 8p; In English; Also announced as 19980202469; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

One of the common problems on twin tail fighters operating at high angles of attack is buffet. The Air Force Research Laboratory Unsteady Aerodynamics Integrated Product Team (IPT) performed an experimental buffet investigation on a scaled F-15 model. The model was tested in the Subsonic Aerodynamic Research Laboratory (SARL) located at Wright Patterson AFB, Ohio. Phase I of this program characterized the buffet characteristics and investigated tangential blowing as a means of buffet suppression. Phase II will investigate the use of piezoelectric actuators on the flexible tail to suppress the structural response due to buffet. A numerical simulation of the rigid model was performed for a Mach number of 0.2, 24 degrees angle of attack, and 4 degrees of slideslip using an unstructured CFD (Computational Fluid Dynamics) code. A second computation was performed to evaluate engine mass flow effects. This paper will present the results of the buffet tests, the computational effort, and a comparison of the computational and test results.
Author
F-15 Aircraft; Computational Fluid Dynamics; Buffeting; Tangential Blowing; Unsteady Aerodynamics; Aerodynamic Loads; Scale Models; Vortices; Wind Tunnel Tests; Computerized Simulation; Aircraft Models; Unstructured Grids (Mathematics)

19980202480 British Aerospace Defence Ltd., Military Aircraft and Aerostructures, Brough, UK
Flutter prediction for complex configurations
Henshaw, M. J. deC., British Aerospace Defence Ltd., UK; McKiernan, D. D., British Aerospace Defence Ltd., UK; Mairs, C., British Aerospace Defence Ltd., UK; Mar. 1998; 8p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Flutter analysis requires the linking of structural deformation modeling with unsteady fluid dynamics; at British Aerospace, Aerospace Military Aircraft and Aerostructures (MA&A) a series of computational methods are used to model the various aspects of flutter to provide clearance data for aircraft. The various methodologies will be briefly described and the manner in which the parts of the process interface outlined. Future aircraft require the tools to be capable of modelling complex configurations includ-

ing novel planforms and aircraft with stores; these must also include the difficult transonic flow regime. The requirements of the unsteady methods needed to provide this capability and the manner in which they must be inserted into the existing process will be discussed. Initial results obtained using an unsteady Multiblock Euler method will be presented and the development of this method within the overall process will be detailed. These results will be used to illustrate the ways that sophisticated unsteady CFD methods must be developed, in terms of interface with structural components of the process, to meet project requirements for complex configurations. The post-processing requirements will also be presented.
Author
Computational Fluid Dynamics; Transonic Flutter; Flutter Analysis; Transonic Flow; Prediction Analysis Techniques; Aerodynamic Configurations; Mathematical Models; Euler Equations of Motion; Unsteady Aerodynamics

19980202870 Royal Melbourne Inst. of Tech., Sir Lawrence Wackett Centre for Aerospace Design Technology, Australia
MATLAB(registered trademark) m Files for Flutter Analysis Using pk Method
Ariyaka, Soma, Royal Melbourne Inst. of Tech., Australia; Feb. 1996; 42p; In English
Report No.(s): TM-96/01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A flutter analysis computer program using the pk method was written in Matlab(registered trademark) m files. Three different systems were examined including two dimensional and two degrees of freedom (2d 2dof), two dimensional and three degrees of freedom (2d 3dof), and three dimensional and three degrees of freedom (3d 3dof). The results of these pk analyses were then compared with the k method of analysis using the flutter parameters which were representative of the Seagull aircraft. Very brief derivations of the flutter equations leading to the form needed by the pk method are given in this report as well. The uncoupled modes formulation given by Scanlan and Rosenbaum was followed. The preliminary flutter analysis of WAC-8 was conducted, and the results are also shown.
Author
Applications Programs (Computers); Flutter Analysis; Uncoupled Modes; Mathematical Models; Aeroelasticity

19980203156 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
An Evaluation of Frequency Domain Ensemble Averaging to Improve Aircraft Stability Derivative Estimation
Hoffman, Lawrence M., Air Force Inst. of Tech., USA; Mar. 1998; 184p; In English
Report No.(s): AD-A341812; AFIT/GAE/ENY/98M-02; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
This research evaluated a process to improve aircraft stability derivative estimation results. The Have Derivatives process used overlap ensemble averaging in the frequency domain to minimize noise on the original time domain signals. The process estimated average complex frequency response functions that were then transformed back into the time domain as a set of discrete pulse responses with far less noise than the original signals. These clean signals were used in a parameter estimation program to estimate better stability derivatives than were estimated with the original noisy signals. Both simulation and flight test data were used to study the effects of various noise levels on stability derivative estimation results and to evaluate the Have Derivatives process to improve those results. The simulations demonstrated dramatic improvement using the Have Derivatives process. The flight test results were not as conclusive. The ensemble averaging step of the Have Derivatives process was not effective enough at reducing noise on the flight test data due to non-uniform frequency content of the flight test input. The overall recommendation was to further evaluate the Have Derivatives process using a broadband flight test input, similar to the input that worked well in simulation.
DTIC
Stability; Evaluation; Stability Derivatives; Derivation; Estimating; Aircraft Stability; Frequency Assignment

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).

19980202562 Tokyo Inst. of Tech., Dept. of Physics, Tokyo, Japan
Simulation Study of X-Ray Polarimetry Using the Photo Effect in the Microstrip Gas Chamber
Nishi, Y., Tokyo Inst. of Tech., Japan; Aoki, S., Tokyo Inst. of Tech., Japan; Ochi, A., Tokyo Inst. of Tech., Japan; Tanimori, T., Tokyo Inst. of Tech., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 92-98; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

We have developed a two-dimensional MicroStrip Gas Chamber(MSGC) with a 5 cm x 5 cm detection area. Using this MSGC, we succeeded to measure the X-ray polarization in the range of approx. 6 keV - 14 keV. Using EGS4 we have simulated the performance of the MSGC as a X-ray imaging polarimeter for the development of the specialized MSGC as an imaging polarimeter. In this article, we report on the result of a simulation and the comparison with actual polarization measurement.
Author
Simulation; X Rays; Photoelectric Effect; Two Dimensional Models; Experimentation; Polarization (Charge Separation)

19980203107 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development and Validation of an Experimental Test Rig for Electrohydrodynamic Enhancement of Forced Convective Heat Transfer
Caldwell, William T., Air Force Inst. of Tech., USA; Dec. 1997; 107p; In English
Report No.(s): AD-A341802; AFIT/GA/ENY/97D-05; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report details the development of a facility for the experimental investigation of electrohydrodynamic (EHD) enhancement of forced convection heat transfer. The test facility was developed for the Thermal and Transparencies Laboratory (TATLAB), Air Force Research Laboratory (AFRL), for use in future research into the applicability of EHD for the miniaturization of Air Force heat exchangers. During this research, a closed loop, medium scale electrohydrodynamic test rig was developed and brought online. The test fluid loop was integrated with a data acquisition and parameter control system. Basic loop and fluid performance testing was accomplished through the use of a 3 mm hydraulic diameter, square channel test section using Flourinert FC-72, a dielectric electronics coolant, as the working fluid. Due to the design of the test section, no heat transfer data was generated in this initial study. However, this study greatly expanded the experimental and practical understanding of the EHD phenomenon within AFRL, by providing a working knowledge of the basics of effective EHD test section design, contamination control procedures, and loop design and operation. Deficiencies in the design of the loop, data acquisition system, and test section were identified and recommendations for improvements in future work were delivered. The Air Force Research Laboratory is now poised to generate useful EHD heat transfer data with this test facility.
DTIC
Performance Tests; Test Facilities; Fabrication; Research Facilities; Heat Transfer; Coolants; Convective Heat Transfer; Proving; Experiment Design

19980203118 Federal Aviation Administration, Civil Aeromedical Inst., Oklahoma City, OK USA
Differential Training Needs and Abilities at Air Traffic Control Towers: Should All Controllers Be Trained Equally? ***Final Report***
Thompson, Richard C., Federal Aviation Administration, USA; Agen, Rebecca A., Federal Aviation Administration, USA; Broach, Dana M., Federal Aviation Administration, USA; Mar. 1998; 17p; In English
Report No.(s): AD-A340829; DOT/FAA/AM-98/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The present study uses job elements identified by subject-matter experts to assess the perceived training needs of air traffic control specialists (ATCSs) who are assigned to towers after successful completion of FAA Academy training. The Director of Air Traffic Services tasked The Air Traffic Resource Management Program (ATX) with conducting a training needs assessment. to measure the needed skills and knowledge of new controllers, a survey was developed by ATX and distributed by the Civil Aeromedical Institute to 172 tower level III, IV, and V facility managers and nine regional Air Traffic Division managers. The survey was used to assess the performance-based skills standards needed by new controllers at the time of entry into a field facility. The training capability of individual towers was also examined. The results indicated that there are some differences in the required training of ATCSs assigned to level IV and V towers. Therefore, the tower assignment of new hires should be identified upon entry into the Academy to better focus on the specific training needs of prospective towers.
DTIC
Air Traffic; Air Traffic Control; Air Traffic Controllers (Personnel)

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19980202292 Wentworth Inst., Wentworth Labs., Boston, MA USA
Aerospace Payload Design and Development ***Final Report, 4 Jun. 1992 - 4 Jun. 1997***
Gates, Richard B., Wentworth Inst., USA; Oct. 02, 1997; 19p; In English

Contract(s)/Grant(s): F19628-92-C-0096; AF Proj. 7659
Report No.(s): AD-A340610; WL-0096-97; PL-TR-97-2128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Summarized in this report is the work performed under Contract F19628-92-C-0096 from June 4, 1992 through June 4, 1997. Efforts consisted of the design, development, analysis and fabrication of sounding rocket, shuttle, satellite and balloon payloads, field service and instrumentation studies.

DTIC

Space Shuttle Payloads; Design Analysis; Fabrication

19980202346 NASA Marshall Space Flight Center, Huntsville, AL USA

Tether Technology Interchange Meeting

Harrison, James K., Compiler, NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998; 462p; In English; Tether Technology Interchange Meeting, 9-10 Sep. 1997, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; Also announced as 19980202347 through 19980202373
Report No.(s): NASA/CP-1998-206900; M-847; NAS 1.55:206900; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This is a compilation of 25 papers presented at a tether technical interchange meeting in Huntsville, AL, on September 9-10, 1997. After each presentation, a technical discussion was held to clarify and expand the salient points. A wide range of subjects was covered including tether dynamics, electrodynamics, space power generation, plasma physics, ionospheric physics, towing tethers, tethered reentry schemes, and future tether missions.

Author

Conferences; Tethering; Technology Assessment; Space Missions; Towed Bodies; Tethered Satellites

19980202347 NASA Marshall Space Flight Center, Huntsville, AL USA

A Review of Scientific and Technological Results from the TSS-1R Mission

Stone, N. H., NASA Marshall Space Flight Center, USA; Wright, K. H., Southwest Research Inst., USA; Winningham, J. D., Southwest Research Inst., USA; Papadapolous, K., Science Applications International Corp., USA; Zhang, T. X., Alabama Univ., USA; Hwang, K. S., Alabama Univ., USA; Wu, S. T., Alabama Univ., USA; Samir, U., Tel-Aviv Univ., Ramat-Aviv, Israel; Tether Technology Interchange Meeting; Jan. 1998, pp. 1-12; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Tethered Satellite System (TSS) program was designed to provide a unique opportunity to explore certain space plasma-electrodynamic processes and the orbital mechanics of a gravity-gradient stabilized system of two satellites linked by a long conducting tether. A unique data set was obtained during deployment which has allowed significant science to be accomplished. This paper focuses on results from the TSS-1R mission that are most important to the future technological applications of electrodynamic tethers in space, in particular, the current collection process. of particular significance is an apparent transition of the physics of current collection when the potential of the collecting body becomes greater than the ram energy of the ionospheric atomic oxygen ions. Previous theoretical models of current collection were electrostatic, assuming that the orbital motion of the system, which is highly subsonic with respect to electron thermal motion, was unimportant. This may still be acceptable for the case of relatively slow-moving sounding rockets. However, the TSS-1R results show that motion relative to the plasma must be accounted for in orbiting systems.

Author

Tethered Satellites; Space Plasmas; Electrodynamics; Gravitation; Collection; Particle Motion; Electric Current

19980202362 NASA Marshall Space Flight Center, Huntsville, AL USA

Tether Transport System Study Summary Performed under Contract to Marshall Space Flight Center

Vonderwell, Dan, Boeing Co., USA; Bangham, Mike, Boeing Co., USA; Dionne, Heather, Boeing Co., USA; Fleming, Beth, Boeing Co., USA; Klus, Bill, Boeing Co., USA; Herring, Karmel, Boeing Co., USA; Suggs, Elton, Boeing Co., USA; Walker, Larry, Boeing Co., USA; Lorenzini, Enrico, Smithsonian Astrophysical Observatory, USA; Cosmo, Mario L., Smithsonian Astrophysical Observatory, USA; Kaiser, Markus, Smithsonian Astrophysical Observatory, USA; Vestal, Linda, NASA Marshall Space Flight Center, USA; Johnson, Les, NASA Marshall Space Flight Center, USA; Carrington, Connie, NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 255-269; In English; Also announced as 19980202346
Contract(s)/Grant(s): NAS8-39400; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The main rationale for this study is to reduce the mission cost of transporting payloads to GEO. A two stage tether transport system was proposed for boosting payloads from LEO to GTO/GEO. The feasibility of the concept is addressed from the point of view of orbital mechanics and other principles of physics. The report presents the results of an engineering analysis that defines

the system, major elements and subsystems, and assesses the feasibility (i.e., the technology readiness level) of designing and developing the system. Results indicate that significant cost savings can be realized over traditional upper stages within a few launches. Certain key technical issues, such as payload rendezvous and capture, need to be addressed in future studies. Advancements in certain technology areas, such as power generation and highly efficient propulsion systems, will have significant effects on the overall system design.
Author
Cost Reduction; Propulsion System Performance; Technology Assessment; Feasibility; Mission Planning

19980202595 Dayton Univ. Research Inst., OH USA
Evaluation of Reformulated Thermal Control Coatings in a Simulated Space Environment ***Interim Report, 3 Mar. 1993 - 7 Aug. 1995***
Cerbus, Cliff A., Dayton Univ. Research Inst., USA; Carlin, Patrick S., Dayton Univ. Research Inst., USA; Feb. 1997; 95p; In English
Contract(s)/Grant(s): F339615-90-C-5963; AF Proj. 2421
Report No.(s): AD-A341190; UDR-TR-97-24; WL-TR-97-4059; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The Air Force Space and Missile Systems Center and Wright Laboratory Materials Directorate (WL/ML) sponsored an effort to reformulate and qualify Illinois Institute of Technology Research Institute (IITRI) spacecraft thermal control coatings. S13G/LO-1, Z-93, and YB-71 coatings were reformulated by IITRI because the potassium silicate binder, Sylvania PS-7, used in the coatings is no longer manufactured. Coatings utilizing the binder's replacement candidate, Kasil 2130, manufactured by The Philadelphia Quartz (PQ) Corporation, Baltimore, Maryland, were tested at the Materials Directorate's Space Combined Effects Primary Test and Research Equipment (SCEPTRE) Facility operated by the University of Dayton Research Institute (UDRI). The SCEPTRE Facility's simulated space environment consists of combined ultraviolet (UV) and electron exposure with in situ specimen reflectance measurements. A brief description of the effort at IITRI, a brief description of the SCEPTRE Facility, results and discussion from testing of the reformulated YB-71, S13G/LO-1, and Z-93 coatings in SCEPTRE and other organizations are presented.
DTIC
Simulation; Temperature Control; Aerospace Environments; Thermal Control Coatings; Satellite Temperature; Thermal Protection; Thermodynamic Properties; Potassium Silicates; Binders (Materials); Vacuum Systems; Solar Simulators

19980202910 Notre Dame Univ., Dept. of Chemistry and Biochemistry, IN USA
Energetic and Steric Effects in Ion/Surface Reactive Scattering ***Final Report, 15 Jan. 1995 - 14 Jan 1998***
Jacobs, Dennis C., Notre Dame Univ., USA; Mar. 14, 1998; 12p; In English
Contract(s)/Grant(s): F49620-95-1-0128; AF Proj. 2303
Report No.(s): AD-A341374; AFRL-SR-BL-TR-98-0288; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The principal investigator explored chemical reactions between small molecular ions and solid surfaces in order to simulate reactions on spacecraft surfaces in a low-earth-orbit environment. The surfaces were prepared in ultrahigh vacuum, and the ions were accelerated to translational energies between 5 and 100 eV before they collided with the surface target. The scattered reaction products were detected with energy-, mass-, and angular resolution. Results are reported for dissociative scattering of OCS(+) on Ag(111), where three different mechanisms were assigned for the three observed fragmentation pathways. Experiments were also conducted on NO(+) reacting with O/Ag(111) and O/Al(111). Here, an atom abstraction channel led to the scattering of NO2. Finally, prolonged bombardment of a silicon nitride surface by low energy O(+) ions was observed to induce irreversible damage in the nitride thin film.
DTIC
Reaction Products; Chemical Reactions; Molecular Ions; Solid Surfaces; Ion Scattering; Surface Energy

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.

19980202202 Army Armament Research, Development and Engineering Center, Warheads, Energetics and Combat-Support Armaments Center, Picatinny Arsenal, NJ USA

A Density Functional Study of Nitro Substituted Methanes

Vladimiroff, T., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 251-260; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Since computers and computational methods are constantly improving, it is becoming more and more attractive to predict molecular properties of energetic materials by direct calculation rather than relying on synthesis and experimental measurements. Then synthetic efforts can be concentrated on molecules that offer the largest gains in performance or stability. Good calculations can routinely be performed on small molecules but large molecules are still a challenge to the theoretical chemist. In this work the series of nitro substituted methanes is considered in order to determine the best approach to employ as molecular size increases. since computational time increase less rapidly for density functional methods than it does for other post Hartree-Fock techniques, these methods are of prime interest for large molecules. Calculations are performed for dinitromethane, trinitromethane, and tetranitromethane. Geometry, vibrational frequencies, acidities, and bond strengths are considered. The results from density functional theory are compared to the more conventional SCF and Mp2 methods and to experimentally determined values. It was found that molecular geometries were best calculated using Mp2 and b3lyp methods. Density functional theory works best for vibrational frequencies. It was possible to make reasonable estimates for the geometry of dinitromethane which is not known from experiment. It was also possible to assign some of the vibrational frequencies for this molecule which were not assigned previously. Bond energies calculated in this work were not as accurate as previous calculations possibly due to the use of the smaller 6-31G* basis set.

Author

Nitro Compounds; Methane; Density (Mass/Volume); Propellant Properties; Vibrational Spectra; Computational Chemistry; Chemical Bonds

19980203139 Naval Postgraduate School, Monterey, CA USA

Characterization and Magnetic Augmentation of a Low Voltage Electromagnetic Railgun

Hartke, John P., Naval Postgraduate School, USA; Dec. 1997; 52p; In English

Report No.(s): AD-A341268; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the near future armored vehicles will be fielded with reactive armor which can not be defeated by today's chemically propelled munitions. Today's munitions are limited to muzzle velocities less than the speed of sound in the chemical propellant which is about 1.8 km/s. Electromagnetic launch technologies have the ability to launch projectiles at velocities in excess of 2 km/s and may be able to defeat the reactive armor. Not only can electromagnetic launch technologies be used as an anti-tank weapon but it can also be used as anti-missile defense. to investigate electromagnetic launch technologies and the effects of augmentation a 44 cm railgun was constructed and tested. The railgun was powered by a capacitor bank of fourteen 330 V, 600 micro-F capacitors. The velocity of the projectile, the voltage across the capacitors and the current through the rails were measured. The augmentation of the gun with a permanent magnetic field increased the velocity of the projectile by 85% while air injection augmentation had no effect.

DTIC

Magnetic Fields; Augmentation; Low Voltage; Railgun Accelerators

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

19980202213 Ergo-Tech, Tujunga, CA USA
Analysis of the Phantom Fires on the Space Shuttle External Tank Base
Chirivella, Jose E., Ergo-Tech, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 385-396; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

This paper discusses anomalous fires observed on the external tank aft dome of the Space Shuttle during ascent. NASA states that the fires, occurring at 92 seconds after lift-off, are due to recirculation of material from the solid rocket boosters. Our analysis shows, however, that the fires must originate in the vicinity of the aft dome of the external tank. We provide a detailed review of NASA's rationale for their claims. NASA's analysis of the thermal and aerodynamic environment erroneously assumes mechanisms that do not apply to the Space Shuttle configuration. The plumes from the solid rocket boosters cannot reverse and make contact with the external tank given that this region is well ventilated and therefore well purged by the external flow. The true cause of the fires must be understood to assure the safety of the Shuttle crew.
Author
Space Shuttles; Fires; Space Shuttle Boosters; Ascent; Plumes; Reversed Flow; Aerospace Safety; Launching

19980202214 Ergo-Tech, Tujunga, CA USA
The Nature of the Space Shuttle Phantom Fires: LH2 Leaks
Chirivella, Jose E., Ergo-Tech, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 397-411; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

This paper advances an alternate theory to the cause of the anomalous fires observed at 92 seconds after take-off on the external tank aft dome of the Space Shuttle: liquid hydrogen (LH2) leaks. The theory is based on the imaging of the video records, and takes into account the characteristics of the visible flames, the design, and operation of the Space Shuttle, as well as the flow configuration at the time the fires become visible. After identifying by imaging the location of the sources of the various flames, selected elements of the structural design, along with the static and dynamic load paths, are reviewed to identify the most likely source of LH2 leaks. Both approaches point at the ET aft attachment ring as a source. It is also demonstrated that at present, NASA does not have the ability to detect an LH2 leak after lift-off. Imaging of the roll maneuver of a nighttime launch, on the other hand, permits the identification of at least one mission where a cryogenic leak is active at 15 seconds after take-off. An analysis of the air flow around the Shuttle leads to an explanation of why the fires display such a consistent timing in all flights. We have no alternative but to conclude that the LH2 leaks occur in all flights, and that there is a generic design flaw with the ET structural design. The hazards of these LH2 leaks to the safety of the crew are evaluated.
Author
Space Shuttles; Space Shuttle Boosters; External Tanks; Fires; Liquid Hydrogen; Leakage; Ascent

19980202962 Georgia Inst. of Tech., Space Systems Design Lab., Atlanta, GA USA
Highly Reusable Space Transportation System Concept Evaluation (The Argus Launch Vehicle) ***Final Report***
Olds, John R., Georgia Inst. of Tech., USA; Bellini, Peter X., Georgia Inst. of Tech., USA; Apr. 30, 1998; 14p; In English
Contract(s)/Grant(s): NCC8-108
Report No.(s): NASA/CR-1998-208093; NAS 1.26:208093; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper summarizes the results of a conceptual design study that was performed in support of NASA's recent Highly Reusable Space Transportation study. The Argus concept uses a Maglifter magnetic-levitation sled launch assist system to accelerate it to a takeoff ground speed of 800 fps on its way to delivering a payload of 20,000 lb. to low earth orbit. Main propulsion is provided by two supercharged ejector rocket engines. The vehicle is autonomous and is fully reusable. A conceptual design exercise determined the vehicle gross weight to be approximately 597,250 lb. and the dry weight to be 75,500 lb. Aggressive weight and operations cost assumptions were used throughout the design process consistent with a second-generation reusable system that might be deployed in 10-15 years. Drawings, geometry, and weight of the concept are included. Preliminary development, production, and operations costs along with a business scenario assuming a price-elastic payload market are also included. A fleet of three Argus launch vehicles flying a total of 149 flights per year is shown to have a financial internal rate of return of 28%. At $169/lb.,

the recurring cost of Argus is shown to meet the study goal of $100/lb.-$200/lb., but optimum market price results in only a factor of two to five reduction compared to today's launch systems.
Author
Space Transportation; Argus Project; Design Analysis; Reusable Launch Vehicles; Spacecraft Design

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.

19980202348 Swales and Associates, Beltsville, MD USA
TiPS: Results of a Tethered Satellite System
Barnds, Jim, Swales and Associates, USA; Kelm, Bernard, Naval Research Lab., USA; Coffey, Shannon, Naval Research Lab., USA; Purdy, Bill, Naval Research Lab., USA; Davis, Mark, Allied Signal Research and Technology, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 13-30; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The following mission goals and objectives are reviewed and discussed: (1) The study of the dynamics of a tethered system; (2) Survivability; (3) A low cost secondary experiment; and (4) The process of building and design on a short schedule.
Author
Tethered Satellites; Deployment; Space Missions; Spacecraft Survivability

19980202349 Boeing Co., Huntsville, AL USA
Tethered Satellite System Time Domain Observer Development for STS-75 Mission
Biglari, Haik, Boeing Co., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 31-39; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Under the influence of Earth's magnetic field the Tethered Satellite System (TSS) exhibits a special motion which resembles the motion of a child's skip-rope. This motion known as SKIPROPE, only develops if the core of the tether is metallic. Active damping must be introduced to control the magnitude of this motion and is not technically feasible. Therefore, indirect measurements are needed to estimate the magnitude of this phenomenon. This paper presents a hybrid scheme in determining the magnitude and the phase of this motion for the STS075 mission. An adaptive Notch Prefilter was augmented with an Extended Kalman Filter operating at 1 Hz. The resulting Observer was successfully used during the actual mission, until an unexpected fault broke the tether causing the observer to diverge.
Author
Tethered Satellites; Space Transportation System; Mathematical Models; Damping; Dynamic Control

19980202350 United Space Alliance, Houston, TX USA
STS-75/TSS-1R Tether Control and Dynamics Operations
Williams, Joseph L., Jr., United Space Alliance, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 41-49; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The reflight of the tethered satellite system (TSS) onboard Space Shuttle Columbia during STS-75 provided many challenges to Mission Operations in preparation for and execution of the mission relating to deployment/retrieval of the tethered satellite and the control of tether dynamics. A new method of flight controller training was developed using the Internet as a backbone between the crew in the simulator, the Johnson Space Center (JSC) tether dynamics team on a set of workstations at JSC, and the Marshall Space Flight Center (MSFC) tether dynamics experts on a remote set of workstations at MSFC. This allowed the team to maximize use of the best available man-in-the-loop tether dynamics and Shuttle piloting system with the actual ground displays to be used in the Mission Control Center (MCC) in Houston, minimizing travel of the MSFC team to JSC. Finally, a clear operations concept was developed in the course of training in which a first-response team consisting of flight controllers at JSC was trained heavily in quick actions, and two teams of tether dynamics experts from MSFC, one hosted in the MCC Payload Operations Control Center (POCC) and the other in the Huntsville Operations Support Center (HOSC), were present to provide technical expertise in more long-range activities.
Author
Tethered Satellites; Space Transportation System; Payload Retrieval (STS); Payload Delivery (STS); Payload Control; Dynamical Systems; Tethering

19980202351 BD Systems, Inc., Control Dynamics Div., Torrance, CA USA

The Dynamics of the TiPS Tether Experiment

Glaese, John R., BD Systems, Inc., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 51-68; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Tether Physics and Survivability (TIPS) experiment results have been simulated and analyzed. Both the initial tether deployment phase and the long term libration phase have been studied. Available data is sparse except for telemetry from the SEDS deployer during deployment and occasional ground observations via laser and radar to indirectly estimate tether libration angles and orbital properties. These data indicate large initial in plane and out of plane libration angles of 40 deg and 30 deg respectively which were quickly damped over the first 2-3 months to values of less than 15-20 deg. Damping slowed from this point eventually ceasing entirely with residual amplitudes of 5-7 deg. Simulations of deployment matched well during early and mid deployment after appropriate adjustments were made for tether properties and the spinning of the deployer. Late deployment which included a pause and a restart of deployment did not match the restart time. However, later analysis with a smaller initial out of plane attitude angle for the deployer matched much better. Libration simulations showed that internal tether damping could provide sufficient damping to explain libration angle decay rates. A nonlinear libration resonance phenomenon was observed which helped explain damping of out of plane libration. The simulation results adequately duplicate the TIPS behavior, but some discrepancies remain such as how to account for observed simultaneous in plane and out of plane damping which probably cannot be answered without more precise libration data.

Author

Tethering; Deployment; Libration; Damping; Systems Simulation; Tethered Satellites; Dynamic Stability

19980202352 Communications Research Centre, Ottawa, Ontario Canada

The BOLAS Mission

James, H. Gordon, Communications Research Centre, Canada; Tether Technology Interchange Meeting; Jan. 1998, pp. 71-102; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Bistatic Observations using, Low Altitude Satellites (BOLAS) is a basic science experiment implemented with a spacecraft comprising, two payload packages that are separated by a 100-m tether. The objectives will be to improve the understanding of two classes of ionospheric dynamic processes that redistribute plasma energy in its flow from the Sun to the low atmosphere: fluid instabilities near the peak of the ionospheric F region, and microscale instabilities in the collisionless topside plasma. The operation of the double payload will be coordinated with ground radio facilities to probe high-latitude density structures hitherto only observed on the ground. The primary facility for radio-science objectives will be phase-coherent receivers on both ends of the tether that measure the direction of arrival, signal delay and other parameters of transionospheric waves. Particle detectors on both ends of the tether will be associated with the receivers in the study of spontaneous auroral processes whose spatial extent approximates the tether length. Electron density distributions will be measured tomographically using transmissions from the Global Positioning System (GPS) satellites to GPS receivers aboard BOLAS. The mission will be implemented with a low-cost spacecraft consisting of two small and nearly identical Subsatellites connected by the nonconducting tether. The current plan is to launch BOLAS into low-earth orbit as a Secondary Payload with RADARSAT II on a Delta II vehicle in the year 2001. The tethered subsatellites will rotate in a cartwheel fashion, approximately in the orbit plane. BOLAS has attracted support from various Canadian and U.S. agencies for its technology research. BOLAS will employ established sounding rocket and tether technology as a base, but also will see new applications, particularly of tethers, microsats and the use of GPS in orbit. Proposed technology demonstrations of the mission have significance to future Canadian microsat and smallsat missions, and to future space station-related and interplanetary missions of NASA.

Author

Global Positioning System; Payloads; Ionospheric Propagation; Energy Transfer; Plasma Heating; Collisionless Plasmas; Tethering

19980202353 NASA Marshall Space Flight Center, Huntsville, AL USA

Propulsive Small Expendable Deployer System (ProSEDS) Space Demonstration

Johnson, Les, NASA Marshall Space Flight Center, USA; Ballance, Judy, NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 103-108; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Propulsive Small Expendable Deployer System (ProSEDS) space experiment will demonstrate the use of an electrodynamic tether propulsion system. The flight experiment is a precursor to the more ambitious electrodynamic tether upper stage demonstration mission which will be capable of orbit raising, lowering and inclination changes-all using electrodynamic thrust. ProSEDS, which is planned to fly in 2000, will use the flight proven Small Expendable Deployer System (SEDS) to deploy a tether

(5 km bare wire plus 15 km spectra) from a Delta II upper stage to achieve approx. 0.4N drag thrust, thus deorbiting the stage. The experiment will use a predominantly ”bare” tether for current collection in lieu of the endmass collector and insulated tether approach used on previous missions. ProSEDS will utilize tether-generated current to provide limited spacecraft power. In addition to the use of this technology for orbit transfer and upper stages, it may also be an attractive option for future missions to Jupiter and any other planetary body with a magnetosphere.
Author
Propulsion System Performance; Propulsion; Deployment

19980202354 Tethers Unltd., Clinton, WA USA
The ”Terminator Tether” (Trade Mark): A Near-Term Commercial Application of the NASA/MSFC ProSEDS Experiment
Forward, Robert L., Tethers Unltd., USA; Hoyt, Robert P., Tethers Unltd., USA; Uphoff, Chauncey, ACTA Consulting Group, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 109-129; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The NASA/MSFC ProSEDS Experiment is designed to demonstrate that electrodynamic drag on a conducting tether can rapidly deorbit a spacecraft. This paper discusses the future commercial application of this technology for mitigating the long-lived orbital debris hazard created by constellation satellites through the use of an electrodynamic drag ”Terminator Tether”(TM) which will remove constellation satellites from orbit after their end-of-life. We show that the electrodynamic drag of a conducting tether is dependent predominantly on the mass, density, and conductivity of the tether, not its length, and we develop analytical tools for predicting the time required for a Terminator Tether to deorbit spacecraft from various orbits. We find that aluminum wire tethers massing just 1 to 5% of the mass of the host spacecraft can deorbit LEO constellation satellites within a few weeks or months, depending upon the initial orbit. Although the tether increases the total collision cross-sectional area of the satellite-plus-tether system during the deorbit phase, we find that the product of the collision cross-sectional area of the satellite-plus-tether times the deorbit time (Area-Time-Product), can be reduced by orders of magnitude by using a Terminator Tether instead of depending upon atmospheric drag alone, greatly reducing the risk of collision with other spacecraft.
Author
Spaceborne Experiments; Drag Reduction; Constellations; Tetherlines; Experiment Design

19980202355 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
The YES Satellite: a Tethered Momentum Transfer in the GTO Orbit
Kruijff, Michiel, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Vander-Heide, Erik Jan, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Tether Technology Interchange Meeting; Jan. 1998, pp. 131-148; In English; Also announced as 19980202346; Sponsored in part by Dutch Government.; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Young Engineers’ Satellite YES is a payload of the Ariane 502 and one of the experiments of the ESA/ESTEC project TEAMSAT. It has been built to perform a tether deployment and tethered momentum transfer in GTO, in order to study the special and unexplored dynamics of a tether in a highly elliptic orbit. to record the dynamics of the system, GPS, cameras, sunsensors and accelerometers are part of the satellite’s instrumentation. As a technological demonstration and for clearing of the orbit after the mission, a precise cut would deliver sufficient (delta)V to de-orbit a subsatellite called TORI, together with the tether. As a way to mitigate the collision risk for the tether with operational satellites in LEO, a preferred launch time, governed by the effect of solar pressure, has been requested but was not compatible with other requirements that turned up during the launch preparations. Therefore, the ESA Steering Committee has decided that YES will fly, but the tether will be cut as to prohibit deployment, before the launch. In this paper, the planned mission is described, along with the measures foreseen to minimize orbital lifetime of the tether. A description of the subsystems related to the tether experiment will show that very interesting science can be performed, that can fulfill the project’s secondary objectives. The tether experiment will be operated as a rehearsal for a re-flight on an Ariane 4 in the near future.
Author
Ariane Launch Vehicle; Tethering; Momentum Transfer; Low Earth Orbits; Global Positioning System; Transfer Orbits; Payloads

19980202356 Naval Research Lab., Washington, DC USA
Experiments in Tether Dynamics Planned for ATEx’s Flight
Zedd, Michael F., Naval Research Lab., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 149-183; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Following the successful one year operation of the Tether Physics and Survivability (TIPS) satellite, the Naval Research Laboratory (NRL) plans to fly a second tethered satellite system in mid-1998. The Advanced Tether Experiment (ATEX) is designed to extend our knowledge of control and survivability of tethered space systems. Experiments in active control will study deployment dynamics via a constant-speed motor and utilization of both in-plane and cross-plane thrusters to excite and arrest librations. Additionally, ATEX will investigate the survivability of long-life tether materials. This paper will describe the ATEX payload carried by the Space Technology Experiment (STEX) spacecraft and preview the anticipated flight experiments as shown by the results of two tethered system dynamics simulations.
Author
Space Technology Experiments; Tethering; Active Control; Surveillance; Experiment Design

19980202357 Tether Applications, Chula Vista, CA USA
A Station Tethered Express Payload System (STEPS)
Carroll, Joseph A., Tether Applications, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 187-190; In English; Also announced as 19980202346
Contract(s)/Grant(s): NAS8-40544; NAS8-40645; NASA Order H-2592D; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Most capsules designed to return payloads from earth orbit use rockets for deorbit. They have modest payload mass & volume fractions. Active attitude control raises costs, and the deorbit rocket imposes risks which increase development and operational costs. This note describes an alternative concept now being developed under NASA funding. It uses a tether to both deorbit and orient the capsule. This allows simultaneous reduction of capsule complexity, cost, loads, hazards, and reentry errors. The flight of SEDS-1 in 1993 proved out the basic concepts. A 20 km tether slung a 26 kg payload back to earth from a 74O x 19O km orbit, accurately enough for a pre-positioned observer to videotape the reentry. As air drag built up just before reentry, the tether was blown back and became a kite-tail, with tension increasing as predicted before flight. The tether was still attached at approx. 110 km, when telemetry was lost.
Derived from text
Loads (Forces); Tethering; Operating Costs; Active Control; Aerodynamic Drag; Attitude Control

19980202360 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Tethers Design Criteria
Tomlin, Donald D., NASA Marshall Space Flight Center, USA; Faile, Gwyn C., NASA Marshall Space Flight Center, USA; Hayashida, Kazuo B., NASA Marshall Space Flight Center, USA; Frost, Cynthia L., NASA Marshall Space Flight Center, USA; Wagner, Carole Y., NASA Marshall Space Flight Center, USA; Mitchell, Michael L., NASA Marshall Space Flight Center, USA; Vaughn, Jason A., NASA Marshall Space Flight Center, USA; Galuska, Michael J., NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 223-237; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The small expendable deployable system and tether satellite system programs did not have a uniform written criteria for tethers. The JSC safety panel asked what criteria was used to design the tethers. Since none existed, a criteria was written based on past experience for future tether programs.
Author
Design Analysis; Tethering; Failure Analysis

19980202363 Tethers Unltd., Clinton, WA USA
Tether System for Exchanging Payloads Between the International Space Station and the Lunar Surface
Hoyt, Robert P., Tethers Unltd., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 271-284; In English; Also announced as 19980202346
Contract(s)/Grant(s): P3776-5-96; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Systems composed of several rotating and/or hanging tethers may provide a means of exchanging supplies between low Earth orbit facilities and lunar bases without requiring the use of propellant. This work develops methods for designing a tether system capable of repeatedly exchanging payloads between a LEO facility such as the International Space Station or a Space Business Park and a base on the lunar surface. In this system, a hanging tether extended upwards from the LEO facility, places a payload into a slightly elliptical orbit, where it is caught by a rotating tether in a higher elliptical orbit. This rotating tether then tosses the payload to the moon. At the moon, a long rotating ”Lunavator” tether catches the payload and deposits it on the surface of the moon. by transporting an equal mass of lunar materials such as oxygen back down to the LEO facility through the tether transport

system, the momentum and energy of the system is conserved, allowing frequent traffic between LEO and the lunar surface with minimal propellant requirements.
Author
Tethering; Payloads; International Space Station; Lunar Surface

19980202364 NASA Marshall Space Flight Center, Huntsville, AL USA
Orbiter-Towed Reboost for ISS
Carrington, Connie, NASA Marshall Space Flight Center, USA; Keller, Vernon, NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 285-303; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Orbiter towing provides a backup reboost capability for the International Space Station (ISS). Results from recent studies are presented, showing performance, system configuration, mission operations, and programmatics. A proposed flight demonstration to mitigate risks is also discussed.
Author
Towing; Systems Engineering; Backups

19980202365 Boeing Aerospace Co., Information, Space and Defense Systems Group, Huntsville, AL USA
Application of an Electrodynamic Tether System to Reboost the International Space Station
Vas, Irwin E., Boeing Aerospace Co., USA; Kelly, Thomas J., Boeing Aerospace Co., USA; Scarl, Ethan, Boeing Aerospace Co., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 305-334; In English; Also announced as 19980202346
Contract(s)/Grant(s): NAS8-50000; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The results of a study on the application of an electrodynamic tether system to reboost the International Space Station are presented. A new and novel method is recommended using a partially bare tether. Locations are suggested as to where the tether system is to be attached at the Space Station. The effects of the tether system on the microgravity environment have been characterized and actually may be beneficial in that the system could be operated during the quiescent period. Alternative approaches to tether deployment and retrieval are discussed. It is shown that a relatively short tether system, 7 km long, operating at a power level of 5 kw could provide a cumulative savings of over a billion dollars during a ten-year period ending 2012. This savings is a direct result from a reduction in the number of flights normally required to deliver propellant for reboost.
Author
Electrodynamics; Tethering; Position (Location)

19980202366 NASA Marshall Space Flight Center, Huntsville, AL USA
An Overview of Electrodynamic Tether Performance in the Jovian System
Gallagher, D. L., NASA Marshall Space Flight Center, USA; Bagenal, F., Colorado Univ., USA; Moore, J., Spectra Research Systems, Inc., USA; Johnson, L., NASA Marshall Space Flight Center, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 335-344; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Jovian magnetosphere with its strong magnetic field and the rapid rotation of the planet present new opportunities and challenges for the use of electrodynamic tethers. An overview of the basic plasma physics properties of an electrodynamic tether moving through the Jovian magnetosphere is examined. Tether use for both propulsion and power generation are considered. Close to the planet, tether propulsive forces are found to be as high as 50 Newtons and power levels as high as 1 million Watts.
Author
Tethering; Electrodynamics; Planetary Magnetic Fields

19980202367 Canadian Space Agency, Saint Hubert, Quebec Canada
OEDIPUS-C Mission Tether Dynamics Results
Jablonski, Alexander M., Canadian Space Agency, Canada; Vigneron, Frank R., Canadian Space Agency, Canada; Tyc, George, Bristol Aerospace Ltd., Canada; James, H. Gordon, Communications Research Centre, Canada; Tether Technology Interchange Meeting; Jan. 1998, pp. 347-368; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The OEDIPUS-C Sounding Rocket Mission was successfully launched on November 6, 1995. The spinning two payloads had two large pairs of booms and were connected by a tether which reached 1174 m in full deployment. It had scientific objectives to address natural and artificial waves in the ionospheric plasma in a series of experiments. A comprehensive Tether Dynamics Experiment was also included to investigate complex dynamics of the configuration. At first this paper describes scientific objectives of the OEDIPUS-C mission. A short description of two subpayloads (aft and forward) follows. Then dynamics states of the

flight are described and some examples of the flight dynamics data are presented. The paper also includes the overall status of the tether technology developed in association with this mission. This tethered mission was filmed by the camera situated at the aft subpayload and a short description of the video is also included. Present status of the post-flight analysis is presented.
Author
Tethering; Plasma Waves; Ionospherics; Experimentation

19980202368 Tethers Unltd., Clinton, WA USA
The Hoytether: A Failsafe Multiline Space Tether Structure
Hoyt, Robert P., Tethers Unltd., USA; Forward, Robert L., Tethers Unltd., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 369-378; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Hoytether is a failsafe, multiline space tether structure for long-duration and high-value tether missions. The Hoytether structure is an open net which provides redundant linkage in such a way as to maintain spatial separation between the individual lines composing the structure as the structure is degraded by orbital debris and meteoroid impactors. The spatial separation between lines prevents one small impactor from severing the entire Hoytether as can happen with a single-line tether. The Hoytether structure thus can suffer many cuts by small impactors while maintaining the design load. Analytical modeling of tether lifetimes in the space debris environment indicate that the redundancy of the Hoytether enables it to provide >99% survival probabilities for periods of months to years. Using numerical modeling, we have developed designs for Hoytether structures capable of operating at very high stress levels while maintaining high reliability for long lifetimes.
Author
Spacecraft Structures; Tethering; Reliability; Spacecraft Survivability

19980202369 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Technology of Bare Tether Current Collection
Estes, Robert D., Smithsonian Astrophysical Observatory, USA; Sanmartin, Juan R., Universidad Politecnica de Madrid, Spain; Martinez–Sanchez, Manuel, Massachusetts Inst. of Tech., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 379-398; In English; Also announced as 19980202346
Contract(s)/Grant(s): NAG8-1303; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The outstanding problem for useful applications of electrodynamic tethers is obtaining sufficient electron current from the ionospheric plasma. Bare tether collectors, in which the conducting tether itself, left uninsulated over kilometers of its length, acts as the collecting anode, promise to attain currents of 10 A or more from reasonably sized systems. Current collection by a bare tether is also relatively insensitive to drops in electron density, which are regularly encountered on each revolution of an orbit. This makes nighttime operation feasible. We show how the bare tether's high efficiency of current collection and ability to adjust to density variations follow from the orbital motion limited collection law of thin cylinders. We consider both upwardly deployed (power generation mode) and downwardly deployed (reboost mode) tethers, and present results that indicate how bare tether systems would perform as their magnetic and plasma environment varies in low earth orbit.
Author
Technology Transfer; Tethering; Electrodynamics; Plasmas (Physics); Electron Energy

19980202370 Universidad Politecnica de Madrid, Escuela Tecnica Superior de Ingenieros Aeronauticos, Madrid, Spain
Validity of the Orbital-motion-limited Regime of Cylindrical Probes
Sanmartin, J. R., Universidad Politecnica de Madrid, Spain; Estes, R. D., Harvard-Smithsonian Center for Astrophysics, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 399-417; In English; Also announced as 19980202346
Contract(s)/Grant(s): DGYCIT-PB94-0417-C03-01; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An asymptotic analysis of electron collection at high bias Phi(sub p) serves to determine the domain of validity of the OML regime of cylindrical Langmuir probes, which is basic for the workings of conductive bare tethers. The breakdown of the regime is found to occur far from the probe, at energies comparable to the ion temperature T(sub i). The radius of a wire collecting OML current in an unmagnetized plasma at rest cannot exceed a value, R(sub max), that increases with T(sub i), and exhibits a minimum as a function of Phi(sub p) ; at Phi(sub p) values of interest R(sub max) is already increasing and is larger than the Debye length lambda(sub De). It is also found that: (1) the maximum width of a thin tape is 4R(sub max); (2) the electron thermal gyroradius must be large compared with both R and lambda(sub De) for magnetic effects to be negligible; and (3) an ion ram energy large compared with kT(sub i) but small compared with e(Phi)(sub p) would have a complex but weak effect on R(sub max).
Author
Validity; Orbits; Cylindrical Bodies; Ion Temperature; Magnetic Effects; Ion Motion

19980202371 Michigan Univ., Space Physics Research Lab., Ann Arbor, MI USA

Response of Electrodynamic Tethers in Ionospheric Plasma due to Step Changes in Voltage

Bilen, Sven G., Michigan Univ., USA; Gilchrist, Brian E., Michigan Univ., USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 421-434; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Understanding the transient behavior of an electrodynamic tether system is of special importance to systems detecting natural electric field transient signatures and those utilizing tether current pulses or modulation, such as for low frequency wave generation. Our research is aimed at understanding the nonlinear propagation characteristics of electromagnetic pulses along electrodynamic tethers in the ionosphere. Such a pulse can occur as a tether/plasma system transitions from open-to-closed-circuit states, i.e., no current to current flowing states or vice versa. This perturbation takes a finite amount of time to propagate along the tether and affects the surrounding ionospheric plasma as it does so. This interaction in turn affects the tether's transmission line characteristics. One of the important items we examine is the dynamic evolution of the sheath as the pulse front travels past a given section of the tether and disturbs the steady-state sheath.

Author

Electromagnetic Pulses; Electrodynamics; Tethering; Plasmas (Physics); Planetary Ionospheres; Electric Potential

19980202372 Consultants in Electronic Components, Germany

Ferromagnetically Screened Reverse Conductor (FSRC) - Tether: A New Tether Principle

Liebscher, Gerhard, Consultants in Electronic Components, Germany; Tether Technology Interchange Meeting; Jan. 1998, pp. 435-438; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The new tether principle is based on a direct current generator or a direct current motor with a ferromagnetically screened reverse-conductor. The principle part consists of an outer hollow conductor made of ferromagnetic material and an inner or reverse conductor which lies within the outer hollow conductor but is galvanically separated from it. The outer hollow conductor and the inner conductor are connected electrically together at one end, while an electric voltage can be extracted at the other end by motion of this device in a magnetic field. by forcing an electrical current at one end of the device the principle is made to operate in reverse and so cause the device to move in the magnetic field. Applications are: so called 'tethers' for electrical power generation for satellites in space or satellite motion in space, unipolar electric generators or unipolar motors without sliding contacts, magnetic field sondes or other magnetic field configurations generated by the device while the current will be supplied at one end.

Author

Ferromagnetic Materials; Tethering; Electric Generators; DC Generators; Conductors

19980202373 Padua Univ., Dept. of Mechanical Engineering, Italy

Past, Present and Future Activity on Tethered Systems

Angrilli, F., Padua Univ., Italy; Basso, R., Padua Univ., Italy; Bianchini, G., Padua Univ., Italy; Bortolami, S., Padua Univ., Italy; DaForno, R., Padua Univ., Italy; Debei, S., Padua Univ., Italy; Fanti, G., Padua Univ., Italy; Reccanello, F., Padua Univ., Italy; Saggin, B., Padua Univ., Italy; Zago, A., Padua Univ., Italy; Tether Technology Interchange Meeting; Jan. 1998, pp. 439-452; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The report discusses: (1) identification of the thermo-mechanical properties of the TSS-1 SEDS tethers and TSS-2; (2) experimental evaluation of the tether life after progressive damage; (3) New non-linear model of tethered satellite systems; (4) experimental and numerical analysis of tethered stabilized platform; (5) monitoring analysis of tethered satellite system; (6) analysis of passive method to damp out the tether flexural motion; (7) analysis of recoil velocity after the cut in the SEDS mission; (8) Design of new failsafe multifunctional tethers; (9) Thermo-mechanical characterization of new tethers; (10) analysis of the tether life due to the dust impact; (11) studies for a multifunctional experiment; and (12) extremely flexible linked robots.

CASI

Tethered Satellites; Thermodynamics; Numerical Analysis

19980202993 Naval Postgraduate School, Monterey, CA USA

Thermal Analysis of PANSAT

Smith, Travis R., Naval Postgraduate School, USA; Dec. 1997; 100p; In English

Report No.(s): AD-A341788; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The thermal control system of a spacecraft is designed to maintain all spacecraft components within their specified operating temperature limits throughout all phases of a spacecraft's mission. In order to verify and aid in such a design process, a thermal analysis of the system must be conducted. A thermal model of the spacecraft is used to simulate its behavior under given thermal environments and boundary conditions so that temperature predictions can be made. The focus of this thesis is to develop and analyze thermal models of PANSAT which describe its thermal behavior while it is in orbit and also prior to its insertion in its

orbit (while it is still in the shuttle). The results of these analyses will serve to help in the thermal design and performance of PANSAT. This thesis completes the thermal model prerequisites of the STS 1995 space shuttle mission hitchhiker program for PANSAT. The emphasis of this thesis is to develop a model that will allow the prediction of the temperatures of all the electrical components including the temperature sensitive electrical components of PANSAT such as batteries over a complete orbit of the satellite.
DTIC
Spacecraft; Thermal Analysis; Artificial Satellites; Temperature Distribution; Temperature Effects; Space Shuttle Missions

19980203021 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Real Time Detection of Anomalous Satellite Behavior from Ground-Based Telescope Images
Maron, Geoffrey S., Air Force Inst. of Tech., USA; Mar. 12, 1998; 68p; In English
Report No.(s): AD-A344283; AFIT/GOA/ENG/98M-01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Air Force analysts are faced with the task of monitoring satellites with ground based telescopes. Images are collected and analyzed in a time consuming and subjective effort to detect any behavior that is anomalous. This research maximizes use of a priori information to create an automated, real time satellite behavior classification tool. Using modeling software and knowledge of a satellite's orbit, reference imagery is created for each measured image in a satellite pass. Features are extracted from the measured and reference image pairs that provide good overall gaussian classification accuracy (85%), reduce the dimensionality of the problem (from 32,768 down to 3), and are least dependent on data partitioning. The statistical image pair classifier is tested for robustness to atmospheric distortion, and training data requirements are explored. Satellite behavior is classified by counting the classification results for the image pairs in a satellite pass. A binomial analysis of the classification technique predicts virtually 100% classification accuracy of satellite behavior. This research demonstrates the validity of model based satellite behavior analysis.
DTIC
Telescopes; Imagery; Real Time Operation; Military Spacecraft; Detection; Pattern Recognition

19980203126 Naval Postgraduate School, Monterey, CA USA
Design of an Attitude Dynamics and Control Subsystem for a Medium Earth Orbit Satellite
Bush, Danny K., Naval Postgraduate School, USA; Dec. 1997; 197p; In English
Report No.(s): AD-A340981; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Department of Defense has a continuing need for satellite communications to satisfy the demand for information exchange for strategic, operational, and tactical warfighters. There is currently a Deputy Undersecretary of Defense for Space (DUSD (Space)) transition planning effort to develop a satellite communications architecture for the 2007-2010 time frame. During this time all three current satellite systems; UFO, DSCS, and MILSTAR, are expected to degrade rapidly. As part of the DUSD - Space effort the U.S. Navy was tasked to form a Mobile Users Study to establish a framework for completing the detailed requirements and engineering work needed to develop the UHF/Mobile User transition plan. Then, as part of the Navy effort the Naval Postgraduate School's Astronautical Engineering class SE-6l under Professor Brij Agrawal's guidance designed a proposed medium Earth orbit communications satellite. This thesis is a design of the Attitude Dynamics and Control Subsystem for the subject medium Earth orbit MUS communications satellite. The thesis describes and explores the five major steps in designing an Attitude, Dynamics and Control Subsystem and focuses on key ADCS related areas that are peculiar to a MEO satellite as compared to a (GEO satellite.
DTIC
Artificial Satellites; Communication Satellites; Design Analysis; Attitude (Inclination); Control Systems Design

19
SPACECRAFT INSTRUMENTATION

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

19980202723 Air Force Research Lab., Space Vehicles Directorate, Kirkland AFB, NM USA
Micro-Particle Impact Detector Experiment on MightySat 1 ***Final Report, 15 Jul. 1996 - 1 Oct. 1997***
Serna, Patrick J., Air Force Research Lab., USA; Liechty, Gary H., Air Force Research Lab., USA; Neslen, Craig L., Air Force Research Lab., USA; DelFrate, Renzo, Air Force Research Lab., USA; Draper, Edwin, Air Force Research Lab., USA; Jan. 30, 1998; 162p; In English
Contract(s)/Grant(s): AF Proj. 4400

Report No.(s): AD-A341096; PL-TR-97-1071; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The purpose of this paper is to present an engineering design of a spaceborne Micro Particle Impact Detector (MPID) experiment. This experiment is manifested on an Air Force Research Laboratory spacecraft called MightySat I scheduled for launch in July 1998. A follow on report will present the resulting particle impact data. The objective of this experiment is to measure direction and time of impact of spaceborne micron size particles with time of impact resolution of 0.1 s. The primary element in this experiment consists of two Metal Oxide Semiconductor (MOS) discharge capacitor detectors that discharge upon hypervelocity particle impact. These detectors were developed by Prof. J.J. Wortman from North Carolina State University. Each MOS particle detector is 3 in x 11/2 inches and approximately 0.013 in thick. Each particle detector is bonded to a detector assembly that is in turn mechanically fastened to the external bottom plate of the MightySat I spacecraft. The detector assembly and associated electronics weigh less than 0.4 lb and have a total impact sensing area of 3.7 in 2. Each particle impact causes an impact event record to be stored in the spacecraft control unit for later downlink. Each impact event record will store time of impact and output from two coarse sun sensors. Data from the coarse sun sensors is used to help determine attitude of the spacecraft. The Air Force Research Laboratory MightySat I spacecraft is a 6-sided composite structure, 20.5 in (height) by 19.0 in (diameter), 150 lb., and spin stabilized with 5 degree attitude knowledge. The MightySat I spacecraft is scheduled for orbit injection using a standard hitchhiker ejection system from space shuttle flight STS-88. Anticipated orbit for the spacecraft is 210 nmi at 51.6 degrees.
DTIC

Hypervelocity Impact; Circuit Boards; Design Analysis; Spaceborne Experiments; Detection; Measuring Instruments; Data Acquisition

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.

19980202212 Lockheed Martin Astronautics, Denver, CO USA

Titan IV/Centaur RL10A-3-3A Postflight Engine Evaluation

Ivanov, Mark C., Lockheed Martin Astronautics, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 373-383; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The Titan IV launch system, built by Lockheed Martin Astronautics, has had nineteen successful flights beginning in 1989 with seven of those flights utilizing the Centaur upper stage. Centaur is a pressure stabilized high energy LO2/LH2 upper stage powered by two Pratt and Whitney RL10A-3-3A main engines. Postflight analysis characterizing the in-flight performance of the RL10A-3-3A main engines has recently been performed. Past methods of characterizing inflight Centaur engine performance range from simple engine relationships with burn time and residual propellant to the c* iteration method currently used by Pratt and Whitney. Centaur subsystems have provided via telemetry a unique amount of information with which to formulate a new approach having much greater accuracy than past methods. This approach combines flight acceleration, the onboard propellant utilization system commands and various engine measurements into a detailed vehicle simulation program. This program employs engine thrust and flowrate models, provided by the Aerospace Corporation, which are driven by flight measurements and test stand relationships to produce initial profiles of thrust, Isp and mixture ratio. These profiles are then biased to match burn time, total residual mass and propellant utilization feedback values. This adjustment process is driven by an optimization algorithm which minimizes acceleration mismatch using engine multipliers, weighted uncertainty in mass distributions and mass changes between burns as control variables. The results have been consistent across missions and compare favorably with reconstruction results from the Aerospace Corporation. Comparisons with the Pratt and Whitney c* method have shown differences, however, it is believed that the additional information employed by the new methodology provides insight into the application of the RL10A-3-3A on Titan IV/Centaur. Comparisons with engine test stand data show clear biases. These results have been incorporated into preflight performance predictions for upcoming Titan IV/Centaur flights as well as guidance flight software algorithms.
Author

Titan 4 Launch Vehicle; Centaur Launch Vehicle; Liquid Propellant Rocket Engines; Postflight Analysis; Propulsion System Performance; Engine Tests; Liquid Rocket Propellants

19980202227 Hessler (R. O.), Sommerville, AL USA

Behavior of Pressure Derivatives During Burnout of Simulated Rocket Motors

Hessler, R. O., Hessler (R. O.), USA; Glick, R. L., Talley Defense Systems, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 527-535; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Burning rate measurement methods based on the pressure-time history of small rocket motors are dependent upon the detection of burnout time, which generally is not instantaneous. Simulated pressure histories based on theory governing pressure in rocket motors are used to explore the effect of non-instantaneous burnout by modeling eccentricity of a cylindrically perforated propellant grain as a general analog for non-uniform web thickness. The beginning and ending of burnout are determined to be reliably characterized by a minimum and a subsequent maximum, respectively, in the second derivative of the pressure history, validating definitions proposed in earlier works. The ending of burnout is determined to be equally well characterized by a minimum in the first derivative of the pressure history if normalized by the instantaneous pressure. As lower-order derivatives are less susceptible to noise, the normalized first derivative minimum is proposed as an alternative method for detection of final burnout. Author

Burning Rate; Pressure Dependence; Burnout; Solid Rocket Propellants; Solid Propellant Rocket Engines; Solid Propellant Combustion; Computerized Simulation

19980202335 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Evaluation of a 'Feasibility Study of an IM Ignitor' and a Summary of the Results to be Used in the 'Thermal Initiation' Project ***Final Report***

Scholtes, J. H. H., Prins Maurits Lab. TNO, Netherlands; Nov. 1997; 21p; In Dutch

Report No.(s): AD-A340757; PML-1997-A39; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the Frame of the project Feasibility study of an IM Ignitor, research has been carried out to develop an Ignitor for a rocket system. The main goal of this project was development of an Ignitor to increase the probability for an IM classification for a rocket system. Besides the development of new rocket propellants, the work was emphasized on the determination of material parameters as a function of the temperature and the response of the propellants in different Cook off tests. It was foreseen that this project would give a lot of interesting information for the project Thermische Initiatie. Therefore a summary of the results and a short evaluation of the project is given. As a result of the project, it can be stated that a planned early initiation of the ignitor in a Cook off test could result in a mild response of the rocket motor instead of a severe explosion. As a condition for this statement, the rocket system must be seen as an open system and the main charge must be in such a condition that, at the moment of initiation, the probability on a severe deflagration or DDT reaction is negligibly. The material parameter from this project can be used in Cook off calculations in the Ti project for verification and improvement of the computer model.

DTIC

Firing (Igniting); Rocket Propellants; Ignition; Propellant Combustion; Computerized Simulation

19980202889 Tennessee Univ. Space Inst., Tullahoma, TN USA

Kinetic and Transport Models for Nonequilibrium Hydrogen/Nitrogen Plasma Propellants ***Final Report, 15 Jul - 14 Nov. 1997***

Keefer, Dennis, Tennessee Univ. Space Inst., USA; Feb. 12, 1998; 38p; In English

Contract(s)/Grant(s): F49620-97-1-0223

Report No.(s): AD-A341689; AFRL-SR-BL-TR-98-0287; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A cascade arc facility was developed to study the characteristics of nonequilibrium plasma propellants for electric propulsion applications. The cascade arc was operated with hydrogen arcs at 2.0 and 6.0 psi. Spatially resolved spectral emission data were collected using a two dimensional Optical Multichannel Analyzer (OMA). Electron density was determined by fitting theoretical line profiles to experimentally measured Abel inverted emission line profiles. Radial distributions of plasma temperature were estimated from Boltzmann plots of spectral line intensity. The measured electron densities and plasma temperatures were compared to values predicted by nonequilibrium cascade arc simulations using the University of Tennessee Space Institute (UTSI) Cascade Arc Plasma Simulation (CAPS) code. The simulations underpredicted the peak experimental electron densities by as much as an order of magnitude and over predicted peak plasma temperatures by as much as a factor of 2.5. The experimental electric field has been accurately predicted by varying chemical kinetics in the CAPS code. Kinetic models developed at the University of Illinois gave the best agreement with the Cascade Arc measurements and are the best chemical kinetics tested for hydrogen. Electron number density profiles for simulated ammonia and hydrazine were also obtained at pressures of 2.0, 6.0, and 10.0 psi.

A hydrogen/nitrogen mixture version of the CAPS code is under development that will enable evaluation of candidate finite rate kinetic models for these propellants.
DTIC
Hybrid Propellants; Nonequilibrium Plasmas; Reaction Kinetics; Hydrogen Plasma; Nitrogen Plasma; Electron Plasma; Plasma Propulsion

19980203147 Hampton Univ., VA USA
(HBCU) Thermal-Electric Propulsion With Magnetoplasmadynamic Acceleration ***Final Report, 1 May 1994 - 31 Oct. 1997***
Tabibi, Bagher M., Hampton Univ., USA; Nguyen, Dung X., Hampton Univ., USA; Lee, Ja H., Hampton Univ., USA; Jan. 31, 1998; 21p; In English
Contract(s)/Grant(s): F49620-94-1-0263
Report No.(s): AD-A341315; AFRL-SR-BL-TR-98-0293; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A solar thermal-electric propulsion (STEP) system has been installed to develop a rocket engine having medium ranges of specific impulse and thrust. The STEP system consisted of a solar thermal and a magnetoplasmadynamic (MPD) thrusters in a tandem arrangement. The thermal chamber temperature versus the optical power was evaluated to be adequate. Without the DC power on the MPD electrodes, the system merely produce a thermal plume of argon gas. An insitu technique, Pitot tube method, was used to measure the total and static pressures of the core flow of the thermal plume in steady state operation in order to characterize and benchmark so that any increment of thrust and specific impulse resulted from the MPD acceleration. The data were compared with the results of CET'93 computer code developed at NASA Lewis Research Center. An increase in the total pressure, therefore the thrust, was found to be proportional to the square of MPD current as expected. The relative increase in total pressure was approximately 40% when the MPD current reached to 500 A.
DTIC
Magnetoplasmadynamics; Plasma Propulsion; Rocket Thrust; Electric Rocket Engines

23
CHEMISTRY AND MATERIALS (GENERAL)

19980201921 Clark Coll., Dept. of Chemistry, Atlanta, GA USA
Novel Macromolecular Materials for Electronic and Optical Applications ***Final Report, 1 Nov. 1995 - 31 Oct. 1997***
Pang, Yi, Clark Coll., USA; Oct. 1997; 32p; In English
Contract(s)/Grant(s): F49620-96-1-0012; AF Proj. 1660
Report No.(s): AD-A339081; AFRL-SR-BL-TR-98-0214; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A series of thiophene containing poly(arylene ethynylene)s have been synthesized and their molecular structures and PL properties have been characterized. A convenient synthetic route has been developed to prepare bis(3-alkylthienyl)ethyne (5) in high yield. Various attempts have been made to use (5) as an essential building block for developing novel poly(arylene ethynylene) materials. Regioregular poly(3-hexyl-2,5- thienylene ethynylene)s (P3HTE) have been synthesized in order to compare the steric interaction in the corresponding polymers. A systematic study has been carried out to evaluate the regioregularity effect of the polymer structure on the PL properties. P3HTE of a head-to-tail chain sequence (12) showed stronger PL intensity than the corresponding polymer with a head-to-head chain sequence (10), although they exhibit the essentially same absorbance. The quantum efficiency of P3HTEs were found to increase sharply with the conjugation length of the molecules when the chain length is shorter than the tetramer. Further extending the conjugation length beyond the tetramer appeared to shift the fluorescence emission band to a longer wavelength, but to have little effect on the quantum efficiency of the molecule. Several alternating copolymers, polyP-PHENYLENE ETHYNYLENE)-ALT-(2,5-THIENYLENE ETHYNYLENE)s (PPETEs), have also been synthesized by using a Reck-type coupling reaction under mild conditions. PPETEs produced under the mild conditions exhibit longer conjugation length (ca. 10 nm in UV-vis absorption /max) than the same polymers synthesized at high temperature. Synthesis of copolymer PPETE successfully combines both good solubility and processibility of PTE and high luminescence of PPE into a single polymer chain, making the material attractive for device applications.
DTIC
Light Emitting Diodes; Molecular Structure; Synthesis (Chemistry); Ultraviolet Absorption; Quantum Efficiency

19980202750 Department of the Navy, Washington, DC USA
Inter-Level Dielectrics with Low Dielectric Constants
Buckley, Leonard J., Inventor, Department of the Navy, USA; Snow, Arthur W., Inventor, Department of the Navy, USA; Griffith,

James R., Inventor, Department of the Navy, USA; Ray, Mark, Inventor, Department of the Navy, USA; Aug. 26, 1997; 8p; In English
Patent Info.: Filed 14 Jul. 1995; US-Patent-Appl-SN-422463; US-Patent-5,660,920
Report No.(s): AD-D018782; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A metallization is coated with a network polymer. The network polymer may he either a cross linked polyfluorinated polyallylether-polyhydromethysiloxane copolymer or a network polymer formed from cross linked fluoromethylene cyanate ester monomers. These polymer networks are resistant to the diffusion of a metallization, such as copper, therethrough.
DTIC
Metallizing; Polymers

19980202755 Department of the Navy, Washington, DC USA
Low Dielectric Constant Allylics
Griffith, James R., Inventor, Department of the Navy, USA; Hu, Henry S., Inventor, Department of the Navy, USA; Jan. 13, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-455606, AD-D017672
Patent Info.: Filed 31 May 1995; US-Patent-Appl-SN-455606; US-Patent-5,708,116
Report No.(s): AD-D018775; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A reaction product of a liquid monomeric allyletherfluoro-alkylene benzene and a liquid polymethylhydrosiloxane, which reaction product in a cured, solid state has dielectric constant below about 2.5.
DTIC
Benzene; Permittivity

19980202990 Cornell Univ., School of Civil and Environmental Engineering, Ithaca, NY USA
Comparison of Alternative Hydrogen Donors for Anaerobic Reductive Dechlorination of Tetrachloroethene ***Final Report, Aug. 1993 - Jan. 1998***
Fennell, Donna E., Cornell Univ., USA; Jan. 1998; 434p; In English
Contract(s)/Grant(s): F08635-93-C-0077
Report No.(s): AD-A341514; AFRL-ML-TY-TR-1998-4502; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

Selective delivery of H2 to a tetrachloroethene (PCE) dechlorinator was investigated and modeled. H2 was delivered using donors lactate, ethanol (EtOH), butyrate, or propionate substrates whose fermentation to H2 is exergonic under H2 partial pressures (ceilings) of less than 1, 0.1, l0 (exp -3.5), and 10 (exp -4.4) atm, respectively. Recent studies of H2 use in reductive dechlorination show that dechlorinators have an affinity for H2 at least an order of magnitude greater than that of hydrogenotrophic methanogens. Slowly fermented substrates producing lower H2 levels may be more effective and persistent 'selective' stimulators of dechlorination than rapidly fermented substrates producing higher H2 levels. Separate, semicontinously operated cultures were enriched with each of the donors. Long-term, all donors equally stimulated the dechlorination of PCE to vinyl chloride and ethene; however, stimulation of methanogenesis differed (EtOH greater than lactate greater than butyrate greater than propionate). During short-term tests, patterns of donor fermentation and H2 production and consumption were significantly different for different donors. When fed amounts stoichiometrically sufficient to completely dechlorinate PCE, half the H2 released during EtOH fermentation was used methanogenically with the remainder channeled to incomplete dechlorination; however, only 1% of the H2 released during propionate fermentation was used methanogenically and the remainder was used for complete dechlorination. A comprehensive model using Michaelis-Menten-type kinetics incorporating H2 thresholds and thermodynamic limitations on donor fermentations was formulated. Mixed-culture behavior under a variety of conditions was fit well by the model.
DTIC
Hydrogen; Trichloroethylene; Anaerobes; Chlorides; Reduction (Chemistry)

19980203196 Army Natick Research and Development Command, Engineering Center, MA USA
Evaluation of Candidate Coatings for the Metal Traycan ***Final Report, Oct. 1989 - Sep. 1990***
Dittmeier, George, Army Natick Research and Development Command, USA; Mar. 1998; 56p; In English
Report No.(s): AD-A341593; NATICK/TR-98/013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this study was to obtain quantitative data on the protective properties of coated tin-plated steel traycans versus coated tin-free steel traycans. Four interior coating variables and a control were tested using electrochemical techniques. The study is divided into two parts: Part A - Investigation of Organic Traycan Coatings, and Part B - Investigation of Corrosion Protection of Coated Tin-Plate versus Coated Tin-Free Steel Substrates. Under Part A, three basic assessments were conducted on the organic coatings: 1. electrochemical quantitative assessment of defect, 2. intrinsic protective property assessment using alternating current impedance techniques, and 3. assessment of blister defects in coatings that are indicative of corrosion. The results showed that

the candidate coating, Dexter-Midland Matte Sheet, was the superior coating in terms of least number of defects of all the coatings assessed. Based on the alternating current impedance evaluation, the Valspar coating over tin-plate coil stock had the best resistance to penetration by the test corrosion medium. It was determined that blistering occurred after thermoprocessing and that blisters are the sites of future corrosion. Under Part B, accelerated corrosion tests were performed on coated tin-plated steel and coated tin-free steel with intentional defects (i.e., scratches) in contact with various foods. The galvanic current generated between steel and tin in these foods was also measured. Results showed that the tin-plated substrate provided two to three times more corrosion protection than the tin-free substrate, and that the greater the galvanic current, the greater the relative protection provided by the tin-plate.
DTIC
Coatings; Evaluation; Data Acquisition; Corrosion Tests; Corrosion Prevention; Accelerated Life Tests; Tin

24
COMPOSITE MATERIALS

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

19980201951 California Univ., Dept. of Chemical Engineering and Materials Science, Davis, CA USA
Modeling the Mechanical Behavior of Aluminum Laminated Metal Composites During High Temperature Deformation ***Final Report, 1 Sep. 1993 - 31 Aug. 1997***
Grishber, R. B., California Univ., USA; Mishra, R. S., California Univ., USA; Mukherjee, A. K., California Univ., USA; Dec. 29, 1997; 23p; In English
Contract(s)/Grant(s): F49620-93-1-0466
Report No.(s): AD-A339080; AFRL-SR-BL-TR-98-0218; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A constitutive model for deformation of a novel Laminated Metal Composite (LMC) which is comprised of 21 alternating layers of Al 5182 alloy and Al 6090/SiC/25p Metal Matrix Composite (MMC) has been proposed. The LMC as well as the constituent or neat structures have been deformed in uniaxial tension within a broad range of strain rates (i.e. 10(exp-6) to 10/s) and moderate to high homologous temperatures (i.e. 0.3 greater than or equal to 0.95 T(sub m)). The LMC structure exhibits a behavior somewhat closer to the MMC layers. The results of these experiments have lead to a thorough characterization of the neat layer's mechanical behavior and a subsequent semi-empirical constitutive rate equation for both the Al 5182 and Al 6O9O/SiC/25p. These predictive relations for the neat layers have been coupled with a proposed model for deformation. This deformation model has led to the development of a constitutive relationship between flow stress and applied strain rate for the laminated structure which has been compared with experimental data.
DTIC
Mathematical Models; Metal Matrix Composites; Deformation; Laminates

19980202321 Materials Sciences Corp., Fort Washington, PA USA
Fiber Composite Analysis and Design: Composite Materials and Laminates, Volume 1 ***Final Report***
Hashin, Z., Materials Sciences Corp., USA; Rosen, B. W., Materials Sciences Corp., USA; Humphreys, E. A., Materials Sciences Corp., USA; Newton, C., Materials Sciences Corp., USA; Chaterjee, S., Materials Sciences Corp., USA; Oct. 1997; 338p; In English
Contract(s)/Grant(s): DTFA03-92-P-01952
Report No.(s): AD-A340559; DOT/FAA/AR-95/29-VOL-1; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This document, originally published as Federal Aviation Administration (FAA) technical report DOT/FAA/CT-85/6, provides an extensive background on the characteristics and mechanics of fiber reinforced composites which permits engineers experienced in the evaluation of structures involving conventional materials specially metals to extend their competence to the assessment of fibrous composite structures. The emphasis is on the definition of the nature and magnitude of the differences associated with the use of composites rather than conventional materials and especially toward the elucidation of the reasons for the differences and their implications for design evaluation. Accordingly, a broad spectrum of technologies is involved, ranging from detailed methods of analysis to the more qualitative discussions on methods of analysis and design. The material is divided into two major categories: (1) composite materials and laminates, treated in this volume, and (2) structures, presented as volume II in a separate FAA technical report (DOT/FAA/CT-88/18) which is currently undergoing similar revision and should be available

early in 1998. The present volume has been revised to include significant advancements in the state of the art in the design of composite structures as well as in the mechanics analysis of composites.
DTIC
Composite Structures; Fiber Composites; Laminates; Structural Analysis

19980202505 Louisiana State Univ., Dept. of Physics and Astronomy, Baton Rouge, LA USA
International Conference: Computer-Aided Design of High-Temperature Materials ***Final Report, 1 May - 30 Sep. 1997***
Kalia, Rajiv K., Louisiana State Univ., USA; Vashishta, Priva, Louisiana State Univ., USA; Apr. 20, 1998; 83p; In English
Contract(s)/Grant(s): F49620-97-1-0265; AF Proj. 2306/BS
Report No.(s): AD-A342689; AFRL-SR-BL-TR-98-0389; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

From July 30 - August 2, 1997 we organized an AFOSR supported international conference in Santa Fe, NM. The focus of the conference was on high temperature materials with applications in defense technologies. The conference was attended by experimental and computational materials scientists, and experts in high performance computing and communications from universities, government laboratories, and industries in the U.S., Europe, and Japan. The topics covered at the meeting were: Synthesis, processing, and characterization of high temperature materials; new algorithms and techniques for computer aided design of materials; and virtual environments for materials design. The proceedings of the conference will published by the Oxford University Press.
DTIC
Computer Aided Design; Composite Materials; High Temperature

19980202633 Naval Postgraduate School, Monterey, CA USA
Creep Behavior of the Interface Region in Continuous Fiber Reinforced Metal-Matrix Composites
Funn, John V., Naval Postgraduate School, USA; Sep. 1997; 107p; In English
Report No.(s): AD-A341255; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The accurate incorporation of interface effects on creep in metal matrix composites is contingent on the direct experimental determination of the deformation kinetics. The goal is accomplished by isolating the composite interface and precisely measuring the creep characteristics of the interface, by utilizing a fiber-pushout apparatus to apply a constant force on the fiber of a model single fiber composite (SFC), so that the interface can creep under the applied shear stress. Two different model fiber/matrix systems one with no mutual solubility and the other with limited mutual solubility were investigated. In both systems, the interface displayed Bingham flow (diffusional flow with a threshold stress). The Finite Element Method (FEM) was utilized to check the conceptual validity of the test approach for one of the model systems, and to provide insight into the design of the sample and test apparatus. FEM was also utilized to estimate the residual radial stresses present in the model composite system following cooling from an elevated to ambient temperature. Based on the experimental results and the FEM analysis, an analytical model is advanced to incorporate the effect of radial residual stresses on the creep of the fiber/matrix interface. The model yields an explicit constitutive law which describes the stress, temperature, and matrix property dependence of interfacial creep. The model also indicates that the experimentally observed threshold stress is directly attributable to the radial stress acting on the fiber/matrix interface.
DTIC
Metal Matrix Composites; Creep Properties; Fiber-Matrix Interfaces; Fiber Composites

19980202688 Materials Engineering Research Lab. Ltd., Hertford, UK
Accelerated Methods for the Determination of Long Term Fatigue Properties of Glass Reinforced Plastics for Rotor Craft Applications ***Final Report, Jun. 1996 - Nov. 1997***
Martin, Roderick H., Materials Engineering Research Lab. Ltd., UK; Nov. 1997; 85p; In English
Contract(s)/Grant(s): N68171-96-C-9061
Report No.(s): AD-A340938; ERO-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The aim of this work was to develop an accelerated and cost effective method of generating long term fracture data for use in life prediction analysis of structures. Two materials were used in this project. These were S2/8552 and S2/F584, both glass epoxy systems. Delamination onset was monitored at both 5 Hz and 20 Hz and no difference in cycles to delamination onset was identified. It was concluded that longer term tests could be run at between 15 and 20Hz to represent structural tests at 5Hz. A multistation fatigue machine was modified to allow up to six composite DCB test pieces to be tested at the same time. Each station had its own instrumentation to monitor individual specimens for compliance changes. The machine operated electro-mechanically. The multistation machine was used to generate delamination onset data up to io8 cycles at 17 Hz for both materials. For both materials a consistent decrease in the values of G between 10(exp 0) and 10(exp 8) cycles was observed. It was estimated that the

increase in frequency and the use of an electromechanical multistation fatigue machine, reduces the cost of generating long term fatigue data to under 5% of that using conventional testing approaches.
DTIC
Life (Durability); Fatigue (Materials); Glass Fiber Reinforced Plastics; Accelerated Life Tests

19980202921 Aerospace Corp., Technology Operations, El Segundo, CA USA
Fiber Strength Utilization in Carbon/Carbon, Part 2, Composites Extended Studies With Pitch- and PAN-Based Fibers
Zaldivar, R. J., Aerospace Corp., USA; Relick, G. S., Aerospace Corp., USA; Yang, J. M., Aerospace Corp., USA; Jan. 15, 1998; 23p; In English; Prepared in collaboration with California Univ., Los Angeles, CA.
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A341676; TR-94(4935)-2; SMC-TR-98-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Measurements of fiber strength utilization (FSU) in unidirectional carbon/carbon (C/C) composites as a function of heat treatment temperature (HTT) have been extended beyond the original group of DuPont pitch-based E-series fibers to include additional pitch and PAN-based fibers. Fibers and composites were characterized by tensile strength, optical microscopy, SEM, fiber preferred orientation, and a single fiber composite (SFC) fragmentation test to provide a relative measure of fiber-matrix interfacial shear strength (IFSS). Results show that fracture behavior and FSU are dominated by the degree of fiber-matrix bonding, as inferred from microscopic observations and measurements of IFSS. In the very high modulus pitch-based fibers, the behavior of the E130 is strikingly different from that of the Amoco and Nippon Oil fibers, in that it retains good bond strength and high FSU even with HTT to 2400 C, in contrast to the other very high modulus pitch-based fibers that are already weakly bonded at the lowest HTT of 1100 C. All PAN based fibers and lower modulus pitch fibers are characterized by strong bonding, brittle fracture, and low FSU for the 1100 C HTT. Subsequent heat treatment of these composites to 2150 and 2400 C, in most cases, results in significant recovery of FSU, suggesting an optimum IFSS for each composite. It is suggested that the difference in bonding between the pitch-based E-series and P-series may be related to the similarity in fine structure between the E-fibers and high-modulus PAN-based fibers.
DTIC
Heat Treatment; Fiber Strength; Technology Utilization; Carbon-Carbon Composites; Mechanical Measurement; Fracture Mechanics

19980202967 Bristol Univ., Dept. of Aerospace Engineering, UK
Through thickness fatigue failure of fibre-reinforced composites
Wisnom, M. R., Bristol Univ., UK; Jones, M. I., Bristol Univ., UK; Golden Jubilee; Special Issue to Commemorate the 50th Anniversary of the Department of Aerospace Engineering, Bristol University; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 83-88; In English; Also announced as 19980202964
Contract(s)/Grant(s): EPSRC-GR/J/08393
Report No.(s): Paper-2264; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only
Simple straight and curved beams of unidirectional glass-epoxy were tested in fatigue to investigate failure under overall interlaminar tension and shear combined with local stresses at cut plies. Similar behavior was observed as under static loading, with overall and local stresses interacting to cause delamination. When normalized, all the results lay close to, or above, a line determined from previous tension tests on specimens with cut plies, suggesting that this could be used as the basis for through thickness fatigue strength calculations.
Author
Epoxy Matrix Composites; Glass Fibers; Fatigue Tests; Structural Failure; Curved Beams; Bending Fatigue; Beams (Supports); Fiber Composites

19980202970 Bristol Univ., Dept. of Aerospace Engineering, UK
Innovative approaches to composite structures
Potter, K. D., Bristol Univ., UK; Wisnom, M. R., Bristol Univ., UK; Lowson, M. V., Bristol Univ., UK; Adams, R. D., Bristol Univ., UK; Golden Jubilee; Special Issue to Commemorate the 50th Anniversary of the Department of Aerospace Engineering, Bristol University; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 107-111; In English; Also announced as 19980202964
Report No.(s): Paper-2267; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only
The precise birth date of the aerospace composites industry cannot readily be identified; perhaps one should really talk about its rebirth as the first aircraft relied on natural composites such as wood. McMullen gives 1946 as the date that work on cellulose based composites for aircraft use was abandoned in favour of much more stable inorganic reinforcement fibres. This change in the direction of approach was crucial to further developments and can be thought of as marking the start of the aerospace compos-

ites industry that can be seen today. Whatever the exact date the industry is now about 50 years old so this golden jubilee edition seems an appropriate place to look at the constraints on the use of composite materials and at recent work at Bristol University aimed at reducing these constraints. A suitable starting point for this investigation is a simple comparison of ”headline” mechanical properties between aluminium alloy and carbon fibre composites. A good engineering aluminium alloy will have a yield strength in the region of 50 MPa at a specific gravity of 2.8 whereas a good CFRP laminate in unidirectional form can exhibit a tensile strength close to 3000 MPa at a specific gravity of 1.6. The carbon fibre based material exhibits a specific strength about ten times as high as that of the aluminium. In terms of specific stiffness the advantage of the carbon fibre is not quite so spectacular, being only tour times higher than that of the metal. In addition the carbon fibre materials are much less sensitive to fatigue, do not corrode in the normal sense of the word, and can readily be fabricated into complex geometries. It might be expected, therefore, that in the thirty years or so since the development of the first reinforcing carbon fibres there would have been a wholesale replacement of aluminium by CFRP as the material of first choice for aircraft construction. While there has been a steady increase in the amount of composites used in commercial aircraft and whole airframes have been made in composites for small and military aircraft there has not been wholesale replacement of aluminium by carbon fibre composites in general aviation. The main reason for this is, perhaps, that the comparisons between properties made above are essentially fallacious when current design approaches are used. While it is true that CFRP in its unidirectional form has a very much higher specific strength and stiffness than aluminium, its mechanical properties when tested in any direction other than along the fibres are very low. As most structures have to carry loadings in many directions, each loading direction requires its own reinforcement thus diluting the advantages available from the composite. Even when the fibres are arranged in three or four directions to give the commonly used quasi-isotropic laminate, the specific strength might be three times as high compared to aluminium and the specific modulus about 40% higher. In addition to the purely structural issues, practical components operate within an environment where they may become damaged and require repair. For composite components to be utilized repair techniques have to be devised and the necessity for a repairable structure can be a major design requirement. Another important influence on the design of composite parts is the definition of how they will be assembled up into larger structures. This impacts both on the structural design and the manufacturing approaches as different manufacturing routes can be very different with regard to geometrical tolerances and similar issues.
Derived from text
Composite Structures; Aluminum Alloys; Aircraft Construction Materials; Carbon Fibers; Fiber Composites; Composite Materials; Weight (Mass)

19980203097 NASA Langley Research Center, Hampton, VA USA
Crash-Energy Absorbing Composite Structure and Method of Fabrication
Kellas, Sotiris, Inventor, NASA Langley Research Center, USA; Carden, Huey D., Inventor, NASA Langley Research Center, USA; May 05, 1998; 8p; In English
Patent Info.: Filed 20 Mar. 1996; NASA-Case-LAR-15397-1; US-Patent-5,746,537; US-Patent-Appl-SN-624843; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A stand-alone, crash-energy absorbing structure and fabrication method are provided. A plurality of adjoining rigid cells are each constructed of resin-cured fiber reinforcement and are arranged in a geometric configuration. The geometric configuration of cells is integrated by means of continuous fibers wrapped thereabout in order to maintain the cells in the geometric configuration. The cured part results in a net shape, stable structure that can function on its own with no additional reinforcement and can withstand combined loading while crushing in a desired direction.
Official Gazette of the U.S. Patent and Trademark
Composite Structures; Fabrication; Fiber Composites; Energy Absorption; Resin Matrix Composites

19980203123 Materials Sciences Corp., Fort Washington, PA USA
Composite Material Modeling for Blast Protection ***Final Report, 2 May - 1 Nov. 1996***
Yen, Chian–Fong, Materials Sciences Corp., USA; Jones, Mark L., Materials Sciences Corp., USA; Mar. 1997; 78p; In English
Contract(s)/Grant(s): DAAB-12-96-C-0013
Report No.(s): AD-A340968; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The USMC/USA has been successfully developing crew/vehicle protection kits (CPK) to provide increased crew survivability of tactical wheeled vehicles subject to mine blast. However, these CPK’s are currently based on a conventional steel/aluminum construction and are close to 1/2 ton in weight. As may be expected, there are payload and mobility penalties associated with the utilization of these devices in the field. Use of lightweight composite material elements presents an opportunity for significant weight savings. It may be readily seen that efficient composite design requires an integrated approach whereby, the material selection, material construction, and response of the structure are all considered concurrently. In general, hydrocodes, however, have been developed mainly for isotropic structures. Phase I of this study has demonstrated that dynamic structural It may be readily

seen that efficient composite design requires an integrated approach whereby, the material selection, material construction, and response of the structure are all considered concurrently. In general, hydrocodes, however, have been developed mainly for isotropic structures. Phase 1 of this study has demonstrated that dynamic structural analysis with the presence of shock waves can be accomplished by the integration of composite material models with a hydrocode. Further research efforts are needed to fully implement these composite material models with the hydrocode and validate the modeling capability for USMC composite structures.
DTIC
Software Engineering; Composite Materials; Dynamic Structural Analysis; Mechanical Properties; Kits

19980203193 Aerospace Corp., Technology Operations, El Segundo, CA USA
Fiber-Matrix Interphase Development in Carbon/Carbon Composites
Rellick, G. S., Aerospace Corp., USA; Zaldivar, R. J., Aerospace Corp., USA; Adams, P. M., Aerospace Corp., USA; Jan. 15, 1998; 15p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A341620; TR-94(4935)-14; SMC-TR-98-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In carbon/carbon (C/C) composites-i.e., a composite in which a carbon matrix is reinforced with carbon fiber when the matrix is derived from a thermosetting resin, we always observe a distinct, highly graphitizable, and well-oriented matrix interphase structure adjacent to the fibers. Qualitatively, the orientation of the interphase is the same as the fiber. It is important to note that thermosetting resins are non-graphitizing when heated in bulk; they form isotropic, amorphous 'glassy' carbon. The structure of this interphase becomes more prominent, i.e., more graphitic, as the heat treatment exceeds about 2200 deg C. We have postulated elsewhere that the basis for this graphite interphase development is molecular orientation induced in the degradation of the polymer matrix to carbon as a consequence of restraint of pyrolysis shrinkage at the fiber/matrix interface. More specifically, we have hypothesized that the critical factor for development of lamellar graphite (by subsequent high temperature heat treatment) in this interphase, rather than amorphous glassy carbon, is a state of multiaxial tensile deformation during pyrolysis. We have studied the structural details of the interphase region in more detail using transmission electron microscopy in conjunction with Selected Area (electron) Diffraction (SAD). We have also examined the influence of matrix microstructure on fracture behavior by using an in situ SEM flexure stage that allowed us to follow the crack tip as it advanced through the different microstructural regions. The development of a graphitized carbon interphase can have major effects on properties. Two are discussed in this publication. The first is the effect on matrix density and associated matrix shrinkage. The other is the effect on mechanical properties.
DTIC
Fiber-Matrix Interfaces; Carbon Fibers; Amorphous Materials; Mechanical Properties; Carbon-Carbon Composites

19980203194 Adherent Technologies, Inc., Albuquerque, NM USA
Fiber Finishes for Improving Galvanic Resistance of Imide-Based Composites ***Final Report, Aug. 1994 - Sep. 1996***
Allred, Ronald E., Adherent Technologies, Inc., USA; Jensen, Richard E., Adherent Technologies, Inc., USA; Donnellan, Thomas A., Adherent Technologies, Inc., USA; Williams, Theotis, Jr., Adherent Technologies, Inc., USA; Feb. 12, 1998; 58p; In English; Prepared in collaboration with Northrop Grumman Corp., Bethpage, NY
Contract(s)/Grant(s): N62269-94-C-1243
Report No.(s): AD-A341614; NAWCADPAX-98-8-TR; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The objective of this program is the development and demonstration of galvanic corrosion resistant carbon/ BMI composites through the use of reactive finishes to form coatings that isolate the carbon fibers from the BMI matrix. A family of novel reactive coupling agents was formulated into based phenolic finishes for carbon and graphite fibers that will subsequently react with the fiber and matrix resin during processing to form chemical bonds at the interface and in the interphase. In this process, each fiber is coated uniformly with the phenolic finish and bonded to the finish before the BMI prepregging process. The finish serves to isolate the carbon fibers from the BMI matrix and interrupts the galvanic cell. The addition of reactive finishes to fiber surfaces serves the dual purposes of protection of the fiber during handling and alteration of the interphase in the cured composite. The surface protection aspect of finishes will become even more critical as composites technology focuses on the use of 3-D braids and weaves for development of low cost composite processes, such as transfer molding. The reactive finish approach will provide a cost efficient means of improving galvanic corrosion resistance in composites with an BMI formulation.
DTIC
Finishes; Carbon Fibers; Corrosion Resistance; Technology Utilization; Coatings; Zinc Coatings

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.

19980201895 Coordinating Research Council, Inc., Atlanta, GA USA
Biodesulfurization of Gasoline: A Technology Roadmap
Atlas, R. M., Coordinating Research Council, Inc., USA; Boron, D. J., Coordinating Research Council, Inc., USA; Deever, W. R., Coordinating Research Council, Inc., USA; Johnson, A. R., Coordinating Research Council, Inc., USA; McFarland, B. L., Coordinating Research Council, Inc., USA; Apr. 1998; 96p; In English
Report No.(s): PB98-144629; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

CRC formed a panel to examine available information on the status of biodesulfurization and compile a report that: identified the processes that may work and the research that is critical for the commercial application of biocatalysis to refining gasoline; addressed major research directions, specific research projects, and goals for each recommended project area; and discussed how biotechnology could be integrated into over-all refinery processes. This report presents the findings of this panel in response to the objectives stated by the CRC.
NTIS
Gasoline; Refining; Sulfur Compounds; Bioprocessing; Biotechnology

19980201956 National Inst. of Standards and Technology, Fire Science Div., Gaithersburg, MD USA
Burning Behavior of Selected Automotive Parts from a Minivan
Ohlemiller, T. J., National Inst. of Standards and Technology, USA; Shields, J. R., National Inst. of Standards and Technology, USA; Mar. 1998; 90p; In English
Report No.(s): PB98-144462; NISTIR-6143; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Selected functional parts from a minivan were subjected to a gas flame ignition source and burned in a manner that allowed measurement of the resulting total heat release rate, mass loss and heat fluxes to the surroundings. This study was undertaken to: (1) assess a possible means for determining the flammability characteristics of automotive components, (2) obtain data on the range of flammability behavior exhibited by such components and the physical processes underlying that behavior, and (3) obtain insights into the fire behavior seen in related full-scale vehicle fires. For most of the vehicle components examined in this study, a significant aspect of the burn behavior was the development of a polymer melt pool fire below the part.
NTIS
Automobiles; Flammability; Combustion; Fires; Structural Members

19980202187 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA
34th JANNAF Combustion Subcommittee Meeting, Volume 1, *8 Nov. 1996 - 27 Oct. 1997*
Fry, Ronald S., Editor, Johns Hopkins Univ., USA; Gannway, Mary T., Editor, Johns Hopkins Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997; 601p; In English; 34th, 27-30 Oct. 1997, West Palm Beach, FL, USA; Also announced as 19980202188 through 19980202234
Contract(s)/Grant(s): SPO700-97-D-4004
Report No.(s): CPIA-Publ-662; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Volume 1 is a compilation of 55 unclassified/unlimited distribution papers presented at the 1997 meeting of the JANNAF 34th Combustion Subcommittee (CS) held jointly with the Propulsion Systems Hazards Subcommittee (PSHS), and the Air-breathing Propulsion Subcommittee (APS) on 27-30 October 1997 at the Palm Beach Gardens Marriott Hotel in West Palm Beach, Florida. Proceedings of the CS, PSHS, and APS meetings are published separately by CPIA. The CS meeting proceedings are published in four volumes. The PSHS and APS proceedings are available as CPIA Pubs 657 and 666 respectively. The JANNAF papers in this volume review propellant technology, charge concepts, erosion, interior ballistics, and ignition for solid propellant guns; diagnostics and modeling for electrothermal chemical (ETC) guns; regenerative liquid propellant guns (RLPG) technology; hybrid rocket fuel properties; and thermal decomposition and cookoff in solid propellants.
Author
Conferences; Ammunition; Rocket Propellants; Interior Ballistics; Propellant Combustion

19980202188 Army Research Lab., Aberdeen Proving Ground, MD USA

A Preliminary Evaluation of the Effect of Radiation on Closed Chamber ETC Firings

Wren, G. P., Army Research Lab., USA; Oberle, W. F., Army Research Lab., USA; Hosangadi, A., Combustion Research and Flow Technology, Inc., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 9-19; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

A model of radiation from an ETC plasma is proposed to investigate bulk heating of the propellant. The radiant energy is transmitted to the solid propellant, the combustion chamber gases, and the chamber walls. A numerical simulation is used to compute the enhancement in the burning rate of the solid propellant as a result of the bulk temperature increase. The model is applied to a closed chamber ETC firing. The model indicates that absorption of radiant energy is efficient to increase the bulk temperature of the propellant to a level which would have a significant impact on the resulting propellant combustion.

Author

Radiation Effects; Guns (Ordnance); Solid Propellant Combustion; Solid Propellants; Gunfire; Gun Propellants; Combustion Chambers; Energy Transfer; Plasma Heating

19980202189 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

Plasma Radiative and Convective Interactions With Propellant Beds

Nusca, Michael, Army Research Lab., USA; White, Kevin, Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 21-33; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Studies have been carried out on convective and radiative energy distribution of a plasma generator output into a propellant bed. The interior ballistic code NGEN has been used to analyze the convective heating of a bed. The results have been compared with experiments in a cannon simulator where both conventional and plasma igniters were used (Perelmutter 1996b). Radiative absorption properties of a number of propellants have been determined in the visible and near UV spectral regions. These data are required for evaluating the radiation energy distribution within a bed from a plasma. These data and a radiation propagation code (Monte Carlo, non-sequential ray tracing) will be used to determine the radiative energy distribution within a propellant bed. Heat flux/fluence gages are described that will be used to measure and differentiate between the convective and radiative energy delivered to a propellant bed.

Author

Convective Heat Transfer; Plasma Interactions; Ballistics; Guns (Ordnance); Radiation Distribution; Gun Propellants

19980202190 Army Research Lab., Weapons Technology Directorate, Aberdeen Proving Ground, MD USA

Propellant Burn Rate Modification by Plasma Injection

DelGuercio, M., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 35-42; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

A study of the effect of plasma injection on the burning rates of single base, double base, triple base, and nitramine propellants, was conducted in a 129 cc closed chamber. These tests were performed at a 2.5 g/cc loading density and 0.8 kJ/g energy density, using a 1.2 milliseconds pulse width generated by a 400 kJ maximum Pulse Forming Network (PFN). A plasma capillary ratio of length over diameter (L/D) was increased for these tests from a previous 13 to 26 and its effect on the burn rates obtained is discussed.

Author

Burning Rate; Double Base Propellants; Nitramine Propellants; Ion Injection; Plasmas (Physics); Gun Propellants; Propellant Combustion; Propellant Tests

19980202191 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

Computational Simulation and Experimental Visualization of an Open-Air Plasma Discharge

Nusca, Michael J., Army Research Lab., USA; White, Kevin J., Army Research Lab., USA; Young, Theodore R., Naval Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 43-56; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The Army Research Laboratory (ARL) in cooperation with the Naval Research Laboratory (NRL) has begun a computational study of open-air plasma discharge experiments conducted at ARL. In this series of experiments a plasma jet was generated using a time-varying power pulse delivered to a plasma cartridge. Three distinct pulses were tested and in each case the unsteady flow

field resulting from the plasma jet was recorded photographically. The computational component of the study was based on the NRL computational fluid dynamics code FAST3D. This code was used to simulate a high velocity, low density, high temperature gas (which represents the plasma) being expelled into quiescent air from the same nozzle geometry used for the ARL open-air plasma tests. The APL plasma code was used to determine the nozzle conditions of this gas based on a specified power-time history supplied to a given plasma cartridge. Computed density and plasma efflux contours are compared with a time sequence of photographs taken of the plasma jet. Details of the shock structure in the jet are revealed by these simulations which enhances the understanding of the nature of plasma jets.
Author
Computerized Simulation; Flow Visualization; Plasma Jets; Unsteady Flow; Cartridges; Plasmas (Physics); Rarefied Gases; Computation; Magnetohydrodynamic Flow; Plasma Generators; Firing (Igniting)

19980202192 North Carolina State Univ., Dept. of Nuclear Engineering, Raleigh, NC USA
Simulation of Plasma-Surface Interactions in Electrothermal-Chemical Devices: Progress on the 2-D Code TURBFIRE
Orton, N. P., North Carolina State Univ., USA; Tucker, E. C., North Carolina State Univ., USA; Gilligan, J. G., North Carolina State Univ., USA; Doster, J. M., North Carolina State Univ., USA; Bourham, M. A., North Carolina State Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 57-63; In English; Also announced as 19980202187
Contract(s)/Grant(s): N00014-95-1-1221; DAAH04-95-1-0214; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Plasma-surface interactions are of great interest for the design and modeling of electric launchers. We are developing a 2-D boundary layer code which includes turbulence and radiation transport, to predict mass evolution rates at plasma-surface interfaces. This code, TURBFIRE, will aid in the understanding of vapor shielding and the effects of turbulence on energy transport to the surface. It has been previously shown that absorption of radiation is the dominant mechanism of heating and ablating plasma-facing components, and that conduction is small. Experimental results suggest that turbulence enhances radiation transport through the turbulent mixing of hot outer fluid with the cooler fluid near the surface. Previous models have not combined radiant energy transport with turbulent convection in a self-consistent manner. Currently, TURBFIRE allows the determination of energy transport to the surface via both radiation and conduction. The system has been modeled using fluid boundary layer equations, including a two-equation (k-omega) model for turbulence, coupled with multigroup thermal radiation transport. Preliminary results show that near-wall temperature and radiation transport to the surface are much greater for turbulent flow than for laminar flow. These preliminary results assume a heat capacity (C(p)) that varies only slightly with temperature. When a more realistic heat capacity was used, problems with stability were encountered. to stabilize the code, the heat capacity has been removed from the energy equation by rewriting it in terms of internal energy. Preliminary results with surface ablation are also presented.
Author
Energy Transfer; Boundary Layer Equations; Plasma Interactions; Radiation Transport; Surface Reactions; Thermal Radiation; Turbulent Flow; Computerized Simulation; Fluid Boundaries; Computer Programs; Mass Flow Rate

19980202193 Army Research Lab., AMSRL, Aberdeen Proving Ground, MD USA
Workshop Report: Laser Ignition of Propellants
Beyer, Richard A., Army Research Lab., USA; Perazzo, Cynthia W., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 127-133; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

A workshop was held at the 1996 JANNAF Combustion meeting on laser ignition of propellants. The impetus for the meeting was the success of the application of laser ignition to the Army's latest generation of 155-mm cannon. The goal was to show the success of the program but also to highlight the many areas where progress still was required to meet all objectives. Twelve speakers from government, industry, and academia spoke of a wide variety of topics from the gun systems and other systems where laser ignition has been used successfully through fundamental studies of laser ignition. Wide ranging discussions were held on the related topics. This report is a summary of the presentations and some of the key points raised during the discussions.
Author
Ignition; Lasers; Ignition Systems; Propellant Combustion; Laser Applications

19980202194 Army Research Lab., AMSRL, Aberdeen Proving Ground, MD USA
Laser Ignition in a Medium Caliber Gun: A Study of Igniter Influence in Action Time
Beyer, Richard A., Army Research Lab., USA; Hirlinger, John M., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 135-141; In English; Also announced as

19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Laboratory experiments and 30 mm caliber guns tests have been pursued in order to explore the action time of the M230 gun using laser ignition. The laboratory tests explored the response of black powder to energy levels from 0.2 to 0.5 J. Tests with class 5 and class 7 BP show that response will probably not be fast enough to use BP as the primary initiator for this gun unless more laser energy is available. The limitation is in the time required for initial laser ignition of the black powder. In the gun tests, pyrotechnic materials were also used and showed excellent response times, well under the 4 ms requirement. Those tested include perchlorates and would not be acceptable for gun use. Several possible cartridge igniter configurations were tested. Low cost windows were successfully demonstrated.

Author

Ignition; Lasers; Guns (Ordnance); Gun Propellants; Igniters; Ignition Systems

19980202196 Army Research Lab., Aberdeen Proving Ground, MD USA

Direct Laser Ignition of Gun Propellants: Simulator Tests of Modular Charges

Howard, S. L., Army Research Lab., USA; Beyer, R. A., Army Research Lab., USA; Reeves, P., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 153-161; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Observations have been made to assess the possibility of obtaining sufficiently rapid flame spread in a multi-increment modular charge bed without using traditional igniter materials. A 150-mm-diameter simulator was used with 150-mm-long propellant modules. The first propellant module was ignited by laser and the flame spread through the multi-increment propellant bed recorded by high-speed film and pressure-time histories. Initial results were obtained with energetic material in the center core of each module and inert propellant in the module.

Author

Flame Propagation; Gun Propellants; Ignition; Simulators; Igniters; Lasers

19980202197 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

Predicting Convective Ignition Delay of Solid Propellant Based on Flame Zone Chemical Decomposition Schemes

Kooker, Douglas E., Army Research Lab., USA; Kotlar, Anthony J., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 163-180; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

This study attempts to evaluate an earlier hypothesis that convective ignition of solid propellant is controlled by the combined influence of the low-pressure flame zone structure and the regression rate. Specifically, before the final flame zone has a chance to form, intermediate gas-phase products evolving from the propellant surface can be swept away into a cooler part of the chamber, and ignition must wait for a runaway reaction in this reactive mixture. An interior ballistic model was modified to include a general description of finite-rate chemical decomposition of reactive gases anywhere in the chamber. Combustion of solid propellant is idealized as a quasi-steady regression rate which is only a function of pressure, together with the possibility of incomplete energy release which generates reactive intermediate gas-phase species. Chemical decomposition schemes for the 'dark' flame region of both a double-base and nitramine propellant were taken from the independent work of Illincic, Anderson, Seshadri & Meagher. A combustion submodel was constructed for a typical double-base and a typical nitramine propellant. Comparison of model predictions with data from the flamespreading chamber experiment of Kooker, Howard and Chang shows that convective ignition is significantly influenced by: (a) the change in flame zone structure with pressure, and (b) the low-pressure regression rate. Somewhat surprising was the result that finite-rate decomposition of the intermediate reactive species in the chamber may be too slow to control ignition delay.

Author

Solid Propellants; Ignition; Flame Propagation; Propellant Combustion; Propellant Properties; Models; Double Base Propellants; Nitramine Propellants

19980202198 Army Research Lab., Aberdeen Proving Ground, MD USA

Irradiance Requirements for the Laser Ignition of Pyrotechnics: Thermal Conductivity and Thermal Diffusivity Considerations

McQuaid, M. J., Army Research Lab., USA; Beyer, R. A., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 181-187; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Room-temperature thermal diffusivity and thermal conductivity values for five pyrotechnic compounds - black powder, red powder. B/KNO3, A1A, and Zr/KClO4 - were experimentally determined. The values were found to fall in a range bounded by polymethylmethacrylate (PMMA) and fused silica, and to be slightly higher than those reported for solid gun propellants. In order to assess the influence of these parameters on the irradiance requirements for the laser ignition of such materials, the experimentally obtained values were employed as input to a 1-D heat transfer description of the thermal transient to the auto-ignition temperature. Computed differences in irradiance requirements for the compounds studied are discussed.
Author
Gun Propellants; Heat Transfer; Irradiance; Thermal Conductivity; Thermal Diffusivity; Igniters; Solid Propellant Ignition; Ignition Systems; Lasers; Pyrotechnics

19980202200 Army Research Lab., Aberdeen Proving Ground, MD USA
Novel Solid Propellant Temperature Testing in a 30-mm Laboratory Gun Fixture
Colburn, Joseph W., Army Research Lab., USA; Johnson, Andrew W., Army Research Lab., USA; Juhasz, Arpad A., Army Research Lab., USA; Bullock, Charles D., Army Research Lab., USA; Ridgley, Melvin, Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 207-216; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The costs associated with initial evaluation of novel gun propellant formulations in a full size (105-mm, 120-mm or 155-mm) gun system can be prohibitively high. to reduce the costs and make cooperative propellant research more attractive to industry, a family of medium-caliber test fixtures, requiring moderate amounts of propellant for each test, were designed, fabricated, proof tested, and are currently in use. Included among these fixtures is an igniter test fixture for development of controlled ignition stimuli, a 30-mm gun for ballistic performance evaluation and a 30-mm short gun/interrupted bumer for propellant ignition and burning studies. These fixtures use common components to provide equivalent conditions through a broad range of tests. This paper provides an overview of the design of the family of test fixtures, a brief look at the development and testing of the custom igniter used in all tests and highlights of the smooth and well-predicted gun and short gun proof test series conducted with M30 propellant. The results from a temperature conditioned test series conducted using ARDEC 7994, an RDX based propellant are detailed. Results from the test firings are analyzed and the pressure data are compared to calculations made using closed bomb burning rate data supplied by the US Army Armament Research Development and Engineering Center (ARDEC).
Author
Ballistics; Gun Propellants; Propellant Combustion; Costs; Igniters; Test Equipment; Fixtures; Combustion Temperature; Solid Propellants

19980202211 Sandia National Labs., Combustion Research Facility, Livermore, CA USA
Hydrodynamic Instability in an Extended Landau/Levich Model of Liquid-Propellant Combustion at Normal and Reduced Gravity
Margolis, S. B., Sandia National Labs., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 355-371; In English; Also announced as 19980202187
Contract(s)/Grant(s): DE-AC04-94AL-85000; MSR-C-32031-E; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The classical Landau/Levich models of liquid-propellant combustion, despite their relative simplicity, serve as seminal examples that correctly describe the onset of hydrodynamic instability in reactive systems. Recently, these two separate models have been combined and extended to account for a dynamic dependence, absent in the original formulations, of the local burning rate on the local pressure and temperature fields. The resulting model admits an extremely rich variety of both hydrodynamic and reactive/diffusive instabilities that can be analyzed either numerically or analytically in various limiting parameter regimes. In the present work, a formal asymptotic analysis, based on the realistic smallness of the gas-to-liquid density ratio, is developed to investigate the combined effects of gravity and other parameters on the hydrodynamic instability of the propagating liquid/gas interface. In particular, an analytical expression is derived for the neutral stability boundary A(p)(k), where A(p) is the pressure sensitivity of the burning rate and k is the wavenumber of the disturbance. The results demonstrate explicitly the stabilizing effect of gravity on long-wave disturbances, the stabilizing effect of viscosity (both liquid and gas) and surface tension on short-wave perturbations, and the instability associated with intermediate wavenumbers for negative values of A(p). In the limiting case of weak gravity, it is shown that hydrodynamic instability in liquid-propellant combustion is a long-wave instability phenomenon, whereas at normal gravity, this instability is first manifested through O(1) wavenumber disturbances. it is also demonstrated that, in general, surface tension and the viscosity of both the liquid and gas phases each produce comparable stabilizing effects in the long-wave-

number regime, thereby providing important modifications to previous analyses in which one or more of these effects were neglected.
Author
Liquid Rocket Propellants; Propellant Combustion; Burning Rate; Hydrodynamics; Gravitational Effects; Microgravity; Perturbation; Mathematical Models; Flow Stability

19980202215 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
AP Diffusion Flame Structure
Parr, T. P., Naval Air Warfare Center, USA; Hanson–Parr, D., Naval Air Warfare Center, USA; Smooke, M., Yale Univ., USA; Ilincic, N., Yale Univ., USA; Tanoff, M., Yale Univ., USA; Yetter, R., Princeton Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 413-422; In English; Also announced as 19980202187
Contract(s)/Grant(s): N00014-97-WX-20347; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The counterflow diffusion flame configuration is demonstrated to be a very useful technique for studying ammonium perchlorate (AP) diffusion flame chemistry and structure in a controllable and diagnostically amenable fashion. Quantitative species and temperature profiles have been measured for four cases: two fuels, methane and ethylene, and two strain rates, given by two separations, 10 mm and 5 mm, between the fuel exit and AP surface. Species measured included CN, NH, NO, OH, soot, and PAH. Temperature was measured using radiation corrected thermocouples and OH rotational population distributions. The burning rate of the AP was also measured as a function of flame strain rate.
Author
Ammonium Perchlorates; Counterflow; Diffusion Flames; Propellant Combustion; Propellant Properties; Propellant Chemistry; Solid Rocket Propellants

19980202216 Hessler (R. O.), Sommerville, AL USA
Implications of Surface-Normal Burning in Modeling Composite Propellant Combustion
Hessler, R. O., Hessler (R. O.), USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 423-426; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The observation that solid propellants burn normal to a macroscopic surface is explored in the context of heterogeneous combustion modeling. Specific findings include identification of mean burning angles requiring non-planar burning of individual particles and burning of individual particles on significantly tilted axes, mathematical justification for surface texture, and a compatibility check for 3D combustion modeling elements.
Author
Composite Propellants; Combustion Chemistry; Solid Propellant Combustion; Mathematical Models

19980202218 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA
Spectroscopy of Inhibited Counterflow Diffusion Flames
Daniel, R. G., Army Research Lab., USA; McNesby, K. L., Army Research Lab., USA; Skaggs, R. R., Army Research Lab., USA; Sagear, P., Army Research Lab., USA; Miziolek, A. W., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 437-446; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

As part of the continuing effort to find an effective, yet safe, replacement compound for the commonly used halon fire suppression agent CF3Br, we have begun a study of reduced pressure counterflow diffusion flames inhibited with iron pentacarbonyl (Fe(CO)5). Iron pentacarbonyl has been shown to be a very effective fire suppression agent in small quantities, but there is little understanding to the mechanism of its activity. Unfortunately, FE(CO)5 is highly toxic and thus cannot be used in occupied spaces. The goal of this study is to understand the mechanism by which Fe(CO), inhibits flames by coupling experimental measurements with computer modeling of diffusion flames. Presented here are results from the spectroscopic examination of uninhibited and inhibited counterflow diffusion flames using emission spectroscopy of active flame species at reduced pressure. The species studied include OH, CH, C2, and iron and iron containing compounds. This project is part of the Next Generation Fire Suppression Technology Program (NGP).
Author
Diffusion Flames; Flame Retardants; Counterflow; Spectroscopy; Iron Compounds; Spectroscopic Analysis

19980202219 Army Research Lab., Aberdeen Proving Ground, MD USA

CN and NH Concentrations in RDX Flames Via Absorption Spectroscopy

Homan, B. E., Army Research Lab., USA; Vanderhoff, J. A., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 447-458; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

At the last JANNAF Combustion Meeting we reported on using 2D snapshot absorption spectroscopy to obtain temperature and concentration profiles for NO and OH in several propellant flames with a temporal resolution of 1 ms. In a continuing effort to expand the database for evaluation of detailed-chemistry-combustion- models, this technique has been applied to profiling two highly reactive, short-lived, diatomic species, CN and NH, in RDX flames at pressures varying from 1 to 2 atm. In order to obtain reasonable signal-to-noise for these species the path length for absorption was increased by about a factor of three via two reflections from partially aluminum coated chamber windows. Moreover, the one dimensionality of the burning RDX surface has been improved with a uniform C02 laser ignition stimulus. Resultant absorption spectra of the B(sup 2)Sigma(+) transitions for CN, A(sup 3)Pi - X(sup 3)Sigma(-) transitions for NH and the A(sup 2)Sigma - X(sup 2)Pi transitions for OH occurring over the wavelength ranges 384 - 389 nm, 335 - 337 nm and 306 - 311 nm, respectively were least squares fitted to obtain best values for concentration and/or temperature. Both OH and NH could be observed simultaneously with the spectral coverage of the spectrometer/grating combination used. In this way temperatures from fitting the OH spectra could be used for fitting the less well-resolved NH spectra. Peak CN mole fractions of about 200 ppm are obtained from absorption spectra of RDX burning in 1 atm. air, mole fractions for NH are about a factor of two lower. As the pressure is increased, the CN and NH species peak closer to the combusting surface and reside over a smaller spatial extent. Peak concentrations drop for these higher pressures, but may be due, at least in part, to limitations of the spatial resolution of the absorption experiment. During the course of these spectroscopic measurements, burn rates for RDX over a pressure range of 1 to 2 atm. have also been determined. These values range from 0.23 mm/s at atmospheric pressure to 0.50 mm/s at two atm. and are noticably lower than some of the other published measurements. Author

RDX; Absorption Spectroscopy; Burning Rate; Propellant Combustion; Mathematical Models; Flames; Nitrogen Compounds; Concentration (Composition)

19980202220 Emory Univ., Dept. of Chemistry, Atlanta, GA USA

Theoretical Calculations for the Kinetics of the NH + NO Reaction

Lin, M. C., Emory Univ., USA; Kristyan, S., Emory Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 459-466; In English; Also announced as 19980202187

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The reaction of (3)NH with NO producing H + N2O and N2 + OH has been investigated with the variational RRKM theory using existing potential energy surface data. The bimolecular constant for the loss of the reactants and those for the formation of N2O and N2 have been calculated and compared with experimental results. The agreement between theory and experiment appears to be satisfactory, although improvement in both areas of this important elementary reaction is desirable.

Author

Reaction Kinetics; Combustion Chemistry; Nitrogen Compounds; Propellant Combustion

19980202223 Army Research Lab., AMSRL, Aberdeen Proving Ground, MD USA

Experimental and Modeling Studies of Neat and NH3-Doped H2/N2O/Ar Flames

Sausa, R. C., Army Research Lab., USA; Venizelos, D. T., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 489-502; In English; Also announced as 19980202187

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A combined experimental and modeling study of neat and NH3-doped (Phi = 1), 30-Torr flames is reported. The major species concentrations are measured by molecular beam mass spectrometry (MB/MS) whereas the minor species OH, NH, and O-atom concentrations are measured by laser-induced fluorescence (LIF). The species NO is measured both by LIF and MB/MS, and O2 by NB/MS. The flame temperatures are measured both by OH and NH LIF and by thin wire-thermometry. The flames are modeled with PREMIX using the temperature profiles and several detailed chemical mechanisms as input. The mechanisms include the GRI2.11, SSLA, and their derivatives. The SSLA mechanism was developed previously in our laboratory from a critical literature review. Calculations using all the mechanisms predict fairly well the profiles of the major species for both neat and doped flames. However, both the SSLA and GRI2.11 calculations fail to predict the postflame O2 concentration in the neat flame, the drop in the O2 concentration with the addition NH3, and the NH3 decay in the doped flame. Sensitivity analyses suggest refinements to

the SSLA and GRI2.11 mechanisms. The experimental results are predicted rather well using a modified SSLA mechanism in which the NH + NO = N2O + H reaction rate is decreased and the N2O + M = N2 + O + M reaction rate and/or H2O third body efficiency is increased to the limit of their uncertainty. Rate analyses performed on the modeled calculations reveal the reactions important to NO, O2, NH, OH, and O-atom production and consumption, and NH3 consumption. These reactions are presented and discussed.
Author
Nitrogen Oxides; Hydrogen; Argon; Flames; Propellant Combustion; Mathematical Models; Combustion Chemistry; Mass Spectroscopy; Doped Crystals

19980202224 Alabama Univ., Huntsville, AL USA
Ultrasonic Instrument Development for Solid Propellant Burning Rate Measurement
McQuade, W. W., Alabama Univ., USA; Moser, M. D., Alabama Univ., USA; Frederick, R. A., Jr., Alabama Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 503-513; In English; Also announced as 19980202187
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Ultrasonics has been used with good success to measure the burning rate of solid rocket propellants for a number of years. When used in a closed bomb it provides data over a wide range of pressures in a single test saving time and material. There is however a number of questions as to how the roughness of the burning surface or the existence of a melt layer affect the ultrasonic signal. Also, the area of the burning surface probed by the ultrasonic signal is unknown. Inert and simulated propellant with known surface characteristics were used to determine the effect of surface roughness, etc. on the measurement. It was found that the 1-inch (25.4 mm) transducers used in this study could not detect imperfections smaller than 1/8 inch (3.2 mm) and the signal only sees the valley on large- scale roughness. The surface area ”seen” by a 1.0-in. transducer was experimentally determined to be a 0.5-in. diameter circle for the conditions investigated.
Author
Solid Rocket Propellants; Burning Rate; Surface Roughness Effects; Ultrasonics; Propellant Tests

19980202225 Hessler (R. O.), Sommerville, AL USA
Comparisons of Burning Rate Calculation Methods
Hessler, R. O., Hessler (R. O.), USA; Glick, R. L., Talley Defense Systems, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 515-520; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Burning rate calculation methods are applied to simulated rocket motor pressure histories to evaluate the intrinsic accuracy of available methods when the propellant grain is misaligned. The burning rate correction to reference pressure is shown to be exact when rate-averaged pressure is used, and to be biased low when time-averaged pressure is used. The results confirm that thickness/time rate is in error by the percent misalignment when only nominal web thickness is known, and that mass conservation rates avoid this problem at the expense of bias due to storage assumptions. A two-measurement method using thickness/time rate is shown to avoid both problems.
Author
Burning Rate; Solid Rocket Propellants; Solid Propellant Rocket Engines; Solid Propellant Combustion

19980202226 Hessler (R. O.), Sommerville, AL USA
An Analysis of Burning Rate Round-Robin Data
Hessler, R. O., Hessler (R. O.), USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 521-525; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Data from four simulated rocket motors are examined to determine propellant burning rate as part of the AGARD/PEP WG 27 Burning Rate Analysis Round Robin. Examination of the round robin data indicates that the design and execution of the simulations preclude conclusions with respect to mass balance burning rate definitions or with respect to end of burning time definitions. Primary burning rate data is based on derivative-based time point definitions for detection of the beginning and ending of burning. Secondary results, based on common ad hoc time point definitions for the beginning of burning time, are contrasted with the more rigorous derivative-based definitions. Pressure exponent and rate at reference pressure are calculated by the traditional method

of least-squares fitting of individual motor data and by the theoretically indicated iterative simultaneous reduction of the four motors with exponent as a parameter.
Author
Rocket Engines; Computerized Simulation; Burning Rate; Propellants; Propellant Combustion

19980202228 SNAPTech Corp., Iuka, MS USA
Burn Rate Factors to Consider
Jordan, Frank W., SNAPTech Corp., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 537-548; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The number of test vehicles and analysis methods used worldwide in the solid propellant rocket industry to obtain solid propellant burn rate data would appear to greatly exceed the number of interior ballisticians trying to obtain the data. The consequence of this large number of test vehicles and analysis methods is a large amount of poor quality/high cost burn rate data. Two factors are basically responsible for this quality/cost phenomena. First, most of the test vehicles were designed by management or project engineering personnel who had little understanding of how to obtain high quality burn rate data and how that data was to be used. Second, the skilled ballisticians either would not or could not devote the effort to learn the proper way to analyze the test data or to develop analysis tools capable of minimizing total uncertainty because of the NIHS (not invented here syndrome). Because of these factors, a very valiant effort on the part of several industry leaders, for several years, to ”standardize” burn rate test vehicles and analysis methods have been unsuccessful. Stalwarts like Ted Brooks, Ron Frye and Dr. Bob Glick have written many papers and spent many hours in committee meetings attempting to get an industry consensus. Although the author has spent thousands of hours perfecting high quality burn rate test vehicles and analysis methods, that effort has been directed toward gathering burn rate data for propellants that were relatively low cost (raw material cost less than $2/pound) and had moderate burn rates (mostly between 0.25 ips and 1.5 ips). When one considers the wide ranges of propellant raw material cost, burn rate, applications (air bags, ASRM, HIT & etc) and required total uncertainty, it becomes clear that no single standard test vehicle or analysis method will fit all situations. Rather than focus on a test vehicle and analysis method to achieve the most accurate burn rate, this paper focuses on methods to determine what is the most appropriate method to get the lowest cost burn rate that will adequately do the job. This paper shows that there are circumstances where liquid strand data is the most appropriate. It also shows that in some instances very tiny motors are appropriate, even if the data quality is not the best. The paper presents the rationale for selecting certain types of test vehicles over others and some unique approaches to getting more data from a test than just the burn rate and ways to better utilize the test vehicles now in use.
Author
Burning Rate; Solid Propellants; Costs; Solid Propellant Combustion; Propellant Tests; Test Vehicles; Test Stands

19980202401 Massachusetts Inst. of Tech., Dept. of Chemical Engineering, Cambridge, MA USA
Nanocrystalline Processing and Interface Engineering of Nitrides ***Progress Report, 1 Jan. - 31 Mar. 1998***
Ying, Jackie Y., Massachusetts Inst. of Tech., USA; Panchula, Martin L., Massachusetts Inst. of Tech., USA; Mar. 31, 1998; 4p; In English
Contract(s)/Grant(s): N00014-95-1-0626
Report No.(s): AD-A342774; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report describes preliminary results obtained from nitridation of nanocrystalline aluminum into nanocrystalline aluminum nitride. In comparison to commercial microcrystalline aluminum, the nanocrystalline aluminum displays significantly higher nitridation rates and does not require high temperatures to achieve significant conversion. Future research will examine the kinetics of the nitridation process and synthesizing nanocrystalline aluminum nitride directly in the forced flow reactor.
DTIC
Microstructure; Nitrides; Aluminum; Aluminum Nitrides; Microcrystals

19980202458 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
Mechanisms of Thin Film Growth and the Influence of Surface Chemistry on Film Growth and Properties ***Final Report, 1 Oct. 1990 - 30 Sept. 1997***
Lampert, William V., Air Force Research Lab., USA; Apr. 1998; 24p; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A342684; AFRL-ML-WP-TM-1998-4060; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This program was a fundamental research study of the mechanisms of thin film growth and the influence of surface chemistry on film growth and properties. The film growth techniques being emphasized include pulse laser deposition and molecular beam epitaxy. This is a bibliography of the publications generated by this program.
DTIC
Thin Films; Molecular Beam Epitaxy; Surface Reactions

19980202502 Naval Research Lab., Washington, DC USA
Overview of Smoke Toxicity Testing and Regulations
Beitel, Jesse J., Hughes Associates, Inc., USA; Beyler, Craig L., Hughes Associates, Inc., USA; McKenna, Lawrence A., Hughes Associates, Inc., USA; Williams, Frederick W., Naval Research Lab., USA; Apr. 15, 1998; 35p; In English; Prepared in collaboration with Hughes Associates, Inc.
Report No.(s): AD-A342016; NRL/MR/6180--98-8128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Historically, more people are injured and die from fire combustion products than from direct heat/flame exposure. Evaluations have shown that personnel remote from the source of a fire are particularly at risk from fire effluent from post flashover fire scenarios. Various test methods have been developed to assess the toxic potential of smoke from burning materials. These test methods are sensitive to the fire exposure (e.g., smoldering vs. flaming), size of the sample, and translation of the measured gases to toxic potential to humans in a real-scale scenario. Test methods use either bioassay methodologies (animal testing) or analytical techniques to establish toxic potency of burning materials. Available test methods are reviewed. Few jurisdictions currently regulate material toxicity in terms of specific criteria. Options for evaluating material toxic potency are outlined. These options should be considered in terms of the material use and hazard, other methods to reduce toxic hazard (e.g., by carefully regulating material ignition, flame spread, and heat release), and the introduction of new/novel materials for shipboard applications.
DTIC
Toxicity; Combustion Products; Temperature Effects; Heat Transfer; Toxic Hazards; Flame Propagation

19980202558 Nuclear Engineering Ltd., Japan
Application of EGS4 Monte Carlo Code to Design of Compton Suppression System
Nunoko, A., Nuclear Engineering Ltd., Japan; Shintani, H., Nuclear Engineering Ltd., Japan; Yamada, M., Nuclear Engineering Ltd., Japan; Murakami, R., Nuclear Engineering Ltd., Japan; Taniguchi, R., Osaka Prefecture Univ., Japan; Asano, T., Osaka Prefecture Univ., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 55-60; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only
We have been developing a new system for continuous measurement of the concentration of I-131 which exists in primary coolants at nuclear power plants. As the experimental and simulated values showed good agreement for the unique device with a Compton suppression system, the effectiveness of EGS4 code for spectrum analysis with the use of such a device has been proven. As a result, we have decided to use the EGS4 Monte Carlo simulation code in the design and development of this system.
Author
Computerized Simulation; Design Analysis; Compton Effect; Iodine Isotopes; Density Measurement

19980202690 Pennsylvania State Univ., University Park, PA USA
Growth and Characterization of Reduced Dimensionality Superconductor-Related Phases by Molecular Beam Epitaxy *Final Report*
Schlom, Darrell G., Pennsylvania State Univ., USA; Feb. 1998; 329p; In English
Contract(s)/Grant(s): N00014-93-1-0512; N00014-94-1-0690
Report No.(s): AD-A340914; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
This contract played a major role in enhancing the understanding and capabilities of reactive molecular beam epitaxy (MBE) to assemble oxide heterostructures with unit cell layering precision. The specific compounds grown under its support included (Ba,K)BiO3, YBa2Cu3 O(7-delta), SRTiO3, PbTiO3, Bi4Ti3O12, and superlattices of these compounds. Several of these materials had never before been grown by MBE and in addition to achieving an enhanced understanding of the underlying growth mechanisms of these compounds, the structural and electrical properties of the thin films and superlattices surpass those achieved by other thin film techniques. For example, our MBE-grown Bi4Ti3O12 films have the lowest RBS minimum channeling yield (chi min) and exhibit remanent polarization values of approx. 3 microC/sq cm along the c-axis which is approximately the value observed in this same measurement direction for bulk single crystals (approx. 4 microC/sq cm) and significantly exceeds the highest value previously reported for epitaxial films of this material (i.e., 1 microC/sq cm). We have identified adsorption-controlled growth conditions, analogous to those used for the preparation of III-V and II-VI semiconductors by MBE, for the synthesis of PbTiO3 and Bi4Ti3O12 and assessed the thermodynamics of why this occurs. In addition this contract supported work related

to the integration of oxides with silicon. This contract supported two (U.S. citizen) graduate students, both of whom completed their M.S.
DTIC
Phase Transformations; Molecular Beam Epitaxy; Reactivity; Superconductivity; Crystal Growth

19980202754 Department of the Navy, Washington, DC USA
Thermoluminescence Radiation Dosimetry Using Transparent Glass Containing Nanocrystalline Phosphor
Justus, Brian L., Inventor, Department of the Navy, USA; Huston, Alan L., Inventor, Department of the Navy, USA; Aug. 12, 1997; 10p; In English; Supersedes US-Patent-Appl-SN-598677, AD-D017902
Patent Info.: Filed 8 Feb. 1996; US-Patent-Appl-SN-598677; US-Patent-5,656,815
Report No.(s): AD-D018776; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Radiation is detected using a light transparent thermoluminescent dosimeter that comprises a nanocrystalline phosphor dispersed in a light transparent glassy matrix, such as Vycor glass. The dosimeter is placed in an environment in which radiation is present for a period of time, removed from the environment and then heated to emit light the intensity of which is indicative of the radiation dose. The method of the invention is useful for detecting and recording the dosage of both UV and ionizing radiation. Ambient or Beta radiation populates traps and, upon heating of the flat dosimeter, the emitted light is guided to the edges of the dosimeter by total internal reflection, where it is detected and recorded.
DTIC
Dosimeters; Radiation Dosage; Thermoluminescence; Phosphors; Radiation Measurement; Ionizing Radiation

19980202757 Department of the Navy, Washington, DC USA
Selective Attachment of Nucleic Acid Molecules to Patterned Self-Assembled Surfaces
Chrisey, Linda A., Inventor, Department of the Navy, USA; Dressick, Walter J., Inventor, Department of the Navy, USA; Calvert, Jeffrey M., Inventor, Department of the Navy, USA; Nov. 18, 1997; 16p; In English; Supersedes US-Patent-Appl-SN-352126, AD-D017379
Patent Info.: Filed 1 Dec. 1994; US-Patent-Appl-SN-352126; US-Patent-5,688,642
Report No.(s): AD-D018773; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Patterns of pre-formed hybridizable nucleic acid oligomers are formed upon a substrate. The substrate is coated with molecules such as aminosilanes, whose reactivity with nucleic acid molecules can be transformed by irradiation. The coated substrate exposed to patterned irradiation then contacted with pre-formed nucleic acid oligomers. The binding of the preformed nucleic acid oligomers to the coating molecules may be covalent or non-covalent (for example ionic bonding or hydrogen bonding). If desired a heterobifunctional crosslinker may be employed before or after irradiation, with the coating to promote covalent binding of the nucleic add oligomers to the coating molecules. Also, the irradiation step may be performed with the assistance of a positive tone or negative tone photoresist.
DTIC
Molecules; Surfaces; Nucleic Acids; Oligomers

19980202760 Department of the Navy, Washington, DC USA
Inorganic Arylacetylenic Monomers
Bucca, Daniel, Inventor, Department of the Navy, USA; Keller, Teddy M., Inventor, Department of the Navy, USA; Oct. 21, 1997; 18p; In English; Supersedes US-Patent-Appl-SN-687880, AD-D018161
Patent Info.: Filed 26 Jul. 1996; US-Patent-Appl-SN-687880; US-Patent-5,678,818
Report No.(s): AD-D018769; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention is a compound having the formula: R 1-Ac1-Ar1-M-Ar2-Ac2-R2 where R1 and R2 are independently selected from the group consisting of hydrogen, unsubstituted alkyl groups, substituted alkyl groups unsubstituted aryl groups, and substituted aryl groups, where Ac1 and Ac2 are Independently selected alkynyl groups having at least 1 carbon-carbon triple bond, where Ar1 and Ar2 are independently selected substituted or unsubstituted aromatic diradicals, and where M has the structure where M is a positive integer wherein x p y, r' n and z are independently selected integers where zo when no and where R3 through R14 are independently selected from d'e group consisting of hydrogen, unsubstituted alkyl groups, substituted alkyl groups, unsubstituted aryl groups, and substituted aryl groups.
DTIC
Monomers; Acetylene; Inorganic Materials; Aromatic Compounds

19980202994 California Univ., Dept. of Materials Science and Engineering, Los Angeles, CA USA
Oxygen Ion Conductors Prepared with Nanosize Particles ***Final Report, 15 Sep. 1996 - 14 Sep 1997***
Dunn, Bruce, California Univ., USA; Mackenzie, J. D., California Univ., USA; Mar. 23, 1998; 9p; In English
Contract(s)/Grant(s): F49620-96-1-0474
Report No.(s): AD-A341794; AFRL-SR-BL-TR-98-0320; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The instrumentation acquired from this grant consists of two atomic force microscopes (from Park Scientific and Molecular Imaging) and a particle size analyzer (from Micromeritics). The atomic force microscopes are complementary in terms of their operation and use the same controller and software. The Park Scientific instrument has been used to characterize the microstructure development of thin films of the oxygen ion conductor, BICUVOX (Bi(2)V(0.9)Cu(0.1)O(5.35)) over the temperature range from 550 to 800 deg C. Grain growth occurring in the film appears to he two-dimensional in nature. The Molecular Imaging AFM is designed for characterizing the topology of liquid/solid interfaces. This instrument has been used to image the surface of a lithium battery cathode material, V2O5, during lithium intercalation. The particle size analyzer has been used to characterize the particle size and particle size distribution of powders of various materials produced by the Pechini method as a function of heat treatment temperature.
DTIC
Atomic Force Microscopy; Intercalation; Particle Size Distribution; Oxygen Ions; Conductors; Imaging Techniques

19980203084 NASA Stennis Space Center, Bay Saint Louis, MS USA
Flame Imaging System
Barnes, Heidi L., Inventor, NASA Stennis Space Center, USA; Smith, Harvey S., Inventor, NASA Stennis Space Center, USA; Mar. 10, 1998; 6p; In English
Patent Info.: Filed 13 Mar. 1996; NASA-Case-SSC-00040; US-Patent-5,726,632; US-Patent-Appl-SN-622178; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A system for imaging a flame and the background scene is discussed. The flame imaging system consists of two charge-coupled-device (CCD) cameras. One camera uses a 800 nm long pass filter which during overcast conditions blocks sufficient background light so the hydrogen flame is brighter than the background light, and the second CCD camera uses a 1100 nm long pass filter, which blocks the solar background in full sunshine conditions such that the hydrogen flame is brighter than the solar background. Two electronic viewfinders convert the signal from the cameras into a visible image. The operator can select the appropriate filtered camera to use depending on the current light conditions. In addition, a narrow band pass filtered InGaAs sensor at 1360 nm triggers an audible alarm and a flashing LED if the sensor detects a flame, providing additional flame detection so the operator does not overlook a small flame.
Official Gazette of the U.S. Patent and Trademark
Flames; CCD Cameras; Imaging Techniques; Bandpass Filters

19980203103 West Virginia Univ., Morgantown, WV USA
Energy Assisted Epitaxy of GaN Using a Low Flux Nitrogen Atom Source
Myers, Thomas H., West Virginia Univ., USA; Oct. 01, 1997; 163p; In English
Contract(s)/Grant(s): N00014-94-1-1149
Report No.(s): AD-A341475; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This grant was issued under the Department of Defense Experimental Program to Stimulate Competitive Research as part of a national effort to develop nationally competitive programs in states which have historically not been successful at obtaining Federal Funding for independent research. In addition, the grant provided funding to both conduct research and to educate scientists and engineers in areas important to national defense. The grant was successful in all three areas. As detailed in this report, we have performed high quality research on fundamental issues of growth in GaN, a strategic material, in addition to training many students. Finally, a nationally competitive program was established as evidenced by the award of a regular ONR grant, ”An Investigation of the Effects of Hydrogen on Growth Kinetics and Defect Formation in Group III-Nitride Semiconductors”, (ONR-N00014-96-1-1008) as a direct offshoot of research performed on this grant.
DTIC
Gallium Nitrides; Epitaxy; Semiconductors (Materials)

19980203144 Naval Research Lab., Washington, DC USA
Synthesis and Self-organizing Properties of Iminodiacetic Phospholipids and their Role in Noncolvant Enzyme Immobilization on Organized Assemblies ***Final Report***
Singh, Alok, Naval Research Lab., USA; Markowitz, Michael A., Naval Research Lab., USA; Puranik, Dhananjoy B., Naval Re-

search Lab., USA; Mar. 13, 1998; 34p; In English
Contract(s)/Grant(s): N000149WX20566
Report No.(s): AD-A341288; NRL/MR/6930-98-8143; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Diacetylenic phospholipids with metal chelating iminodiacetic acid (IDA) headgroup, (R-O-CH2-CH(OR)-CH-OP(OH)(O)- (OCH2CH-n-N(CH2COOH)2 where R = palmitoyl or tricosa-lO,12-diynoyl and n = 1-3, have been synthesized to explore their technical utility. The lipids homogeneity was confirmed by 1H and 13C NMR spectrometry. The microstructure formation properties of the lipids were studied by Langmuir film balance technique and transmission electron microscopy (TEM). Synergistic influence of copper ions, ionic strength and pH of the dispersion medium, and length of the ethyleneoxy spacer in the headgroup caused the formation of ribbons and tubules. Increasingly, racemic diacetylenic phospholipids upon binding with copper produced ribbons and tubules when di- and tri-ethylenoxy spacer was inserted to separate phosphate and IDA moieties. In fully formed tubules, helical striations of uniform handedness were observed. Mixture of metal chelating lipids with diacetylenic phosphatidyicholine produced vesicles. to these vesicles and enzyme bovine carbonic anhydrase II (EC 4.2.1.1) was non-covalently linked with the aid of copper ion. An affinity between copper-IDA complex and histidines available on enzyme surface facilitated this binding without affecting enzyme activity. Polymerized vesicles showed improved stability and sustained activity of enzymes.
DTIC
Synthesis (Chemistry); Lipids; Carbonic Anhydrase; Metal Ions; Polymerization; Microstructure; Phosphates; Immobilization

19980203162 City Univ. of New York, Brooklyn, NY USA
Application of the Optimized Effective Potential Method to Quantum Chemistry ***Final Report, 15 Feb. 1993 - 11 Nov. 1997***
Krieger, Joseph B., City Univ. of New York, USA; Nov. 11, 1997; 11p; In English
Contract(s)/Grant(s): DAAH04-93-G-0055
Report No.(s): AD-A344400; ARO-30930.5-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this final year of the grant period, we have concentrated our efforts in three areas: (1) The determination of the exact exchange mixing parameter by requiring that the ionization energy theorem for atoms with Z less than or equal 20 be satisfied as closely as possible, (2) the completion of the application of Kohn-Sham Theory for Orbital Dependent (Self-Interaction-Corrected) Exchange-Correlation Energy Functionals to Diatomic Molecules, and (3) The development of a new accurate, zero parameter, correlation energy functional obtained from the homogeneous electron gas with an energy gap and its application to the calculation of the ionization potentials and electron affinities of atoms. This approach is the first one that takes explicit account of the non zero energy of excitation for bound electrons. The functional includes the important self-interaction effects employing a method that is invariant under a unitary transformation. In both (1) and (2) the KLI approximation is employed to provide an accurate solution to the integral equation for the Optimized Effective Potential.
DTIC
Quantum Chemistry; Molecular Energy Levels

26
METALLIC MATERIALS

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

19980201945 California Inst. of Tech., Dept. of Applied Mathematics, Pasadena, CA USA
Numerical Methods for the Computation of Propagating Phase Boundaries ***Final Report***
Hou, Thomas Y., California Inst. of Tech., USA; LeFloch, Philippe G., California Inst. of Tech., USA; Jan. 1997; 13p; In English
Contract(s)/Grant(s): F49620-94-1-0215
Report No.(s): AD-A340390; AFRL-SR-BL-TR-98-0274; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the proposed research is to develop new numerical methods for computing propagating phase boundaries in solids undergoing phase transformations, such as the austenite martensite phase transitions. We are especially interested in understanding how small scale structures, such as tip splitting and cusp formation, are dynamically generated in the process of energy minimization. Another objective of this project is to develop innovative numerical schemes for computing multiscale solutions on a coarse finite element grid. The purpose of this study is to study scattering and wave propagation in strongly heterogeneous media.
DTIC
Mathematical Models; Phase Transformations; Numerical Analysis; Finite Element Method

19980202176 National Association of Home Builders, Washington, DC USA
Monotonic Tests of Cold-Formed Steel Shear Walls with Openings
McKee, S., National Association of Home Builders, USA; Jul. 1997; 30p; In English
Report No.(s): PB98-138845; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Light-gauge steel-framing has recently become recognized as a viable alternative framing method for residential construction in the U.S. With this recognition, the need to efficiently design for lateral loads produced by winds and seismic forces has prompted research to fill this need. This paper presents monotonic load tests of 40-foot long, cold-formed steel-frame shear walls with openings.
NTIS
Load Tests; Steel Structures; Frames; Openings; Walls

19980202835 Eidgenoessische Technische Hochschule, Nichtmetallische Werkstoffe, Zurich, Switzerland
The Role of Silver in the Processing and Properties of Bi-2212
Lang, T., Eidgenoessische Technische Hochschule, Switzerland; Heeb, B., Eidgenoessische Technische Hochschule, Switzerland; Buhl, D., Eidgenoessische Technische Hochschule, Switzerland; Gauckler, L. J., Eidgenoessische Technische Hochschule, Switzerland; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 753-761; In English; Also announced as 19980202795
Contract(s)/Grant(s): SNSF-NFP-30; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The influence of the silver content and the oxygen partial pressure on the solidus temperature and the weight loss during melting of Bi2SR2CaCu2O(x) has been examined by means of DTA and TGA. by decreasing the oxygen partial pressure, the solidus is lowered (e.g. delta T=59 C by decreasing pO2 from 1 atm to 0.001 atm) and the weight loss is increased. The addition of silver causes two effects: (a) the solidus is further decreased (e.g. 2 wt% Ag lower T(sub solidus) by up to 25 C, depending on the oxygen partial pressure), (b) the weight loss during melting is reduced. Thick films (10-20 microns in thickness) with 0 and 5 wt% silver and bulk samples with 0 and 2.7 wt% silver were melt processed in flowing oxygen on a silver substrate in the DTA, allowing the observation of the melting process and a good temperature control. The critical current densities are vigorously dependent on the maximum processing temperature. The highest j(sub c) in thick films (8000 A/sq cm at 77 K, 0 T) was reached by melting 7 C above the solidus temperature. The silver addition shows no significant effect on the processing parameters or the superconducting properties. The highest j(sub c) for bulk samples (1 mm in thickness) was obtained by partial melting at 900 C or 880 C, depending on the silver content of the powder (O or 2.7 wt%). The j(sub c) of the samples is slightly enhanced from 1800 A/sq cm (at 77 K, 0 T) to 2000 A/sq cm by the silver addition. to be able to reach at least 80% of the maximum critical current density, the temperature has to be controlled in a window of 5 C for thick films and 17 C for bulk samples.
Author
BSCCO Superconductors; Superconducting Films; Thick Films; Silver; Oxygen; Partial Pressure; Melting

19980202919 Vanderbilt Univ., Dept. of Mechanical and Materials Engineering, Nashville, TN USA
Fretting Corrosion in Airframe Riveted and Pinned Connections ***Final Report, 1 Aug. 1993 - 31 Jul. 1997***
Hahn, George T., Vanderbilt Univ., USA; Rubin, Carol A., Vanderbilt Univ., USA; Mar. 20, 1998; 169p; In English
Contract(s)/Grant(s): F49620-93-1-0488
Report No.(s): AD-A341669; AFRL-SR-BL-TR-98-0339; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This year, URI-Initiation project examined the fretting and corrosion response of multiple rivet, one and two rivet-row, lap joints. Tribological parameters governing fretting as well as the effects of interference and clamping on fretting wear and fretting fatigue have been evaluated using 2-D and 3-D finite element analyses. A piezoelectrically-driven fretting wear machine that can simulate the fretting conditions in connections has been constructed. In this way the specific fretting wear rates of 7075-T6 and 2024-T3 in contact with aluminum and hardened steel under dry and corrosive conditions have been measured. Finally, small, one-rivet-row and 2-rivet-row lap joints have been cyclically tested under dry and corrosive conditions and examined for fretting damage.
DTIC
Riveted Joints; Fretting Corrosion; Lap Joints; Fatigue (Materials); Butt Joints

19980203052 NASA Lewis Research Center, Cleveland, OH USA
Effects of Surface Area, Polymer Char, Oxidation, and NiO Additive on Nitridation Kinetics of Silicon Powder Compacts
Bhatt, R. T., Army Research Lab., USA; Palczer, A. R., NASA Lewis Research Center, USA; Mar. 1998; 19p; In English
Contract(s)/Grant(s): 1L161102AH45
Report No.(s): AD-A341777; ARL-TR-1551; NASA-E-10932; NASA-TM-113171; NAS 1.15:113171; No Copyright; Avail:

CASI; A03, Hardcopy; A01, Microfiche

The oxidative stability of attrition-milled silicon powder under reaction-bonding processing conditions has been determined. The investigation focused on the effects of surface area, polymer char, preoxidation, nitriding environment, and a transitional metal oxide additive (NiO) on the nitridation kinetics of attrition-milled silicon powder compacts tested at 1230 and 1350 C for 4 hrs. Silicon powder was wet attrition-milled from 2 to 48 hrs to achieve surface area (SA's) ranging from 1.3 to 63 sq m/g. A silicon powder of high surface area (63 sq m/g) was exposed for up to 1 month to ambient air or for up to 4 days to an aqueous-based solution with the pH maintained at 3, 7, and 9. Results indicated that the high-surface area silicon powder showed no tendency to oxidize further, whether in ambient air for up to 1 month or in deionized water for up to 4 days. After a 1 day exposure to an acidic or basic solution, the same powder showed evidence of oxidation. As the surface area increased, so did the percentage nitridation after 4 hrs in N2 at 1250 or 1350 C. Adding small amounts of NiO significantly improved the nitridation kinetics of high-surface area powder compacts, but both preoxidation of the powder and residual polymer char delayed it. Conversely, the nitridation environment had no significant influence on the nitridation kinetics of a high-surface area powder. Impurities present in the starting powder, and those accumulated during attrition milling, appeared to react with the silica layer on the surface of silicon particles to form a molten silicate layer, which provided a path for rapid diffusion of N2 and enhanced nitridation kinetics.
DTIC

Oxidation; Silicon; Nitriding; Nickel; Charring; Stability; Ferroelectric Materials; Powder (Particles)

19980203140 Naval Postgraduate School, Monterey, CA USA

The Effect of Water Temperature on Underbead Cracking of Underwater Wet Weldments

Johnson, Robert L., Naval Postgraduate School, USA; Sep. 1997; 107p; In English

Report No.(s): AD-A341270; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Specifications for Underwater Welding have not yet addressed the effect of water temperature on weldment microstructure. The environmental effects on Underwater Wet Welding using a shielded metal arc welding (SMAW) process are severe with higher quenching rates, porosity, slag inclusions and diffusible hydrogen levels. One of the problems associated with these high quenching rates and high diffusible hydrogen levels is the increased likelihood of underbead cracking in the heat affected zone (HAZ), particularly with steel weldment which have a higher carbon equivalent (approximately greater than 0.3). In this work, the underbead cracking resulting in three underwater test welds made on ASTM 516 grade 70 steel three different water temperatures (2.8 deg C, 10 deg C and 31 deg C) was investigated. This was done by optical and scanning electron microscopy (SEM) and by making microhardness measurements. HAZ underbead cracking was observed in all three weldments, but was much less prevalent in the 31 deg C sample and could only be seen at high magnifications in the optical microscope. The cracking in this weldment only appeared to occur in isolated regions where head tempering had been ineffective for some reason. The weldments made at 10 deg C and 2.8 deg C both showed extensive evidence of underbead HAZ cracking typical of that associated with rapid cooling rates, high diffusible hydrogen levels and hard microstructures. SEM studies of the surfaces of these cracks showed evidence for transgranular failure with secondary cracking, both of which are typical of hydrogen induced cracking. This work highlights the importance of water temperature, quenching and diffusible hydrogen levels in underwater wet welding. This is an issue of critical importance in the future wet welding structural repair of Naval ships.
DTIC

Cracks; Heat Affected Zone; Temperature Effects; Water Temperature; Underwater Tests; Diffusion; Arc Welding; Cracking (Fracturing)

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.

19980201891 National Inst. of Standards and Technology, Polymers Div., Gaithersburg, MD USA

Preparation and Characterization of Polymer/Dendrimer Blends ***Progress Report***

Amis, E. J., National Inst. of Standards and Technology, USA; Bauer, B. J., National Inst. of Standards and Technology, USA; Topp, A., National Inst. of Standards and Technology, USA; Prosa, T. J., National Inst. of Standards and Technology, USA; Liu, D., National Inst. of Standards and Technology, USA; Apr. 1998; 54p; In English

Report No.(s): PB98-144520; NISTIR-6151; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Dendrimer and dentrigraft solutions, blends, and interpenetrating polymer networks are characterized by small angle neutron and x ray scattering, reflectivity, and transmission electron microscopy.
NTIS
Polymer Blends; Polymerization; Preparation; Characteristics

19980202195 Princeton Scientific Enterprises, NJ USA
Electrically Conductive Polymers as Large Gun Propellant Ignitors
Blair, David W., Princeton Scientific Enterprises, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 143-152; In English; Also announced as 19980202187
Contract(s)/Grant(s): DAAL01-94-C-0073; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Previous work under Phase 1 SBIR contract #DAAA15-92-C-0065 established the feasibility of using electrically conductive organic polymers to ignite solid propellants. Subsequent effort under a current Phase II SBIR contract has extended that work towards developing ignitors for large gun propellants. The intent of the work herein reported was to develop conductive polymer ignitors that can establish ignition simultaneously over the entire length of long charges. This is expected to decrease ignition lags and to avoid pressure oscillations that are set up by non uniform ignition over the length of a charge. Conventional ignitors establish primary ignition over a small region to the rear of a charge and rely upon flame spreading to complete ignition over its entire length. As charge loading densities increase and projectile hardware extends ever farther into the axial core of charges, decreased ullage makes flame spreading more and more problematical. This can be addressed by placing a thin strand of polymer along the axis of a charge and using it as a simple electrical resistance heater to initiate ignition. There it will ignite the charge along its full length prior to any flame spreading. A secondary ignition charge may encase the polymer to provide pressurization and enhanced transfer of ignition energy to the primary charge. We have previously reported work using conductive polyaniline impregnated twine to achieve ignition. Recently we have worked with ignitors that use conductive strands of heavily carbon loaded polyethylene as fuses to improve ignition uniformity over the length of long fuses, to lower ignition delays and to reduce the voltages that are required for ignition. This paper reports on this new work.
Author
Gun Propellants; Igniters; Polymers; Solid Propellants; Propellant Combustion; Solid Propellant Ignition

19980202400 Ohio State Univ., Dept. of Physics, Columbus, OH USA
Direct and Alternating Current Light-Emitting Devices Based on Pyridine-Containing Conjugated Polymers
Wang, Y. Z., Ohio State Univ., USA; Gebler, D. D., Ohio State Univ., USA; Epstein, A. J., Ohio State Univ., USA; Feb. 06, 1998; 38p; In English
Contract(s)/Grant(s): N00014-95-I-0302
Report No.(s): AD-A338060; TR-324; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present novel direct and alternating current light-emitting devices based on several pyridine-containing conjugated polymers and copolymers in various device configurations. The high electron affinity of pyridine-based polymers improves stability and electron transport properties of the polymers and enables the use of relatively stable metals such as Al or even ITO as electron injecting contacts. Bilayer devices utilizing poly(9-vinyl carbazole) (PVK) as a hole transporting electron blocking polymer show dramatically improved efficiency and brightness as compared to single layer devices. This is attributed to charge confinement and exciplex emission at the PVK/emitting polymer interface. The incorporation of a conducting polyaniline network electrode into PVK reduces the device turn on voltage significantly while maintaining the high efficiency of the bilayer device. The bilayer device structure can be arranged to enable the device to work in both forward and reverse bias, as well as in AC modes. Interfaces play an important role in the operation of these devices. Furthermore, when the EB is replaced by sulfonated polyaniline (SPAN) on the cathode side and the emitting layer is properly modified to balance electron and hole transport, the device generates different colors of light, red under forward bias and green under reverse bias.
DTIC
Direct Current; Alternating Current; Conjugation; Light Emitting Diodes

19980202670 Texas Research Inst., Inc., Austin, TX USA
Mechanical and Physical Properties of Both Unaged and Aged Coflon and Tefzel
Samulak, M., Texas Research Inst., Inc., USA; Campion, R. P., Texas Research Inst., Inc., USA; Jun. 11, 1996; 60p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG10-153
Report No.(s): NASA/CR-97-207626; NAS 1.26:207626; CAPP/M.12-Rev-A; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report deals with all recent mechanical testing performed on variously aged samples of Coflon and TefzeL to complete the work for Phase 1. Earlier results were reported in CAPP/M.7. Fluids A, F, G, and I have all been used for ageing in the last 12 month period, with particular attention concentrated on the effects of Fluid F as a result of discussions at the December 1995 steering committee meeting in Austin. Dramatic mechanical and physical changes occurred to Coflon in our initial studies after 4 weeks at 120 C in this sour gas mixture and so a detailed matrix was drawn up to investigate the effects of time and temperature of exposure. Subsequent tensile tests and compact tension (CT) fatigue tests were performed. Fatigue testing has been limited during this period to Coflon only; however, Tefzel CT samples have been exposed to the same conditions as the Coflon allowing the possibility for fatigue tests to be performed at a later date. Fluid A exposures during the last 6 months have been long-term at 65 C, 100 C and 120 C only. These exposures have been a continuation of earlier work and will complete the investigation of this fluid. Other chemical ageings have involved Fluid G at 120 C to confirm and investigate the hostile nature of this fluid on Coflon. Again, this fluid will not be used in Phase 2. Finally, long-term exposures in Fluid 1, a high aromatic oil mixture, were carried out to investigate the effects on the polymers of aromaticity in a simulated service fluid.
Author
Mechanical Properties; Organic Compounds; Fluoropolymers; Chemical Properties; Fatigue Tests; Tensile Tests

19980202713 Minnesota Univ., Minneapolis, MN USA
Active Thin Films ***Final Report, 1 Apr - 31 Dec. 1997***
James, Richard, Minnesota Univ., USA; Luskin, Mitchell, Minnesota Univ., USA; Mar. 23, 1998; 7p; In English
Contract(s)/Grant(s): F49620-97-1-0187
Report No.(s): AD-A341236; AFRL-SR-BL-TR-98-0308; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This project developed mathematical models and computational methods for the design of new active thin films having applications as actuators. The focus was on magnetostrictive and shape memory materials, and a recently discovered class of active materials that combine shape memory and ferromagnetism. A major part of the research was concerned with the behavior of these materials at small scales: the development of new models and computational methods that predict small scale behavior. Computational models were developed for simple micromachines that have applications as valves and pumps.
DTIC
Thin Films; Actuators; Mathematical Models; Magnetostriction; Computation; Procedures; Ferromagnetism

19980202758 Department of the Navy, Washington, DC USA
Conductive Polymer Coated Fabrics for Chemical Sensing
Buckley, Leonard J., Inventor, Department of the Navy, USA; Collins, Creg, Inventor, Department of the Navy, USA; Oct. 07, 1997; 16p; In English; Supersedes US-Patent-Appl-SN-543412, AD-D017870
Patent Info.: Filed 16 Oct. 1995; US-Patent-Appl-SN-543412; US-Patent-5,674,752
Report No.(s): AD-D018771; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A fabric chemical sensor a process and an apparatus is disclosed. The sensor, process and apparatus are for the detection, classification, identification and/or quantitation of one or more component chemicals of a chemical vapor via a resistance measurement made across sensor in response to exposure of the sensor to the chemical vapor.
DTIC
Conductivity; Polymers; Coatings; Fabrics; Chemicals; Detection

19980202820 NASA Lewis Research Center, Cleveland, OH USA
HTS Thin Films: Passive Microwave Components and Systems Integration Issues
Miranda, F. A., NASA Lewis Research Center, USA; Chorey, C. M., NYMA, Inc., USA; Bhasin, K. B., NASA Lewis Research Center, USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 611-620; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
The excellent microwave properties of the High-Temperature-Superconductors (HTS) have been amply demonstrated in the laboratory by techniques such as resonant cavity, power transmission and microstrip resonator measurements. The low loss and high Q passive structures made possible with HTS, present attractive options for applications in commercial, military and space-based systems. However, to readily insert HTS into these systems, improvement is needed in such areas as repeatability in the deposition and processing of the HTS films, metal-contact formation, wire bonding, and overall film endurance to fabrication and assembly procedures. In this paper, we present data compiled in our lab which illustrate many of the problems associated with these issues. Much of this data were obtained in the production of a space qualified hybrid receiver-downconverter module for the Naval Research Laboratory's High Temperature Superconductivity Space Experiment II (HTSSE-II). Examples of variations

observed in starting films and finished circuits will be presented. It is shown that under identical processing the properties of the HTS films can degrade to varying extents. Finally, we present data on ohmic contacts and factors affecting their adhesion to HTS films, strength of wire bonds made to such contacts, and aging effects.
Author
Superconductors (Materials); High Temperature Superconductors; Thin Films; Microwave Equipment; Systems Integration

19980202827 Eidgenoessische Technische Hochschule, Nichtmetallische Werkstoffe, Zurich, Switzerland
Tape Casting and Partial Melting of Bi-2212 Thick Films
Buhl, D., Eidgenoessische Technische Hochschule, Switzerland; Lang, T., Eidgenoessische Technische Hochschule, Switzerland; Heeb, B., Eidgenoessische Technische Hochschule, Switzerland; Gauckler, L. J., Eidgenoessische Technische Hochschule, Switzerland; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 686-693; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

To produce Bi-2212 thick films with high critical current densities, tape casting and partial melting is a promising fabrication method. Bi-2212 powder and organic additives were mixed into a slurry and tape casted onto glass by the doctor blade tape casting process. The films were cut from the green tape and partially molten on Ag foils during heat treatment. We obtained almost single-phase and well-textured films over the whole thickness of 20 gm. The orientation of the (a,b)-plane of the grains was parallel to the substrate with a misalignment of less than 6 deg. At 77 K/0 T a critical current density of 15,000 A/sq cm was reached in films of the dimension l cm x 2 cm x 20 microns (1 microV/cm criterion, resistively measured). At 4 K/0 T the highest value was 350,000 A/sq cm (1 nV/cm criterion, magnetically measured).
Author
Casting; Melting; Thick Films; Bismuth Compounds; Fabrication

19980202891 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
US-Japan Research Collaboration on Hard Driving Ceramic Actuators ***Final Report, 1 Jul. 1996 - 31 Jan. 1998***
Yoshikawa, Shoko, Pennsylvania State Univ., USA; Pan, Ming–Jen, Pennsylvania State Univ., USA; Mar. 18, 1998; 56p; In English
Contract(s)/Grant(s): N00014-96-1-1128
Report No.(s): AD-A341698; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

High field properties of electro-active ceramics are an important issue to understand in order to apply these ceramics in actuator applications. This project was developed to establish research collaborations with Japanese piezoelectric ceramic researchers in order to fully characterize these ceramics. Due to a PI change during the contract, the collaboration was not completed as originally planned. The information exchange was summarized as a trip report. However, at Penn State University, three very different family of active ceramics (electrostrictor, phase switching ceramics and various compositions of conventional PZT) were prepared and tested under high field and various pre-load and temperature conditions. The electrostrictive PMN-PT showed little stress dependence where as the AFE-FE phase switching composition showed intriguing stress dependence which introduced a new idea of incorporating additional phase transformation steps. The tetragonal structure of conventional PZTs showed less stress dependence than the morphotropic phase boundary (MPB) and rhombohedral compositions. Stress depoling can be reduced by maintaining a DC bias. These results showed correlations between intrinsic material behavior and external stresses, both electrical and mechanical.
DTIC
Actuators; Ceramics; Phase Transformations

19980202925 Army Construction Engineering Research Lab., Champaign, IL USA
REMR Management System: Coatings for Use on Wet or Damp Steel Surfaces ***Final Report***
Beitelman, Alfred D., Army Construction Engineering Research Lab., USA; Dec. 1997; 43p; In English
Report No.(s): AD-A341787; CERL-TR-REMR-EM-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Corps of Engineers is responsible for maintaining numerous steel structures that are subjected to conditions of constant condensation inside locks and dams. The surfaces of these structures normally can be blast cleaned to a white metal grade, but condensation and/or water leaking around seals immediately make the surfaces too wet for the application of many coatings. The coatings industry has recently developed and marketed new coatings that adhere to wet or damp steel. In this study a number of these products were evaluated, both in the laboratory and on structures in the field. Results indicate that some of these coatings

hold promise for long-term corrosion protection. Eased on the results, a draft Commercial Item Description is included to specify durable coatings for wet and damp steel surfaces.
DTIC
Surfaces; Coatings; Wetting; Evaluation; Management Systems; Maintenance; Steel Structures; Metal Surfaces; Composite Structures

19980203055 California Univ., Dept. of Materials Science and Mineral Engineering, Berkeley, CA USA
Micromechanisms of Fracture and Fatigue-Crack Growth in Bulk Metallic Glass Alloys ***Final Report, 1 May - 31 Dec. 1997***
Gilbert, Christopher J., California Univ., USA; Ritchie, Robert O., California Univ., USA; Mar. 10, 1998; 21p; In English
Contract(s)/Grant(s): F49620-97-1-0365
Report No.(s): AD-A341769; UCB/R/98/A1140; AFRL-SR-BL-TR-98-0324; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The recent development of metallic alloy systems which can be processed with an amorphous structure over large dimensions, specifically to form metallic glasses at low cooling rates (tilde 10 K/s), has permitted novel measurements of important mechanical properties. These include, fatigue crack growth and fracture toughness behavior, representing the conditions governing the sub-critical and critical propagation of cracks. In the present study, bulk plates of a Zr41.2 Ti13.8 Cu12.5 Ni10 Be22.5 alloy, machined into 7 mm thick, 33 mm wide compact tension specimens and fatigue precracked following standard procedures, revealed fracture toughness in the fully amorphous structure of KIc tilde 55 MPa(square root m), i.e., comparable with that of a high strength steel or aluminum alloy. However, annealing to induce partial and full crystallization was found to result in a drastic reduction in fracture toughness to 1 MPa(square root m), i.e., comparable with silica glass. Under cyclic loading, whereas crack propagation behavior of the bulk amorphous metal was similar to that observed in traditional steel and aluminum alloys, the stress-life (S-N) properties of were markedly different. As in more traditional crystalline metallic alloys, the crack propagation mechanism in the metallic glass was associated with alternating blunting and resharpening of the crack tip as evidenced by striations on fatigue fracture surfaces. Alternatively, during S-N tests flaws apparently initiated quite easily due to the lack of microstructural barriers which would normally provide local crack arrest points, thereby giving rise to poor S-N properties.
DTIC
Aluminum Alloys; Amorphous Materials

19980203089 NASA Langley Research Center, Hampton, VA USA
Tough, Soluble, Aromatic, Thermoplastic Copolyimides
Bryant, Robert G., Inventor, NASA Langley Research Center, USA; Apr. 21, 1998; 10p; In English
Patent Info.: Filed 16 Dec. 1994; NASA-Case-LAR-15205-1; US-Patent-5,741,883; US-Patent-Appl-SN-359752; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Tough, soluble, aromatic, thermoplastic copolyimides were prepared by reacting 4,4'-oxydiphthalic anhydride, 3,4,3',4'-biphenyltetracarboxylic dianhydride and 3,4'-oxydianiline. These copolyimides were found to be soluble in common amide solvents such as N,N'-dimethyl acetamide, N-methylpyrrolidinone, and dimethylformamide allowing them to be applied as the fully imidized copolymer and to be used to prepare a wide range of articles.
Official Gazette of the U.S. Patent and Trademark
Copolymers; Synthesis (Chemistry); Thermoplastic Resins; Polyimide Resins; Aromatic Compounds

19980203090 NASA Johnson Space Center, Houston, TX USA
Method and Apparatus for Production of Powders
Storltzfus, Joel M., Inventor, NASA Johnson Space Center, USA; Sircar, Subhasish, Inventor, NASA Johnson Space Center, USA; Apr. 14, 1998; 7p; In English; Division of US-Patent-Appl-SN-413732, filed 29 Mar. 1995
Patent Info.: Filed 17 Jan. 1997; NASA-Case-MSC-22358-2; US-Patent-5,738,830; US-Patent-Appl-SN-785500; US-Patent-Appl-SN-413732; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Apparatus and method are disclosed for producing oxides of metals and of metal alloys. The metal or alloy is placed in an oxygen atmosphere in a combustion chamber and ignited. Products of the combustion include one or more oxides of the metal or alloy in powdered form. In one embodiment of the invention a feeder is provided whereby material to be oxidized by combustion can be advanced into a combustion chamber continuously. A product remover receives the powder product of the combustion.
Official Gazette of the U.S. Patent and Trademark
Metal Oxides; Metal Powder; Combustion; Production Engineering

19980203121 Georgia Inst. of Tech., School of Mechanical Engineering, Atlanta, GA USA
A Technique for Achieving 4000 Microstrain from Hard PZT ***Annual Report, 1 Apr. 1997 - 30 Mar. 1998***
Lynch, Christopher S., Georgia Inst. of Tech., USA; Mar. 30, 1998; 9p; In English
Contract(s)/Grant(s): N00014-96-1-0711
Report No.(s): AD-A340943; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The year 2 effort was divided between experimental characterization of the constitutive behavior of ferroelectric ceramics and reliability of actuators constructed from these materials. Key results of the study of the constitutive behavior under combined stress and electric field loading were the ability to obtain over 3000 microstrain from PZT without excessive hysteresis or cracking and the characterization of several compositions of PZT under high field and high stress loading. Key results under the reliability study were the development of a J-integral testing technique and a technique for the measurement of the displacement fields induced by electric field in front of a notch.
DTIC
Experimentation; Lead Titanates; Zirconates; Reliability Analysis; Stress Distribution; Electric Fields; Ceramics

19980203166 NASA Langley Research Center, Hampton, VA USA
Method of Forming a Composite Coating with Particle Materials that are Readily Dispersed in a Sprayable Polyimide Solution
Tran, Sang Q., Inventor, NASA Langley Research Center, USA; May 19, 1998; 4p; In English
Patent Info.: Filed 11 Sep. 1996; NASA-Case-LAR-15369-1; US-Patent-5,753,306; US-Patent-Appl-SN-712529; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A method for creating a composite form of coating from a sprayable solution of soluble polyimides and particle materials that are uniformly dispersed within the solution is described. The coating is formed by adding a soluble polyimide to a solvent, then stirring particle materials into the solution. The composite solution is sprayed onto a substrate and heated in an oven for a period of time in order to partially remove the solvent. The process may be repeated until the desired thickness or characteristic of the coating is obtained. The polyimide is then heated to at least 495 F, so that it is no longer soluble.
Official Gazette of the U.S. Patent and Trademark
Coating; Composite Materials; Polyimides; Solvents; Sprayed Coatings

19980203168 NASA Kennedy Space Center, Cocoa Beach, FL USA
Gas-Liquid Supersonic Cleaning and Cleaning Verification Spray System
Caimi, Raoul E. B., Inventor, NASA Kennedy Space Center, USA; Lin, Feng–Nan, Inventor, NASA Kennedy Space Center, USA; Thaxton, Eric A., Inventor, NASA Kennedy Space Center, USA; Mar. 24, 1998; 6p; In English; Continuation of abandoned US-Patent-Appl-SN-116593, filed 30 Aug. 1993
Patent Info.: Filed 8 May 1995; NASA-Case-KSC-11641; US-Patent-5,730,806; US-Patent-Appl-SN-437859; US-Patent-Appl-SN-116593; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A gas-liquid cleaning spray system employs one or more converging-diverging nozzles to accelerate a gas-liquid mixture to a supersonic velocity for cleaning various types of articles, such as mechanical, electrical, and fluid components. The gas, such as air or nitrogen, is supplied at high pressure to a nozzle body where it is mixed with cleaning liquid, such as water or liquid detergent, which is supplied to the nozzle body at a relatively low flow rate. Acceleration of the gas-liquid mixture to a supersonic velocity eliminates the need for a high pressure, high flow rate, and high volume liquid supply. After the components are contacted with the gas-liquid mixture, the cleaning liquid can be recaptured and analyzed for cleanliness verification of the components.
Official Gazette of the U.S. Patent and Trademark
Cleaning; Convergent-Divergent Nozzles; Spray Nozzles; Spraying; Cleaners; Liquid-Gas Mixtures; Gases; Sprayers

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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.

19980202199 Gough (Paul) Associates, Inc., Portsmouth, NH USA
Extensions to the NGEN Code: Propellant Rheology and Container Properties
Gough, Paul S., Gough (Paul) Associates, Inc., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 189-205; In English; Also announced as 19980202187

Contract(s)/Grant(s): DAAL01-96-C-0012; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

NGEN has been formulated as a general purpose interior ballistics code applicable to all types of chemical gun propulsion systems, including solids, liquids and electrothermal systems. NGEN consists of two main computational modules: a Continuum Flow Solver (CFS) and a Large Particle Integrator (LPI). The CFS is based on the LCPFCT algorithm developed by Boris et al and is applied to the balance equations for the fluid components of the propulsion system. The LPI is based on a Lagrangian approach to the solution of the equations which govern the behavior of the solid propellant grains. In previous papers NGEN has been shown to be applicable to both tank and artillery charges and to admit the modeling of high performance multi-increment charges using granular, stick, slab or concentric wraps in arbitrary two-dimensional configurations with imbedded surface flow resistance attributed to the increment boundaries to reflect the presence of the containers. Several new capabilities are discussed in the present paper. A model of the combustible cartridge case present in many tank gun charges is described. The modeling of MACS type artillery charges is extended by means of a rigid body model of the containers to constrain the motion of the inclosed propellant increment. Failure of the container and the subsequent relaxation of mechanical constraint on the propellant is conducted on a local basis according to both mechanical and thermal criteria. The code is extended to a fully three-dimensional analysis of the flow on the assumption that only the tube is axisymmetric. We also report on work in progress to revise the model of the rheology of the solid propellant. Previously, we have used an isotropic stress model for granular propellant with the intergranular stress depending on the porosity in an irreversible manner. Sticks have been treated as rigid in the longitudinal direction as have wraps. We describe the approach being taken to develop a comprehensive model of propellant rheology which will apply to all the granulations of current interest and admit a more complete representation of wave propagation through the solid media.
Author

Computer Programs; Gun Propellants; Chemical Propulsion; Algorithms; Continuum Flow; Interior Ballistics; Rheology; Propellant Combustion

19980202201 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

Molecular Structure of Bis(2,2-Dinitropropyl)-Nitramine: Possible RDX Replacement

Bracuti, A. J., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 239-250; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

An x-ray diffraction single-crystal structure determination of Bis(2, 2-dinitropropyl)-nitramine (BDNPN) was carried out. Bis(2, 2- dinitropropyl)-nitramine has the molecular formula C6H1ON6O10 and a density of 1.78 g/cc. It crystallizes with two formula weights in the C-centered monoclinic space group C2 (no. 5) with unit cell parameters a = 10.726(4) A, b = 5.992(3) A, c = 10.400(4) A, and beta = 110.01(3)deg. The positions of the atoms were determined with both direct methods and difference Fourier techniques. The structure was refined to a final R value of 0.036. The crystal structure consists of BDNPN molecules oriented along the c axis at 000 and 220. The crystal is held together by van der Waals forces between each molecule and its six nearest-neighbors. The molecule is composed of two gem-dinitropropyl groups bonded to a central nitramine group. A comparison of the thermochemical data of BDNPN, cyclotrimethylenetrinitramine (RDX), and 1, 3, 3-trinitroazetidine (TNAZ) reveals that BDNPN has the highest Impetus and lowest flame temperature within this group of molecules.
Author

Molecular Structure; Nitramine Propellants; RDX; Molecules; Thermochemistry; Microstructure; Propellant Combustion; Product Development

19980202203 Army Armament Research, Development and Engineering Center, Warheads, Energetics and Combat-Support Armaments Center, Picatinny Arsenal, NJ USA

An Ab Initio and Density Functional Study of Nitroguanidine

Vladimiroff, T., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 261-270; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

It has long been known that amine groups stabilize nitro groups. This is one of the reasons that trinitrotriaminobenzene is so stable. Another example is nitroguanidine which is an important constituent of triple-base propellants. In this study, the molecules methyleneimine, methylenenitramine, and nitroguanidine are considered. Density functional methods are employed and results are compared to the more conventional SCF and Mp2 methods. Local, non-local, and hybrid methods are considered. Geometry, vibrational frequencies, and bond strengths are calculated and compared to experimental values when available. It was found that experimental geometries are best reproduced with the hybrid density functional methods although all of the density functional methods produced better geometries than the conventional SCF technique. For vibrational frequencies, all of the density function-

al methods were better than the Mp2 results. The best results were achieved with the non-local methods. The strength of the N-M bond was considered next. It is shown by direct calculation that strength of the N-N bond in methylenenitramine is 34 +/-3 kcal/mole and that the N-N bond strength is 50 +/-4 kcal/mole in nitroguanidine. Thus it is concluded that the effect of the addition of the two amines group is to strengthen the N-N bond by 16 kcal/mole.
Author
Nitroguanidine; Vibrational Spectra; Density Measurement; Solid Propellants; Molecules; Chemical Bonds; Propellant Chemistry

19980202204 Alliant Techsystems, Inc., Radford, VA USA
Deterrent Coated Propellants: Application of Infrared Micro-Imaging to Evaluate the Concentration Profile of Deterrent Compounds
Williams, C., Alliant Techsystems, Inc., USA; Ritchie, S., Alliant Techsystems, Inc., USA; Worrell, D. A., Alliant Techsystems, Inc., USA; Alberg, J., Alliant Techsystems, Inc., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 271-283; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The interior ballistic performance of propellants can be greatly improved through the application of deterrent compounds. Previously techniques for measuring deterrent penetration depths involved staining and optical methodologies. These techniques were able to illuminate depth of deterrent permeation, but were cumbersome and unable to identify a concentration profile. This paper illustrates the use of infrared micro-imaging to illuminate the diffusive concentration profile of methyl centralite coated single base propellants. Infrared analysis of the experimental propellants will show the influence that various coating environments impart on the deterrent concentration profile and by combining the infrared analysis with closed bomb data, propellant ballistic performance will be explained. This information can be used to develop a more effective ballistic model and through ballistic simulation an optimal coating concentration profile can be determined for a given propellant/deterrent/gun system. In this work the coated grain is microtomed and infrared spectra are taken at discrete intervals across the width of the grain. Preliminary research conducted on the base grains and deterring compound established absorbance peaks that could be used as a ”fingerprint” to track the penetration depth of the ballistic modifier. Results have shown that diffusion profiles for deterrent compounds may be established and have been used to qualitatively explain ballistic performance for various experimental propellant lots. Integration of deterrent profiles with closed bomb experiments and actual gun tests has illuminated the parameters which drive ballistic performance.
Author
Ballistics; Gun Propellants; Additives; Infrared Imagery; Propellant Chemistry; Propellant Combustion; Concentration (Composition)

19980202205 Lawrence Livermore National Lab., Livermore, CA USA
Laminar Burn Rates of Gun Propellants Measured in the High-Pressure Strand Burner
Reaugh, J. E., Lawrence Livermore National Lab., USA; Maienschein, J. L., Lawrence Livermore National Lab., USA; Chandler, J. B., Lawrence Livermore National Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 285-291; In English; Also announced as 19980202187
Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The pressure dependence of the laminar burn rate of gun propellants plays a role in the design and behavior of high-performance guns. We have begun a program to investigate the effects of processing variables on the laminar burn rates, using our high-pressure strand burner to measure these rates at pressures exceeding 700 MPa. We have burned JA2 and M43 propellant samples, ARL, from propellant lots previously used in round-robin tests. Our results at room temperature are in accord with other measurements. In addition, we present results measured for propellant that has been preheated to 50 C before burning. We used our thermochemical equilibrium code, CHEETAH, to help interpret the simultaneous pressure and temperature measurements taken during the testing, and show examples of its use. It has been modified to provide performance measures and equations of state for the products that are familiar to the gun-propellant community users of BLAKE.
Author
Gun Propellants; Pressure Dependence; Burning Rate; Burners; Propellant Tests; Pressure Measurement; Propellant Combustion

19980202206 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

An Intact Core Model for Simulating Pressure Oscillations in Regenerative Liquid Propellant Guns

Coffee, T. P., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 293-301; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Regenerative liquid propellant guns (RLPG) have been studied for many years. RLPG gun firings almost always show large high frequency pressure oscillations. to study this phenomenon, a two-dimensional (2D) axisymmetric fluid dynamics model of the combustion chamber/gun tube of a regenerative Liquid propellant gun has been developed. High frequency oscillations are generated naturally by the code. Recently the code has been extended to three dimensions (3D). There are some recent firings where the code is in poor agreement with the data. A number of extensions to the code have been implemented to try to improved the fidelity of the simulations. The most useful extension has been an intact core model. Comparisons with several 30-mm RLPG shots are discussed, including a shot with a flow disperser.

Author

Computerized Simulation; Liquid Rocket Propellants; Gun Propellants; Pressure Oscillations; Two Dimensional Models; Three Dimensional Models; Firing (Igniting); High Frequencies; Propellant Tests

19980202207 Army Research Lab., Aberdeen Proving Ground, MD USA

The Effects of Pressure Oscillation Reduction Techniques on the Spectra Observed in a 30-mm Concept 6C, Regenerative Liquid Propellant Gun

Colburn, Joseph W., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 303-319; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

It has been demonstrated that a variety of devices and materials can reduce the amplitude of high frequency pressure oscillations in the combustion chamber of a regenerative injection liquid propellant gun (RLPG). These findings have been reported at JANNAF Combustion Subcommittee Meetings since 1990. With few exceptions, analysis of the effects of these devices and materials have been confined to reporting reductions in RMS pressure oscillation levels. In this paper an attempt will be made to correlate the temporal development and subsequent modulation of the pressure oscillation spectrum with critical events in the interior ballistic cycle of the 30-mm Concept 6C Slice RLPG. The list of significant system events shall include initial piston motion, initial projectile motion, time of peak chamber pressure and end of LP injection. The primary spectral analysis will be conducted with Fast Fourier Transformations (FFT's) of a series of small time windows of pressure data. This paper briefly summarizes the experimental efforts to reduce pressure oscillations through the inclusion of liners and particulates in the combustion chamber. The effects of several of these techniques on chamber pressure oscillation structure are compared through time resolved spectral analysis.

Author

Guns (Ordnance); Liquid Rocket Propellants; Pressure Oscillations; Propellant Combustion; Pressure Effects; Fast Fourier Transformations; Acoustic Frequencies

19980202208 Pennsylvania State Univ., Mechanical Engineering Dept., University Park, PA USA

Peculiar Combustion Characteristics of XM46 Liquid Propellant

Jennings, Stephen T., Pennsylvania State Univ., USA; Chang, Yi–Ping, Pennsylvania State Univ., USA; Koch, Donald, Pennsylvania State Univ., USA; Kuo, Kenneth K., Pennsylvania State Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 321-333; In English; Also announced as 19980202187

Contract(s)/Grant(s): DAAH04-96-1-0054; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The liquid propellant strand burner (LPSB) was utilized to study intrinsic burning behavior of XM46 by feeding it into the flame zone. Unlike the nitromethane flame which can be stabilized at the end of the feeding tube, numerous unusual phenomena have been encountered while using XM46 liquid propellant in this system which have hindered the effort to obtain a stable flame at a fixed location. The flame regresses down into the feeding system regardless of the rate at which the propellant is fed upward. The mechanism for this behavior is theorized as being liquid-phase reactions caused by the transport of radicals beneath the reaction surface due to agitations within the liquid. Another phenomenon observed is the presence of a black, conical region immediately above the regressing surface which appears to grow with increasing feed rate and is not present at all in static tube tests (with no feeding motion). Pyrolysis tests were conducted in a specially designed pyrolyzer used in conjunction with a gas chromatograph / mass spectrometer to determine the decomposition species concentrations as a function of temperature to better understand the combustion process of this unique monopropellant. These tests have shown the major pyrolysis products to be NO, H2O, N2,

N2O, HCN, C2H4 and C2H4O when Pyrolyzed at temperatures between 540 and 700 C. The relative concentrations of these species have also been shown to vary with pyrolysis temperature in the neighborhood of the regressing surface temperature.
Author
Liquid Rocket Propellants; Propellant Combustion; Pyrolysis; Propellant Chemistry; Burners; Combustion Stability; Propellant Tests; Flame Propagation; Burning Rate

19980202209 Pennsylvania State Univ., Dept. of Mechanical Engineering, University Park, PA USA
Intrinsic Burning Rate and Temperature Sensitivity of Nitromethane
Boyer, E., Pennsylvania State Univ., USA; Koch, Donald, Pennsylvania State Univ., USA; Kuo, Kenneth K., Pennsylvania State Univ., USA; Lu, Y. C., Pennsylvania State Univ., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 335-346; In English; Also announced as 19980202187
Contract(s)/Grant(s): DAAH04-93-D-0364; DAAL03-92-G-0118; DAAH04-96-1-0054; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The intrinsic burning rate of nitromethane over a range of pressures and initial temperatures was measured using an optically accessible, high-pressure liquid propellant strand burner (LPSB). Compared to other methods, the LPSB minimizes undesirable effects introduced by gelling agents and LP-containing tubes that may modify burning behavior. to determine the intrinsic burning rate, chamber pressure was varied to achieve a steady-state position of the LP burning surface at a set actuator feeding rate. Burning rates at four different initial temperatures from -30 C to +45 C were determined in an air environment. Over a pressure range of 2.5 to 15 MPa (250 to 2200 psig), the intrinsic burning rate of nitromethane was determined as a power law of chamber pressure for the four different initial temperatures. Temperature sensitivity (sigma(p)) was then deduced and found to decrease significantly with increasing pressure as a second-order polynomial. The tube confinement encountered in conventional LP burning-rate measurements proved to have a non-negligible effect in reduction of the LP burning rate.
Author
Nitromethane; Liquid Rocket Propellants; Burning Rate; Pressure Effects; Temperature Effects; Propellant Tests; Combustion Temperature

19980202210 Naval Undersea Warfare Center, Launcher and Missiles Systems Dept., Newport, RI USA
Physics Based Navy Launcher Model Utilizing COTS Gas Generators
Williams, M. W., Naval Undersea Warfare Center, USA; Gieseke, T. J., Naval Undersea Warfare Center, USA; Cipolla, J. L., Naval Undersea Warfare Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 347-354; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Previous studies have been undertaken by the USA Navy to determine the feasibility of using Commercial, Off-The-Shelf (COTS) pyrotechnic devices, i.e., safety restraint (airbag) inflators, as energy sources in certain launcher applications. An energy transport modeling formulation was used in past studies to predict the transfer of energy within a small device launcher and performance was estimated. The transport formulation was chosen due in part to the scarce knowledge of the proprietary ballistic characteristics of the inflators. This formulation was limited in that it could not account for coupling between multiple gas generators and other launcher components, therefore some simplifying assumptions regarding the internal gas dynamics were necessary. This paper details the formulation of a more rigorous mass and energy transport modeling approach while addressing the scarcity of known internal ballistic parameters. The dynamics of multiple pyrotechnic devices and their coupling to the launcher behavior has been fully simulated. This approach was necessary to predict the energy lost during launch of a device in air, as gas escapes around the annulus (blow-by) between the device and the launch tube. Unknown physical properties of the gas generators were optimized by utilizing a model of the discharge of a gas generator into a pressure vessel and corresponding experimental data. A ’random walk’ approach was used to iteratively adjust the unknown quantities until an optimal match with an experimental data was obtained. Once the parameters were fixed, the simulated behavior of a launcher was compared with results of past models and experimental launches using multiple passenger side airbag inflators. Surface ship torpedoes with associated blow-by are to be launched in the winter of 1997 with airbag inflators to further validate the model.
Author
Energy Transfer; Pyrotechnics; Launchers; Torpedoes; Launching; Mathematical Models

19980202217 Army Research Lab., Aberdeen Proving Ground, MD USA
Derivation of Optical Parameters From Integrating Sphere Measurements for NC Propellants
Cohen, A., Army Research Lab., USA; Newberry, J. E., Army Research Lab., USA; Kranze, R., Army Research Lab., USA; McNesby, K. L., Army Research Lab., USA; Beyer, R. A., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee

Meeting; Oct. 1997, pp. 427-435; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Values for the optical parameters of JA2 and M9 propellants at 1.06 micro-m and 1.71 micro-m have been derived using an integrating sphere. Measurements (of sphere transmittance) were made with samples located at the rear, front, and center of the sphere. The transfer functions which relate sphere transmittance to sample transmittance and reflectance were obtained by solving the radiant energy transfer equations for each operating mode of the sphere. The values for reflection, absorption, and scattering coefficients were obtained from transmittances and reflectances using the equations given by a 2-flux model of radiant transfer in the sample. Reliable estimates for the reflection coefficient have been obtained from the rear data. Due to scattering losses, values for absorption and scattering coefficients derived from front measurements represent upper limits. At present, due to the questionable validity of the derived transfer function, it is difficult to evaluate the results obtained from the center data.
Author

Solid Propellant Ignition; Gun Propellants; Optical Properties; Mathematical Models; Plasma Radiation; Cellulose Nitrate; Transfer Functions; Radiative Heat Transfer

19980202222 Army Research Lab., Aberdeen Proving Ground, MD USA

Development of a Quantum Mechanical Database for the Accurate Prediction of Heats of Formation of Energetic Materials

Pai, S. V., Army Research Lab., USA; Chabalowski, C. F., Army Research Lab., USA; Rice, B. M., Army Research Lab., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 479-487; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

Quantum mechanical calculations are used to develop an efficient screening tool of candidate energetic materials considered for use in advanced propellant formulations. The computational tool accurately predicts gas-phase Heats of Formation of energetic molecules. A simple atom-equivalent method converts quantum mechanical energies of atoms to heats of formation of energetic materials. Two sets of atom equivalents were considered: Those in which no consideration was given to the types of bonds or functional groups in which the atoms are involved, and one in which atom equivalents are determined based on whether the atom is involved in only single Lewis bonds or multiple Lewis bonds. Measured Heats of Formation for thirty energetic species, including nitroalkanes, nitroalkenes, nitrate estates, and azides were used in conjunction with the quantum mechanical calculations to parameterize the model. The calculated Heats of Formation using the resulting computational tool for the thirty experimental test compounds have a root-mean-square deviation of 2.4 kcal/mol and a maximum deviation of 5.9 kcal/mol from experiment.
Author

Quantum Mechanics; Heat of Formation; Data Bases; Energetic Particles; Propellants; Propellant Properties

19980202229 Sandia National Labs., Combustion Research Facility, Livermore, CA USA

Coupling Experimental Data and a Prototype Model to Probe the Physical and Chemical Processes of 2,4-Dinitroimidazole Solid-Phase Thermal Decomposition

Behrens, Richard, Sandia National Labs., USA; Minier, Leanna, Sandia National Labs., USA; Bulusu, Suryanarayana, Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 549-567; In English; Also announced as 19980202187

Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The time-dependent, solid-phase thermal decomposition behavior of 2,4-dinitroimidazole (2,4-DNI) has been measured utilizing simultaneous thermogravimetric modulated beam mass spectrometry (STMBMS) methods. The decomposition products consist of gaseous and non-volatile polymeric products. The temporal behavior of the gas formation rates of the identified products indicate that the overall thermal decomposition process is complex. In isothermal experiments with 2,4-DNI in the solid phase, four distinguishing, features are observed: (1) elevated rates of gas formation are observed during the early stages of the decomposition, which appear to be correlated to the presence of exogenous water in the sample; (2) this is followed by a period of relatively constant rates of gas formation; (3) next, the rates of gas formation accelerate, characteristic of an autocatalytic reaction; and (4) finally, the 2,4-DNI is depleted and gaseous decomposition products continue to evolve at a decreasing rate. A physicochemical and mathematical model of the decomposition of 2,4-DNI has been developed and applied to the experimental results. The first generation of this model is described in this paper. In this model, decomposition of 2,4-DNI and evolution of gaseous products is controlled by at least six basic processes. These processes include: (1) sublimation and decomposition in the gas phase (small contribution), (2) decomposition in a reactive shell on the surface of the particles, (3) enhancement of the reaction rates and reduction of the 2,4-DNI sticking coefficient due to absorbed exogenous water and impurities in the 2,4-DNI sample, (4) the growth of polymeric reactive nuclei in the reactive shell, (5) adsorption of 2,4-DNI on the surface of the reactive nuclei, followed by reac-

tion of the 2,4-DNI on the surface to release gaseous products and add to the polymer, and (6) transformation of the polymer formed by the initial reaction with 2,4-DNI to a more thermally stable polymer, releasing gas in the process. The combination of processes four through six characterize the autocatalytic nature of the 2,4-DNI decomposition. Global reaction chemistry is currently used to characterize each of the basic decomposition processes. The development of the model is presented along with examples of the model applied to experiments conducted under a range of different conditions. Differences between the first generation of the model and the experimental data collected under different conditions suggest refinements for the next generation of the model.
Author
Nitro Compounds; Thermal Decomposition; Mathematical Models; Solid Phases

19980202230 Sandia National Labs., Combustion Research Facility, Livermore, CA USA
Mechanistic and Kinetic Studies of the Thermal Decomposition of TNAZ and NDNAZ
Anderson, Kraig, Sandia National Labs., USA; Homsy, Jason, Sandia National Labs., USA; Behrens, Richard, Sandia National Labs., USA; Bulusu, Suryanarayana, Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 569-583; In English; Also announced as 19980202187
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

We have studied the mechanism and detailed reaction kinetics of the thermal decomposition of 1,3,3-trinitroazetidine (TNAZ), and separately, its key decomposition intermediate, 1-nitroso-3,3-dinitroazetidine (NDNAZ), using a simultaneous thermogravimetric modulated beam mass spectrometer (STMBMS). These decompositions were conducted in a sealed alumina cell with a 2.5 micro-m orifice, at varying temperatures and at a range of isothermal temperatures (at 10 C intervals from l20-l60 C for NDNAZ and l60-210 C for TNAZ). The gaseous products have been identified and their rates of formation have been measured as a function of time, temperature, and pressure. This system is complex, with TNAZ decomposing, by four separate routes, one of which leads to NDNAZ, which itself decomposes by at least two distinct routes.
Author
Thermal Decomposition; Mass Spectroscopy; Reaction Kinetics; Nitro Compounds; Combustion Chemistry; Propellant Combustion

19980202231 Sandia National Labs., Albuquerque, NM USA
Characterization of Energetic Materials at Temperatures Approaching Cookoff
Renlund, A. M., Sandia National Labs., USA; Miller, J.C., Sandia National Labs., USA; Trott, W. M., Sandia National Labs., USA; Erickson, K. L., Sandia National Labs., USA; Hobbs, M. L., Sandia National Labs., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 585-591; In English; Also announced as 19980202187
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

We conducted experiments that monitored the response of heated, confined energetic materials in both fixed-volume and fixed-load configurations. We studied a variety of HMX-based materials, looking at the effects of particle size and binders. The beta-delta phase transition near 170 C led to a more reactive state. Materials that underwent complete transition in the fixed-load experiments (allowed to expand fully to accommodate the 5% volume increase) cooked off faster than those in the fixed-volume configuration.
Author
HMX; Chemical Reactions; Heating; Temperature Effects; Propellant Combustion; Explosives; Firing (Igniting)

19980202232 Sandia National Labs., Combustion Research Facility, Livermore, CA USA
Influence of Pressure-Driven Gas Permeation on the Quasi-Steady Burning of Porous Energetic Materials
Margolis, S. B., Sandia National Labs., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 593-607; In English; Also announced as 19980202187
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

A theoretical two-phase-flow analysis is developed to describe the quasi-steady propagation, across a pressure jump, of a multi-phase deflagration in confined porous energetic materials. The difference, or overpressure, between the upstream (unburned) and downstream (burned) gas pressure leads to a more complex structure than that which is obtained for an unconfined deflagration in which the pressure across the multi-phase flame region is approximately constant. In particular, the structure of such a wave is shown by asymptotic methods to consist of a thin boundary layer characterized by gas permeation into the unburned

solid, followed by a liquid/gas flame region, common to both types of problems, in which the melted material is preheated further and ultimately converted to gaseous products. The effect of gas flow relative to the condensed material is shown to be significant, both in the porous unburned solid as well as in the exothermic liquid/gas melt layer, and is, in turn, strongly affected by the overpressure. Indeed, all quantities of interest, including the burned temperature, gas velocity and the propagation speed, depend on this pressure difference, leading to a significant enhancement of the burning rate with increasing overpressure. In the limit that the overpressure becomes small, the pressure gradient is insufficient to drive gas produced in the reaction zone in the upstream direction, and all gas flow relative to the condensed material is directed in the downstream direction, as in the case of an unconfined deflagration. The present analysis is particularly applicable to those types of porous energetic solids, such as degraded nitramine propellants, that can experience significant gas flow in the solid preheat region and which are characterized by the presence of exothermic reactions in a bubbling melt layer at their surfaces.
Author
Asymptotic Methods; Deflagration; Two Phase Flow; Pressure Effects; Porous Materials; Propellant Combustion; Nitramine Propellants; Burning Rate

19980202233 Sandia National Labs., Albuquerque, NM USA
Millisecond Burning of Confined Energetic Materials During Cookoff
Schmitt, R. G., Sandia National Labs., USA; Baer, T. A., Sandia National Labs., USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 609-619; In English; Also announced as 19980202187
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

To predict the violence of reaction of confined energetic materials during cookoff requires a description of the relevant physical processes that occur on time scales ranging from days to submicroseconds. The time-to-ignition can be characterized accurately using heat transfer with chemistry and quasi-static mechanics. After ignition the energetic material deflagrates on a millisecond time scale. During this time the mechanical processes become dynamic. If the confinement survives burning then accelerated deflagration can lead to shock formation and deflagration to detonation transition. The focus of this work is the dynamic combustion regime in the millisecond time domain. Due to the mathematical stiffness of the chemistry equations and the prohibitively fine spatial resolution requirements needed to resolve the structure of the flame, an interface tracking approach is used to propagate the burn front. Demonstrative calculations are presented that illustrate the dynamic interaction of the deflagrating energetic material with its confinement.
Author
Explosives; Combustion; Deflagration; Firing (Igniting); Heat Transfer; Temperature Effects; Combustion Physics; Mathematical Models; Turbulent Combustion

19980202234 New Mexico Tech, Research Center for Energetic Materials, Socorro, NM USA
Violence of Small Scale Cook-Off Reactions
Melof, Brian, New Mexico Tech, USA; Olson, Douglas, New Mexico Tech, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 621-626; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

A small scale laboratory test has been developed, to quantitatively measure how violently an energetic material responds to thermal stress. Tests were conducted on 20 and 40 mg of explosive and propellant. Cook-off violence was found to increase rapidly as temperature increased beyond the critical temperature of the sample. Violence reached a maxima approximately 20 to 30 C above the critical temperature, and continued increase of temperature resulted in a gradual decline of violence. Particle size had a negligible effect on cook-off violence. A ranking of explosives and propellants based on maximum cook-off pressure was created. It was surprising that RDX gave higher pressures than HMX, and HMX gave higher pressures than CL-20.
Author
Explosives; Propellants; Combustion; Combustion Physics; Thermal Stresses; Temperature Effects; Turbulent Combustion

19980202547 Prins Maurits Lab. TNO, Rijswijk, Netherlands
The Construction of the Friability Test at TNO-PML *Final Report*
Scholtes, J. H. G., Prins Maurits Lab. TNO, Netherlands; Nov. 1997; 20p; In English
Contract(s)/Grant(s): A94KL419
Report No.(s): TNO-PML-1996-A58; TD-96-0035; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., PO Box 45, 2280 AA Rijswijk, The Netherlands); US Sales Only, Hardcopy, Microfiche

In co-operation with SNPE, France, the friability test has been constructed. This test is applied to determine the effect of impact on an explosive substance which is a candidate to be assigned as an Extremely insensitive Detonating Substance (EIDS). In this test a sample is directed against a steel plate at a velocity of about 150 m/s by using a gas gun. After having performed this test, the explosive is tested in the closed vessel test to assess any changes in the burning characteristic, i.e. the peak pressure and pressure rise rate, due to the impact. The volume of the existing closed vessel needed to be adjusted in order to fulfill the calibration requirements with respect to peak pressure (80 +/- 0.2 MPa) and pressure rise rate (not more than 15.2 +/- MPa/msec). This calibration was performed using a reference propellant delivered by SNPE. It appears that neither calibration requirement could be met by the closed vessel. The requirement for the peak pressure could be fulfilled, but not for the pressure rise rate.
Author
Construction; Explosives; Propellants; Combustion; Sensitivity

19980202666 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Variation of the Mechanical Properties of HTPB PBX's *Final Report Onderzoek naar de Variatie van Mechanische Eigenschappen van HTPB PBX'en*
Scholtes, Ir. J. H. G., Prins Maurits Lab. TNO, Netherlands; Dec. 1997; 23p; In Dutch
Contract(s)/Grant(s): A95/KL/483
Report No.(s): TD97-0282; PML-1997-A55; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., P O Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

Several compositions of HTPB based RDX-PBXs with TMHD were mixed. The compositions were tested in the SCB-test, the Friability test, the GAP-test and in the uni-axial tensile strength test. The results have been compared with a standard TNO-PML PBX RU81. No changes in sensibility in the SCB and GAP-test were noticed. The new compositions are stronger and have a higher E-modulus. At room temperature and 60 C the maximum strain has improved. At -40 C the strain is very low and also much lower than the reference material. However, the improved mechanical properties at room temperature have their influence in the Friability test. The pressure derivative in the closed vessel test were 2.3 and 5.8 MPa/ms at projectile velocity of about 150m/s. These values are much better than with a comparable HTPB-based PBX with a derivative of 7.68 at 100 m/s. The combination of the ingredients is not yet optimal and more research must be carried out to improve the mechanical properties of these new HTPB/TMHD/IPDI based PBXs. Also the use of a bonding agent could improve these properties.
Author
Mechanical Properties; HTPB Propellants; Tensile Strength; Projectiles; RDX

19980202687 Prins Maurits Lab. TNO, Rijswijk, Netherlands
The Construction of the Friability Test at TNO-PML *Final Report*
Scholtes, J. H., Prins Maurits Lab. TNO, Netherlands; vandeMeer, B. J., Prins Maurits Lab. TNO, Netherlands; Nov. 1997; 23p; In English
Report No.(s): AD-A340941; PML-1996-A58; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In co-operation with SNPE, France, the friability test has been constructed. This test is applied to determine the effect of impact on an explosive substance which is a candidate to be assigned as an Extremely Insensitive Detonating Substance (EIDS). In this test a sample is directed against a steel plate at a velocity of about 150 m/s by using a gas gun. After having performed this test, the explosive is tested in the closed vessel test to assess any changes in the burning characteristic, i.e. the peak pressure and pressure rise rate, due to the impact. The volume of the existing closed vessel needed to be adjusted in order to fulfill the calibration requirements with respect to peak pressure (80 +/- 0.2 MPa) and pressure rise rate (not more than 15.2 +/- MPa/msec). This calibration was performed using a reference propellant delivered by SNPE. It appears that neither calibration requirement could be met by the closed vessel. The requirement for the peak pressure could be fulfilled, but not for the pressure rise rate.
DTIC
Explosives; Detonation; Impact Tests; Sensitivity

31
ENGINEERING (GENERAL)

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

19980201890 National Inst. of Standards and Technology, Precision Engineering Div., Gaithersburg, MD USA
Summary Report of NIST/MSC Workshop on Traceability in Length
Swyt, D. A., National Inst. of Standards and Technology, USA; Apr. 1998; 26p; In English; Traceability in Length, 4 Feb. 1998,

Gaithersburg, MD, USA
Report No.(s): PB98-144470; NISTIR-6149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Institute of Standards and Technology, in conjunction with the Measurement Science Conference, conducted an industry-needs workshop on February 4, 1998, on issues which U.S. manufacturing companies, particularly smaller ones, may have in meeting their need to demonstrate traceability of their dimensional measurements to the international and national standard of length. The conclusions of the workshop was that there is a need for education, training, and dissemination of information about the new requirement of traceability for statements of uncertainty and a role for NIST in facilitating, leading, or providing an element of the education, training, or dissemination of information regarding traceability and measurement uncertainty associated with that need.

NTIS

Dimensional Measurement; Conferences; Length; Metrology

19980201893 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA

Features, Limitations, and Uncertainties in Enclosure Fire Hazard Analyses: Preliminary Review ***Final Report***

Mowrer, F. W., Maryland Univ., USA; Stroup, D. W., National Inst. of Standards and Technology, USA; Mar. 1998; 38p; In English

Report No.(s): PB98-144546; NISTIR-6152; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a review of three fire modeling tools (FIVE, COMPBRN III, CFAST) currently being used in fire safety design and a fourth model (LES) of the field model type which is beginning to be used in fire protection engineering. This review forcuses on the application potential for these models in the nuclear power industry. In view of the uncertainties associated with fire modeling predictions, extreme care must be excerised in the interpretation of fire modeling results. For scenarios where the level of predicted hazard is well below the damage threshold, the results can be used with a high level of confidence provided there is a high level of confidence that all risk-significant scenarios have been considered. For scenarios where the level of predicted hazard is near the damage threshold, the results should be used with caution in view of the uncertainties that exist. In order to address some of the uncertainties inherent in the current state of fire modeling, a multi-tiered approach is proposed which combines professional judgement, correlations, zone modeling, and field models.

NTIS

Nuclear Power Plants; Reactor Safety; Fires; Mathematical Models; Computerized Simulation

19980202912 Naval Postgraduate School, Monterey, CA USA

Reliability Enhancement of the Navy Metrology and Calibration Program

Albright, Jon D., Naval Postgraduate School, USA; Dec. 1997; 96p; In English

Report No.(s): AD-A341394; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Three quarters of the Naval Air Systems Command Metrology and Calibration (METCAL) budget is spent on Support Equipment with calibration intervals that are 12 months or less. These intervals are based on End-of-Period (EOP) operational reliability targets of 72% for non-critical General Purpose Test Equipment (GPTE) and 85% for critical Special Purpose Test Equipment (SPTE). Over one-third of all Support Equipment are performing above their reliability targets, but are unnecessarily being inducted into calibration facilities due to maximum interval restrictions. With continued budget constraints, the Navy will be forced to adopt innovative measures to save costs, while not sacrificing readiness or safety. Based on our analysis, we conclude that by increasing the reliability targets, and interval restrictions, we will save the Navy over $1.2 million per year with a concomitant increase in the reliability of 46% of Naval Aviation's TAMS by 9.71%.

DTIC

Optimization; Metrology; Reliability Analysis; Reliability Engineering; Calibrating

19980202940 NASA Ames Research Center, Moffett Field, CA USA

Method for Molding Planar Billet of Thermally Insulative Material Into Predetermined Non-Planar Shape

Kolodziej, Paul, Inventor, NASA Ames Research Center, USA; Carroll, Joe A., Inventor, NASA Ames Research Center, USA; Smith, Dane, Inventor, NASA Ames Research Center, USA; Jan. 06, 1998; 5p; In English

Patent Info.: NASA-Case-ARC-14051-1-SB; US-Patent-5,705,012; US-Patent-Appl-SN-644630; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A method and apparatus is discussed for molding thermal protection system (TPS) tiles for spacecraft. The apparatus and method include a bottom mold member defining a mold surface shaped like a surface of the spacecraft, e.g., the nose cap of wing leading edge, sought to be thermally protected. A flat billet of TPS material is positioned over the periphery of the mold surface, and a hollow weight element that has a periphery configured like the periphery of the mold surface is positioned on the billet. The

billet is then heated in accordance with a predetermined heating regime, and during the heating process the weight of the weight element causes the billet to deform to assume the shape of the mold surface. If desired, a TUFI coating is impregnated into the billet prior to heating, and the coating is sintered to the billet during heating. After heating, a composite matrix material, e.g., a graphite or fiberglass cloth which is impregnated with epoxy or polimide, is bonded to the now-shaped tile to support the tile. Silicone can then be impregnated into the now-formed tile to provide flexibility of the tile.
Official Gazette of the U.S. Patent and Trademark
Thermal Protection; Casting; Molds; Tiles; Spacecraft Construction Materials; Composite Materials; Ablative Materials

19980203018 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Smart Materials, Structures, and Mathematical Issues for Active Damage Control ***Final Report, 1 Jul. 1992 - 30 Jun. 1997***
Inman, Daniel J., Virginia Polytechnic Inst. and State Univ., USA; Cudney, Harley H., Virginia Polytechnic Inst. and State Univ., USA; Oct. 1997; 38p; In English
Contract(s)/Grant(s): DAAL03-92-G-0180
Report No.(s): AD-A344272; ARO-30364.6-EG-URI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The three objectives of this research were to study and create new technologies for: (1) identifying damage in complex structures; (2) mitigating damage in structures built from composite materials; and (3) controlling smart material systems and structures. Model independent, nondestructive evaluation methods for complex structures have been developed to detect incipient damage, delaminations and disbondments, and to allow structures to perform self-diagnostics. A patent has been granted for a method improving the impact tolerance and penetration resistance of composites. Several new technologies were developed to control smart material systems and structures. A compact actuator, producing both large displacements and forces, was designed, built, and tested for helicopter vibration and noise control. A theoretical model of wave propagation and energy dissipation in joints was developed. A new signal processing technique was developed for arrays of sensors to directly create a signal for the modal content of the structural vibration. A method of damage detection for complex structures that does not depend on an analytical model of the structure has been developed and experimentally verified.
DTIC
Smart Materials; Damage; Composite Materials; Active Control; Nondestructive Tests; Impact Tolerances

19980203085 NASA Lewis Research Center, Cleveland, OH USA
Directional Electrostatic Accretion Process Employing Acoustic Droplet Formation
Oeftering, Richard, Inventor, NASA Lewis Research Center, USA; Mar. 03, 1998; 21p; In English; Division of US-Patent-Appl-SN-278724, filed 11 Jul. 1994
Patent Info.: Filed 5 Jun. 1995; NASA-Case-LEW-15408-2; US-Patent-5,722,479; US-Patent-Appl-SN-465070; US-Patent-Appl-SN-278724; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The present invention is directed to an apparatus for manufacturing a free standing solid metal part. In the present invention, metal droplets are ejected in a nozzleless fashion from a free surface pool of molten metal by applying focused acoustic radiation pressure. The acoustic radiation pressure is produced by high intensity acoustic tone bursts emitted from an acoustic source positioned at the bottom of the pool which directs the acoustic energy at the pool surface. The metal droplets are electrostatically charged so their trajectory can be controlled by electric fields that guide the droplets to predetermined points on a target. The droplets impinge upon the target and solidify with the target material. The accretion of the electrostatically directed solidified droplets forms the free standing metal part.
Official Gazette of the U.S. Patent and Trademark
Deposition; Metal Surfaces; Manufacturing; Drops (Liquids); Electrostatics

19980203125 White Sands Missile Range, NM USA
Stress Level Testing of Missile and Rocket Systems During Development Tests (Environmental Stress Screening) ***Final Report***
Sep. 30, 1997; 26p; In English
Report No.(s): AD-A340980; TOP-5-1-033; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This TOP presents guidance procedures for the planning and conduct of Environmental Stress Screening (ESS) tests. ESS is a process where hardware is exposed to one or more environments in a serial fashion to accelerate the discovery of design, workmanship, or part flaws inherent in electrical, optical, or mechanical equipment. Emphasis is placed on temperature cycling and random vibration test environments to include instructions for the conduct of thermal and vibration surveys.
DTIC
Missile Systems; Stress Measurement; Vibration Tests; Environmental Tests; Rocket Vehicles

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.

19980201924 Texas Technological Univ., Lubbock, TX USA
High Power Microwaves. Research Training of the AASERT: Funded Students ***Final Report, 30 Jun. 1994 - 15 Jan. 1998***
Kristiansen,, Texas Technological Univ., USA; Jan. 15, 1998; 3p; In English
Contract(s)/Grant(s): F49620-94-1-0299; AF Proj. 3484
Report No.(s): AD-A339052; AFRL-SR-BL-TR-98-0246; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Over the period 30 June 1994 through 15 January 1998, one graduate student, Kevin Woolverton, and seven undergraduate students, Mark Sudduth, Mark Barkley, Lance Salo, Christopher Holderman, Chad Michaelis, Beverly Garcia (minority student), and Eva Rivas (minority student) worked on this project. Kevin Woolverton had the day-to-day responsibility for our vicator and mode converter research. The undergraduates, except for Beverly Garcia and Eva Rivas, assisted in various aspects of data collection and analysis, computer program development, and in electronic device designs. Beverly and Eva mainly assisted in the administrative work, purchasing, messages, account bookkeeping, report preparation, etc.
DTIC
Education; Students; Computer Programming; Data Acquisition

19980201942 Naval Postgraduate School, Monterey, CA USA
A Fuzzy Associative Data Fusion Algorithm for VTS ***Interim Report, 1 Jan. - 30 Sep. 1997***
Tummala, Murali, Naval Postgraduate School, USA; Midwood, Sean A., Naval Postgraduate School, USA; Feb. 27, 1998; 26p; In English
Report No.(s): AD-A339412; NPS-EC-98-004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An algorithm to fuse redundant observations due to multiple sensor coverage, in order to reduce duplicate track information provided to Vessel Traffic Services (VTS) operator displays, is reported. The algorithm receives inputs from multiple sensors as long as the basic decision criteria elements are provided. The algorithm is tested with real data collected from the VTS system at Puget Sound in September 1996. The results indicate that the algorithm correctly fuses redundant sensor observations on the same vessel resulting in a significant reduction in the amount of unnecessary information presented to the VTS operator.
DTIC
Algorithms; Multisensor Fusion; Sounds (Topographic Features); Radar Tracking

19980201943 Army Research Lab., Aberdeen Proving Ground, MD USA
Mutual Inductance Between a Coil and an Electromagnetically Launched Plate ***Final Report***
Hummer, Charles R., Army Research Lab., USA; Berning, Paul R., Army Research Lab., USA; Mar. 1998; 50p; In English
Report No.(s): AD-A339892; ARL-TR-1643; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A possible countermunition against kinetic energy (KE) rods is a thin square metal launched edge-on so that an edge strikes the rod first followed by the rest of the plate. A properly designed coil gun can launch plates edge-on to velocities of several hundred meters per second. The proper design of the coil gun depends on knowing the mutual inductance between the coil and the plate, which was calculated by assuming that the current distribution in plate can be described by a polynomial that has some arbitrary coefficients. These coefficients were determined by equating the magnetic induction of the current distribution to the negative of the applied magnetic induction of the launch coil at selected points on the plate. This step was aided by the fact that all the integrals arising from the Biot-Savart law are analytic. In the next step, the mutual inductance was calculated from the current distribution and the applied magnetic induction. The calculation was repeated for various plate positions in the coil. These results were used to design the power supply for the launch coil and to calculate the final velocity of the plate.
DTIC
Hypervelocity Guns; Gun Launchers; Magnetic Induction; Rods; Electric Coils; Armor; Plates (Structural Members); Hypervelocity Launchers

19980202306 Nichols Research Corp., Wakefield, MA USA
Maximum Likelihood Adaptive Neural Systems (MLANS) Application to High Frequency (HF) Propagation ***Final Report, Apr. - Dec. 1994***
Perlovsky, L. I., Nichols Research Corp., USA; Marzetta, T. C., Nichols Research Corp., USA; Webb, V. H., Nichols Research

Corp., USA; Plum, C. P., Nichols Research Corp., USA; Sep. 1997; 60p; In English
Contract(s)/Grant(s): F19628-94-C-0049; AF Proj. 4600
Report No.(s): AD-A339150; NRC-TR-94-149; RL-TR-97-94; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The feasibility of applying a model-based neural network technique to investigate the properties of ionospheric clutter observed in the operation of high frequency (HF) propagation systems was examined. Individual ionospheric clutter structures found in the amplitude-range-Doppler (ARD) spectra of over-the-horizon (OTH) radar data were successfully segmented and characterized. A multi-mode Gaussian clutter model was formulated using the Maximum Likelihood Adaptive Neural System (MLANS) to fit the observations. The results indicate that either a three or a four mod e Gaussian model is sufficient for MLANS to segment and characterize the observed clutter. High Fidelity simulations of time slices of the raw data were achieved by combining time-varying Gaussian together with a time-varying uniform distribution to represent the noise floor. Each Gaussian mode (or model) is characterized by a time-varying set of three parameters: amplitude, Doppler spread, and Doppler shift.
DTIC
Neural Nets; Clutter; Over-The-Horizon Radar; Maximum Likelihood Estimates; Signal Processing; Radar Tracking; Ionospheric Propagation; Target Acquisition

19980202593 Physics and Electronics Lab. TNO, The Hague, Netherlands
Fast Convolution Module (Fast Convolution Module)
Bierens, L. H., Physics and Electronics Lab. TNO, Netherlands; Beukelman, P. C., Physics and Electronics Lab. TNO, Netherlands; Wout, C., Physics and Electronics Lab. TNO, Netherlands; Oct. 1997; 70p; In Dutch
Report No.(s): AD-A341195; FEL-96-A307; TDCK-TD96-0400; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the design and realization of a real-time range azimuth compression module, the so-called 'Fast Convolution Module', based on the fast convolution algorithm developed at TNO-FEL. The module will be part of a Real-Time SAR Processor for Air Force applications. Range and azimuth compression, as well as the Corner Turning Memory, are the critical steps within the SAR processing chain. The result of this project, a tested hardware module, shows the feasibility of the technological concept of the 'Fast Convolution Module'. The module is tested in the Real-Time SAR Testbed environment, that has been developed at TNO-FEL. The realization of this module is an important step in the realization of a demonstrator Real-Time SAR Processor.
DTIC
Signal Processing; Synthetic Aperture Radar; Azimuth; Algorithms; Real Time Operation; Fast Fourier Transformations

19980202684 Operational Technologies Corp., San Antonio, TX USA
Electromagnetic Radiation Inverse Scattering ***Final Report, Apr. 1993 - Oct. 1994***
Roberts, Thomas, Operational Technologies Corp., USA; Aug. 1997; 119p; In English
Contract(s)/Grant(s): F41624-92-D-4001; AF Proj. 7757
Report No.(s): AD-A340974; AL/OE-TR-1997-0107; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The report is divided into four parts. Part one is about nonlinear microwave amplification and the further use of nonlinear Schroedinger equations to model amplifiers. Part two is about speeds of frequency components of electromagnetic pulses, and a related inversion method. Our numerical computation of precursors shows that damping increases the speed of frequency components to a degree that is consistent with energy velocity. The speed up here is slight, and a medium that has been called 'highly absorptive' exhibits no speed up. These small effects lead us to question the extent to which energy velocity would be more useful than group velocity in the laboratory. We also introduce an especially simple method for measuring permittivity. Part three is about an inversion method for depth-dependent dispersive objects that are flat, and whose properties vary only with depth. Tissue and soil are discretely layered examples of such media. But this paper's algorithm also applies to dispersive media that are continuously layered. A time domain layer stripping method that uses wave splitting and Krueger-Ochs Green functions is presented. Part four is about general rules of pulse propagation in dispersive media, with applications to inversion. We develop some new methods for describing pulse propagation for general dispersive media, using a Debye model for water as an example. Short pulse, long pulse, short time, and long time approximations are presented. We explain a factor of nine effect in the speed of waves in water, which seems to have been previously unnoticed. We provide sharp tipper bounds for the propagated amplitude and reduce the computation of those bounds to a calculator exercise. These bounds may be useful in controlling the electromagnetic interference on damage produced in dispersive media.
DTIC
Electromagnetic Radiation; Inverse Scattering; Nonlinear Equations; Microwaves; Amplification; Numerical Analysis; Velocity

19980202699 Massachusetts Univ., Dept. of Electrical and Computer Engineering, Amherst, MA USA
Proceedings of the 1996 Antenna Applications Symposium ***Final Report, 18-20 Sep. 1996***
Schaubert, Daniel H., Massachusetts Univ., USA; Oct. 1997; 492p; In English, USA
Contract(s)/Grant(s): F30602-96-C-0262; AF Proj. 4600
Report No.(s): AD-A341737; RL-TR-97-189; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The Proceedings of the 1996 Antenna Applications Symposium is a collection of state-of-the art papers relating to phased array antennas, multibeam antennas, satellite antennas, microstrip antennas, reflector antennas, HF, VHF, UHF and various other antennas.

DTIC

Antennas; Conferences; Antenna Arrays; Multibeam Antennas; Reflector Antennas; Microwave Antennas; Microstrip Antennas; Phased Arrays

19980202707 Naval Postgraduate School, Monterey, CA USA
Frequency Reuse Through RF Power Management in Ship-to-Ship Data Networks
Rodriguez, Alfredo, Naval Postgraduate School, USA; Dec. 1997; 74p; In English
Report No.(s): AD-A341252; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A proposed U.S. Navy ship to ship, line of sight, high data rate communication system is analyzed. Because of the limited bandwidth available in the UHF band, it is desired to reuse a frequency channel at the shortest possible range. by limiting the radiated power to the minimum required to establish a desired quality of service, the channel can be reused at considerably shorter ranges than when the transmitter output power is fixed to the maximum available. Frequency reuse, however, introduces the problem of co-channel interference which degrades system performance. A computer simulation was developed to determine the bit error rate (BER) of a QPSK system in a Ricean fading channel with one co-channel interferer. The simulation generates plots of energy per bit to one sided noise power spectral density ratio (Eb/N0) versus BER. Simulation results are used to compute the minimum range (R) at which the channel can be reused while maintaining an average BER of 10 to the 6th power. The results show that even when no power control is used the channel can be reused at a range, R, of approximately 45 kilometers. This range can be reduced to less than 20 kilometers if an interfering ship can reduce its output power by 30 dB.

DTIC

Frequency Reuse; Data Management; Communication Networks; Radio Frequencies; Multichannel Communication

19980202721 Maryland Univ., Center for Automation Research, College Park, MD USA
Advanced Automatic Target Recognition ***Final Report, 1 May 1997 - 31 Jan. 1998***
Chellappa, Ram, Maryland Univ., USA; Mar. 15, 1998; 27p; In English
Contract(s)/Grant(s): F49620-97-1-0523
Report No.(s): AD-A341102; AFRL-SR-BL-TR-98-0289; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report summarizes the findings of the research, Advanced Automatic Target Recognition, supported by AFOSR grant P4962O-97-I-O523. In this research effort, we have developed a method for detecting buildings from SAR images, so that false alarms due to building returns can be reduced. We consider three scenarios corresponding to incremental data availability from a high-resolution, airborne SAR, multiple SAR images and interferometric SAR. In a single strip-map SAR image, we look for certain characteristics exhibited by buildings in radar imagery, namely the combination of cardinal streaks and supporting shadow, to delineate buildings. We then present a framework for registering multi-pass airborne SAR images and for extracting heights of 3-D structures which produce identifiable linear patterns in them. Finally, given noisy elevation data derived from an interferometric (IF) SAR, buildings are segmented from the ground using a local histogram-based thresholding scheme, consolidated by propagating the thresholds, and refining along their edges to reduce errors. The effectiveness of the building detection and height estimation algorithms is demonstrated using examples of high-resolution SAR data from Lincoln Laboratory's ADTS radar and elevation data derived from Sandia's IPSAR platform. Our results will make possible on-the-fly, context-based exploitation of SAR images.

DTIC

Target Recognition; Procedures; Synthetic Aperture Radar; High Resolution; Algorithms; Pattern Recognition

19980202745 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
A Case for Call Activity Detection for ATM Voice Services in Project Parakeet
Blair, W. D., Defence Science and Technology Organisation, Australia; Jan. 1998; 42p; In English
Report No.(s): DSTO-TR-0606; DODA-AR-010-411; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance

Research Lab., PO Box 1500, Salisbury, South Australia); US Sales Only, Hardcopy, Microfiche

The introduction of Asynchronous Transfer Mode (ATM) into the Australian Army tactical communication system will provide significant benefits through responsive network management and the integration of multiple communication applications. ATM integration into Parakeet is complicated as the current network employs military standard protocols which are quite different to civil standards. This report seeks to quantify capacity economies which can be achieved through the development of an adaptive approach to voice services on the ATM network by transmitting only active connections. An examination is also made to determine whether data communications protocols can access the released capacity. The study finds that savings are significant and the released capacity should add substantially to data communications capability.

Author

Asynchronous Transfer Mode; Protocol (Computers); Military Operations; Integrated Circuits; Pulse Communication

19980202763 Physics and Electronics Lab. TNO, The Hague, Netherlands

Classification of Broad Side Radar Range Profiles Using a Synthetic Database

vanderHeiden, R., Physics and Electronics Lab. TNO, Netherlands; Groen, F. C. A., Physics and Electronics Lab. TNO, Netherlands; Mar. 1998; 35p; In English; Original contains color illustrations

Contract(s)/Grant(s): A95/KM/811; Proj. 25668

Report No.(s): TD97-0344; FEL-97-A206; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche

Target recognition with radar range profiles relies on the availability of a database filled with profiles of all targets of interest, measured at a large number of aspect angles. Avoiding expensive and lengthy measurement campaigns, electromagnetic computations on geometric aircraft models can be used to acquire the data base. For these computations RAPPORT, a so called RCS-prediction code developed at TNO-FEL, is used. This report provides the first results on the classification of measured range profiles with synthetic range profiles.

Author

Classifications; Radar Range; Radar Tracking; Geometry

19980202819 Prairie View Agricultural and Mechanical Coll., Center for Materials, Microdesign and Microfabrication, TX USA

High Temperature Superconductors Applications in Telecommunications

Kumar, A. Anil, Prairie View Agricultural and Mechanical Coll., USA; Li, Jiang, Prairie View Agricultural and Mechanical Coll., USA; Zhang, Ming Fang, Prairie View Agricultural and Mechanical Coll., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 601-610; In English; Also announced as 19980202795

Contract(s)/Grant(s): Proj. 010366-215; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The purpose of this paper is twofold: (1) to discuss high temperature superconductors with specific reference to their employment in telecommunications applications; and (2) to discuss a few of the limitations of the normally employed two-fluid model. While the debate on the actual usage of high temperature superconductors in the design of electronic and telecommunications devices - obvious advantages versus practical difficulties - needs to be settled in the near future, it is of great interest to investigate the parameters and the assumptions that will be employed in such designs. This paper deals with the issue of providing the microwave design engineer with performance data for such superconducting waveguides. The values of conductivity and surface resistance, which are the primary determining factors of a waveguide performance, are computed based on the two-fluid model. A comparison between two models - a theoretical one in terms of microscopic parameters (termed Model A) and an experimental fit in terms of macroscopic parameters (termed Model B) - shows the limitations and the resulting ambiguities of the two-fluid model at high frequencies and at temperatures close to the transition temperature. The validity of the two-fluid model is then discussed. Our preliminary results show that the electrical transport description in the normal and superconducting phases as they are formulated in the two-fluid model needs to be modified to incorporate the new and special features of high temperature superconductors. Parameters describing the waveguide performance - conductivity, surface resistance and attenuation constant - will be computed. Potential applications in communications networks and large scale integrated circuits will be discussed. Some of the ongoing work will be reported. In particular, a brief proposal is made to investigate of the effects of electromagnetic interference and the concomitant notion of electromagnetic compatibility (EMI/EMC) of high T(sub c) superconductors.

Author

High Temperature Superconductors; Telecommunication; Technology Transfer; Utilization

19980202899 Naval Postgraduate School, Monterey, CA USA
A High Resolution Satellite Communication Model
Murphy, Brandee L., Naval Postgraduate School, USA; Sep. 1997; 133p; In English
Report No.(s): AD-A341533; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Information warfare is a cornerstone of Joint Vision 2010 which addresses the future strategic environment for the USA. An integral component of information warfare is the continuing development of joint space doctrine. The Joint Warfare System (JWARS) is a large scale, systemic simulation being developed by the Joint Warfare Systems Office to aid in the evaluation of future joint doctrine and force structure. The purpose of this thesis is to develop and demonstrate Simulation of Satellite Communications (SIMSATCOM), a high resolution, stochastic simulation of satellite communications for evaluating the effectiveness of message transmission and receipt by specified senders and receivers. SIMSATCOM is designed to operate as a stand alone simulation, but may be adopted as a high resolution module for a large scale simulation such as JWARS. The thesis describes SIMSATCOM in detail and provides analyses of simulation runs for different jamming levels and channel capacities.
DTIC
Message Processing; High Resolution; Models; Simulation; Satellite Communication

19980202916 Washington Univ., Dept. of Systems Science and Mathematics, Saint Louis, MO USA
Analytical and Computational Methods for Nonlinear Feedback Design ***Final Report, 1 Sep. 1994 - 30 Aug. 1997***
Byrnes, Christopher I., Washington Univ., USA; Isidori, Alberto, Washington Univ., USA; Aug. 1997; 37p; In English
Contract(s)/Grant(s): F49620-94-1-0438
Report No.(s): AD-A341528; 22-1345-59074; AFRL-SR-BL-TR-98-0290; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The lack of a systematic methodology for the design of feedback laws capable of controlling complex dynamical systems has been a limiting factor in several current and emerging DoD missions. The research carried out by the principal investigators in this three year research effort has focused on analyzing and computing the steady-state behavior of controlled complex dynamical systems. One of the fundamental discoveries made during this research effort concerns the steady-state behavior of a dynamical system which provides estimates of the current state. The analysis led to an unanticipated geometric discovery which led to the solution of an outstanding problem in linear systems theory with applications in speech synthesis, voice recognition and signal processing. These advances were supported by computational methods developed in this research effort and which are documented in this final report and in a patent application. Another fundamental discovery made during this research effort was focused on controller design for a class of distributed parameter systems. Our results quantify properties of attractors and the steady-state behavior of solutions. The principal investigating team also discovered results concerning the asymptotic behavior of linear distributed parameter systems undergoing harmonic, or periodic, forcing.
DTIC
Signal Processing; Speech Recognition; Computation; Analysis (Mathematics); Nonlinear Feedback; Design Analysis; Voice Communication

19980202918 Physics and Electronics Lab. TNO, The Hague, Netherlands
Bistatic Radar as a Concept for an Weapon Locating Radar ***Bistatische radar als concept voor een Wapen Locatie Radar***
Paquay, M. H., Physics and Electronics Lab. TNO, Netherlands; Oct. 1997; 21p; In Dutch
Contract(s)/Grant(s): A94KL783
Report No.(s): AD-A341667; FEL-97-A214; TDCK-TD97-0144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the candidate successors of the Artillery Locating Radar AN/TPQ-37 is based on the bistatic radar concept. One of the apparent advantages is the invulnerability for ARM's and ECM. Probably, state of the art components and processors are needed to realize this complex concept. This report looks into the principles of bistatic radar and the allied properties. In a system evaluation, attention has te be paid to the applied solutions for some basic technical problems.
DTIC
Multistatic Radar; Weapon Systems; Position (Location)

19980202920 Naval Postgraduate School, Monterey, CA USA
Current and Future Efforts to Vary the Level of Detail for the Common Operational Picture
Hager, Richard S., Naval Postgraduate School, USA; Dec. 1997; 98p; In English
Report No.(s): AD-A341674; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The Joint Staff developed the C4I for the Warrior Concept in 1992 which stated that the warrior needs a fused, real-time, true representation of the battlespace. to help accomplish this vision, the Global Command and Control System was created. It provides

the Common Operational Picture described above, but only down to the level of the Unified Commander. This thesis is a comprehensive report that gives a complete review of the current situational awareness systems available to the commander in addition to current and future efforts to bring a common operational picture to all levels of command. These thesis is designed to give situational awareness to all levels of command. The detailed discussions in the thesis of these systems will help students and researchers in the Joint C4I curriculum at the Naval Postgraduate School develop a better understanding of the difficulties in getting a true common operational picture to all services at all levels.
DTIC
Command and Control; Control Systems Design; Images

19980202939 NASA Pasadena Office, CA USA
Modulated Source Interferometry with Combined Amplitude and Frequency Modulation
Gutierrez, Roman C., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jan. 06, 1998; 14p; In English; Continuation of abandoned US-Patent-Appl-SN-530386, filed 14 Sep. 1995
Patent Info.: Filed 22 Apr. 1997; NASA-Case-NPO-19418-2; US-Patent-5,706,084; US-Patent-Appl-SN-841478; US-Patent-Appl-SN-530386; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An improved interferometer is produced by modifying a conventional interferometer to include amplitude and/or frequency modulation of a coherent light source at radio or higher frequencies. The phase of the modulation signal can be detected in an interfering beam from an interferometer and can be used to determine the actual optical phase of the beam. As such, this improvement can be adapted to virtually any two-beam interferometer, including: Michelson, Mach-Zehnder, and Sagnac interferometers. The use of an amplitude modulated coherent tight source results in an interferometer that combines the wide range advantages of coherent interferometry with the precise distance measurement advantages of white light interferometry.
Official Gazette of the U.S. Patent and Trademark
Interferometers; Amplitude Modulation; Frequency Modulation; Coherent Light; Interferometry; Light Beams

19980202963 Institute for Human Factors TNO, Soesterberg, Netherlands
Speech Transmission Quality and Sound Attenuation of the Bose ANR Prototype for the SPH-5 Helmet ***Final Report S-praaktransmissiekwaliteit en geluidverzwakking van het Bose ANR Prototype voor de SPH-5 helm***
vanWijngaarden, S. J., Institute for Human Factors TNO, Netherlands; Oct. 06, 1997; 16p; In English
Contract(s)/Grant(s): A97/KLu/328; Proj. 786.4
Report No.(s): TM-97-A064; TD-97-0247; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

Upon request of the Royal Netherlands Air Force, speech transmission and hearing protection of an Active Noise Reduction (ANR) prototype by Bose for the SPH-5 helmet has been investigated. The (active and passive) sound attenuation properties and the speech transmission quality of the telephones of the headset have been measured. On the basis of ambient noise levels measured in the helicopter, noise levels at the ear and maximum daily exposure time have been predicted. The maximum exposure time, calculated from the attenuation curves, may be extended using the Bose ANR prototype to up to 8 hours daily in the cockpit and 2.5 hours daily in the cargo compartment. The passive attenuation is poor; the good active attenuation due to the ANR at low frequencies compensates for this. The active attenuation for frequencies below 160 Hz is higher than generally found for other (commercial) systems. The speech transmission quality in ambient noise is higher than with the original SPH-5, but lower than with the Peltor-modified version of the SPH-5. The system showed good stability in the laboratory; no clipping or oscillations were observed.
Author
Acoustic Attenuation; Noise Intensity; Aircraft Noise; Helmets; Hearing; Earphones; Noise Prediction; Voice Communication; Noise Reduction

19980202992 Colorado Univ., Optoelectronic Computing Systems Center, Boulder, CO USA
Adaptive Phased Array Radar Signal Processing Using Photorefractive Crystals ***Final Report, Jan. 1992 - Jan 1996***
Wagner, Kelvin, Colorado Univ., USA; Weverka, Ted, Colorado Univ., USA; Sarto, Anthony, Colorado Univ., USA; Weaver, Sam, Colorado Univ., USA; Feb. 1998; 330p; In English
Contract(s)/Grant(s): F30602-92-C-0011; AF Proj. 2863
Report No.(s): AD-A341647; RL-TR-97-223; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This report covers the development, test and evaluation of an adaptive phased array optical processor. This system is designed to optimally process the wide band signals from large phased array antennas in real time, achieving a computational throughput approaching 10-15 multiplies per second, demonstrating the potential of optical-based architectures to surpass performance

achievable with conventional technology. The processor uses a three-dimensional volume hologram to create and store adaptive weights to simultaneously perform beam steering and jammer-nulling functions. The adaptive processor consists of two sub-sections, the main beam steering processor and the jammer-nulling processor. The nature of the architecture is that the number of processor components used is independent of the number of elements in the phased array. The report contains extensive treatment of models and analytical expressions developed to relate system parameters and to predict expected system behavior and performance of the experimental signal processors. A variety of jammer scenarios are described and analyzed. Experimental results obtained in a working hardware configuration of the processor are shown to verify the theoretical models. The models guided the development and evolution of the experimental optical hardware system with increasingly improved performance. by improving component stability, electronic gain, and feedback loop isolation, 45 dB jammer cancellation was demonstrated in the experimental system. Also described are results of main beam formation experiments that did not require a priori knowledge of the angle-of-arrival of the desired signal. In addition, results from simultaneous operation of both the nulling processor and the main beam processor are presented.
DTIC
Signal Processing; Phased Arrays; Adaptive Control; Signal Analyzers; Crystals; Photorefractivity

19980203016 Naval Postgraduate School, Monterey, CA USA
OPNET Implementation of Spread Spectrum Network for Voice and Data Distribution
Standfield, Roger D., Naval Postgraduate School, USA; Dec. 1997; 137p; In English
Report No.(s): AD-A341138; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis presents an OPNET model and simulation of a single cell wireless communications system within a proposed expeditionary warfare communications network. The focus of this thesis is to model and implement data and voice traffic generation, slofted ALOHA medium access control protocol, and direct sequence spread spectrum code division multiple access (CDMA) mechanisms in OPNET. The RF channel is modeled as both a Rayleigh fading channel and a non-fading noise limited channel. Simulation results evaluating the induced BER and multiple access implementation are presented.
DTIC
Wireless Communication; Communication Networks; Code Division Multiple Access; Access Control; Spread Spectrum Transmission; Voice Communication

19980203102 Naval Postgraduate School, Monterey, CA USA
Management of Autonomous Systems in the Navy's Automated Digital Network System (ADNS)
Sullivan, James A., Naval Postgraduate School, USA; Sep. 1997; 98p; In English
Report No.(s): AD-A341474; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

In an effort to create a more efficient, interoperable communications environment for its ships at sea the Navy has developed the Automated Digital Network System. Because of its recent introduction into the fleet and the evolving nature of the program there has not yet been any high level operational guidance provided for communications planners and managers. The major contribution of this thesis is to describe key issues fundamental to successful mission accomplishment. Operating in a network centric environment represents a conceptual departure from standard Navy at sea communications methods. The changes in thinking necessitated by this departure are presented to highlight the need for a new approach to communications management. Analysis of program design and implementation yielded the framework for the outline of system requirements and the management considerations necessary for effective operational employment. Reviews of fundamental concepts underlying the system and program origins are provided as background material.
DTIC
Digital Systems; Pulse Communication

19980203191 Army Research Lab., Adelphi, MD USA
A Technique for Calibrating the Phase Detector of a Wideband Radar Using an External Target ***Final Report, Jan - Aug. 1997***
Wallace, H. B., Army Research Lab., USA; Pizzillo, Thomas J., Army Research Lab., USA; Mar. 1998; 19p; In English
Report No.(s): AD-A341633; ARL-TR-1521; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A signal processing method is presented for correcting imbalances in the phase detection channels of a coherent, wideband radar. The technique, an expansion of an earlier method, derives phase and gain corrections using an external point target illuminated by a wideband waveform. The technique does not depend upon the target or the phase and gain flatness of the radar wave-

form. Errors remaining after application of this technique depend on the signal to noise ratio and the correlation of the sampling with the radar waveform.
DTIC
Synthetic Aperture Radar; Phase Detectors; Calibrating; Broadband; Signal Processing

19980203198 Naval Space Command, Dahlgren, VA USA
Naval Space Command. Space Tracks, *Mar. - Apr. 1998*
Apr. 1998; 24p; In English
Report No.(s): AD-A341588; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Space Tracks is published five times a year as an official communications medium for Naval Space Command. Its purpose is to discuss naval space issues and initiatives, and promote a broader awareness of space support available to the naval warfighter. Information contained in Space Tracks does not necessarily reflect the official views of the U.S. Government, the Department of Defense or the Department of the Navy. The editorial content is prepared by the Public Affairs Office of the Commander, Naval Space Command.
DTIC
Defense Program; Navy

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.

19980202175 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
Semiconductor Measurement Technology: Thin Film Reference Materials Development *Final Report*
Belzer, B. J., National Inst. of Standards and Technology, USA; Eberhardt, K., National Inst. of Standards and Technology, USA; Chandler–Horowitz, D., VLSI Standards, Inc., USA; Ehrstein, J. R., VLSI Standards, Inc., USA; Durgapal, P., VLSI Standards, Inc., USA; Apr. 1998; 52p; In English
Report No.(s): PB98-140965; NIST/SP-400/100; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Independent single-wavelength ellipsometric measurements of thermally grown silicon dioxide thin films on silicon substrates and data analyses were compared between two laboratories (National Institute of Standards and Technology and VLSI Standards, Inc.) under a Cooperative Research and Development Agreement (CRADA). The primary intent, based on a sequence of sample exchanges, was to establish a measurement baseline enabling the demonstration of traceability to NIST for several silicon dioxide film thicknesses that are outside the range of Standard Reference Materials (SRMs) available from NIST. Thin films less than 10 nm thickness were of particular interest. The results of the intercomparison show that there are small systematic differences in the value of the ellipsometric parameters delta and psi between the two laboratories along with occasional larger differences. Artificial differences in the calculated film thicknesses exist because of the use of different algorithms for computation. A single-layer model and a fixed value of the oxide index of refraction are assumed for the primary comparison in this collaboration; a two-year model of the oxide/interface/substrate system is also presented.
NTIS
Semiconductors (Materials); Film Thickness; Silicon Dioxide; Dimensional Measurement; Ellipsometry; Thin Films

19980202294 International Society for Optical Engineering, Bellingham, WA USA
Optoelectronic Integrated Circuits *Final Report, 20 Feb. - 31 Dec. 1997*
Ramaswamy, Ramu V., Editor, International Society for Optical Engineering, USA; Mar. 10, 1998; 499p; In English
Contract(s)/Grant(s): N00014-97-1-0338
Report No.(s): AD-A340630; V3006; ISBN 0-8194-2417-X; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
This paper discusses the following topics: Progress in normal incidence III-V quantum well infrared photodetectors; Technologies for large scale IaP based optoelectronic integrated circuits; GaAs/AIGaAs traveling-wave electro-optic modulators; Modeling and simulation of optoelectronic multichip modules using VHDL; and Progress in optoelectronic polymers and devices.
DTIC
Optoelectronic Devices; Integrated Circuits; Quantum Wells; Electro-Optics

19980202455 Stanford Univ., Dept. of Mechanical Engineering, Stanford, CA USA

Fundamental Studies of the Electrode Regions in Arcjet Thrusters ***Final Report, 1 Aug. 1995 - 30 Nov. 1997***

Cappelli, Mark A., Stanford Univ., USA; Mar. 1998; 154p; In English

Contract(s)/Grant(s): F49620-95-1-0317; AF Proj. 2308/AS

Report No.(s): AD-A342673; AFRL-SR-BL-TR-98-0388; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This research focuses on the understanding of the plasma dynamics in the near node and near-cathode region of arcjets with an emphasis on the development of an extensive database for the validation of arcjet models. During the first year of this research period, the arc cathode interaction was investigated by in-situ spectroscopic imaging and by axial emission spectroscopy, providing measurements of cathode current density, cathode temperature, and near-cathode plasma properties. In addition, during this grant period, we have extended the use of Laser Induced Fluorescence (LIF) to make measurements of plasma properties within the expanding region of the nozzle and have accumulated an extended data base that includes, in addition to the use of pure hydrogen propellant, mixtures of hydrogen and nitrogen to simulate hydrazine decomposition products. In the final year, a new laser based diastic, Doppler-Free Absorption Spectroscopy (DFAS) was developed and applied to measure the exit plane electron number density in a hydrogen arcjet, one of the last properties needed to provide closure to the vast data set that we have generated for low power hydrogen arcjet. As a spin-off to this grant, the LIF diagnostics that was developed for arcjet through this program was extended to the study xenon plasmas, and implemented to measure both neutral and ionized on velocities at the exit of a Hall thruster. This contributed to a comprehensive study of the near exit region of our Hall discharge device. to compliment the LIF diagnostics on our Hall thrusters, we have made extensive measurements of the transient and time average plasma properties using conventional electrostatic probes.

DTIC

Electrodes; Arc Jet Engines; Absorption Spectroscopy; Electron Density (Concentration); Thrustors

19980202457 Honeywell Technology Center, Minneapolis, MN USA

Avionics/Electronics Quick Reliability Assessment ***Final Report, Sep. 1991 - Feb. 1994***

Havey, G., Honeywell Technology Center, USA; Lewis, S., Honeywell Technology Center, USA; Seifert, G., Honeywell Technology Center, USA; Mar. 1998; 78p; In English

Contract(s)/Grant(s): F30602-91-C-0083; AF Proj. 2338

Report No.(s): AD-A342681; C950805; AFRL-IF-WP-TR-1998-5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes the Quick Reliability Assessment Tool (QRAT) developed under this effort. The QRAT is a configurable data acquisition device designed to collect, process, and store environmental data for military and commercial electronic systems. It is designed for easy transfer from one platform to another, and to operate on its own battery, independent of the platform. The battery is considerably larger than the QRAT device itself. Highly accurate sensor systems are combined with state of the art processing units to capture and store a wide range of physical data to be used in predictive maintenance and other history based prognostics. Triaxial vibration, physical shock, temperature, humidity, and voltage transient data are processed and recorded in real time by a 0.9 x 3 x 4 inch Sensor and Electronics Package and transferred to a host PC for post collection display and analysis.

DTIC

Avionics; Data Processing; Electric Potential; Real Time Operation

19980202559 Mitsubishi Electric Corp., Amagasaki, Japan

Calculation of CdTe Semiconductor Detector Response

Nishizawa, H., Mitsubishi Electric Corp., Japan; Ikegami, K., Mitsubishi Electric Corp., Japan; Takashima, K., Mitsubishi Electric Corp., Japan; Usami, T., Mitsubishi Electric Corp., Japan; Yamamoto, T., Osaka Univ., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 61-69; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Calculations of detector response normally assume that the energy absorption of the sensor part is proportional to the output pulse height. However, the response of a semiconductor detector whose charge carrier mobility is as small as that of CdTe can not be simulated because the output pulse height is not proportional to the absorbed energy of the sensor part. In the EGS4 calculation, the response of the CdTe semiconductor detector can be simulated by multiplying the value of the absorbed energy by the weight function, which takes into account the mean free path of the charge carriers and the interaction position. The calculated results agree well with the results of the experiment and indicated that the simulation model is valid.

Author

Computation; Cadmium Tellurides; Semiconductor Devices; Carrier Mobility; Experimentation

19980202598 Kiev National Univ., Radiophysics Faculty, Kiev, Ukraine

Bragg Cell on TeO2 for 2-D Deflector with Reduced Drive Power: Analysis, Design, and Experimental Examination ***Final Report, 10 Jan. 1996 - 9 Dec. 1996***

Yurchenko, A. V., Kiev National Univ., Ukraine; Oboznenko, V. M., Kiev National Univ., Ukraine; Moskalev, V. M., Kiev National Univ., Ukraine; Stevens, D. M., Wright Lab., USA; Sep. 1997; 41p; In English

Report No.(s): AD-A341126; WL-TR-97-1192; EOARD,XC-SPC-95-4036; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work is to study the mechanisms limiting the bandwidth of 2-D Acousto-Optic Deflector (AOD) and to examine such a deflector experimentally. The work consists of three parts: (1) The construction of 2-D AOD was considered. The frequency characteristic was analyzed using the physical model of the plane light wave, interacting with the divergent sound beam inside the TeO2 crystal. The entire frequency characteristic has been calculated, taking into account the change of the light polarization. The dependence of the frequency characteristic on the acoustic power and constructive parameters of the acousto-optical element have been analyzed. (2) A technique for wide band matching of the high frequency LiNbO3 transducers that allows the exclusion of the impedance transformer has been described and used to match the acousto-optical element on TeO2. The calculated network was practically constructed and examined experimentally. (3) The 5.5 deg and 7.9 deg acousto-optical deflections were investigated experimentally. The frequency characteristics at various adjustment angles and drive powers have been measured and analyzed.

DTIC

Deflectors; Bragg Cells; Acousto-Optics; Bandwidth

19980202635 Naval Postgraduate School, Monterey, CA USA

A 3-Channel 14-Bit Optimum SNS Wideband Digital Antenna: Analysis of the Electro-Optic Sampling Front End

Foster, Kevin D., Naval Postgraduate School, USA; Sep. 1997; 87p; In English

Report No.(s): AD-A341258; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Space considerations onboard naval surface ships frequently preclude adequate separation between high frequency (HF) transmit antennas and HF receive only antennas. As a result, high power shipboard emanations (for example Link-11), interfere with low power signals of interest operating within the same frequency band. Symmetrical Number System (SNS) digital antennas provide high resolution direct digitization of wideband signals with excellent in band signal rejection characteristics, which makes them ideal for operating within high RF environments. This thesis describes the design, construction, testing and analysis of the optical electronics at the front end of a prototype optimum SNS digital antenna with a desired accuracy of 14 bits and a bandwidth of 2.5 MHz. The digital antenna utilizes pulsed laser sampling in conjunction with a parallel configuration of Mach-Zehnder interferometers which provide superior bandwidth and isolation performance over electronic sampling mechanisms. The interferometer folded output signal is in accordance with the optimum Symmetrical Number System (SNS) which yields the maximum amount of information from a folding waveform. The theory and experimental performance of the optical subsystem and the analog electronics subsystem is presented, and the total system performance is evaluated. A summary of results and a conclusion with recommendations for improvements to follow-on systems is also discussed.

DTIC

Digital Techniques; Bandwidth; Electro-Optics; Antennas; Pulse Communication

19980202659 Georgia Tech Research Inst., Atlanta, GA USA

Multidimensional Multiwavelength Circuit/ Switching using Wavelength Conversion Via Four Wave Mixing (FWM) in Semiconductor Optical ***Final Report, 1 Nov. 1996 - 31 Oct. 1997***

Blumenthal, Daniel J., Georgia Tech Research Inst., USA; Nov. 1997; 7p; In English

Contract(s)/Grant(s): F49620-96-1-0168; AF Proj. 1651

Report No.(s): AD-A341042; AFRL-SR-BL-TR-98-0311; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this program is to investigate multichannel, multiwavelength switching via four wave mixing in semiconductor optical amplifiers. We have successfully demonstrated and modeled two channel switching within a single amplifier for the first time. Bit error rate and power penalty measurements are reported as well as techniques to increase channel capacity using Gain Clamping Technique.

DTIC

Optical Switching; Semiconductors (Materials); Circuits; Four-Wave Mixing; Wavelengths; Channel Capacity; Light Amplifiers

19980202692 Department of the Navy, Washington, DC USA

Method of Forming an Interband Lateral Resonant Tunneling Transistor with Single Narrow Gate Electrode

Meyer, Jerry R., Inventor, Department of the Navy, USA; Hoffman, Craig A., Inventor, Department of the Navy, USA; Bartoli, Filbert J., Jr., Inventor, Department of the Navy, USA; Sep. 09, 1997; 12p; In English; Supersedes US-Patent-Appl-SN-379833

Patent Info.: Filed 27 Jan. 1995; US-Patent-Appl-SN-379833; US-Patent-5,665,618

Report No.(s): AD-D018768; No Copyright; Avail: US Patent and Trademark Office, Microfiche

It is the objective of this invention to provide a resonant tunneling device based on resonant tunneling processes in narrow-gap macrostructures capable of driving follow-on devices within the electronic circuit, another object of this invention is to provide a resonant tunneling transistor displaying negative differential resistance (NDR) and transconductance microns% that are favorable to fanout (-l0% ms/mm) at temperatures up to 300 K%. These objects are achieved by an interband lateral resonant transistor that is a narrow-gap heterostructure transistor employing the resonant tunneling technique with a single gate. Tunneling occurs via valence states in the gate region which have been brought into energy resonance with the conduction states in the source and drain channels. In the design of the interband lateral resonant transistor advantage is taken of the fact that the valence quantum states or levels are well resolved because the subband splitting for holes near the top of the valence band in both Hg-based and IELAs-based quantum wells are nearly as large as for the electrons.

DTIC

Gates; Resonant Tunneling; Transistors; Electrodes

19980202718 Rochester Inst. of Tech., Dept. of Electrical Engineering, NY USA

An Investigation of Deterministic and Stochastic Properties of Microwave/Millimeter Wave Signals Generated in Laser Diodes with Short External Cavity ***Final Report***

Li, Guifang, Rochester Inst. of Tech., USA; Nov. 24, 1997; 38p; In English

Contract(s)/Grant(s): N00014-96-1-0794

Report No.(s): AD-A341207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

From a nonlinear dynamic point of view, Hopf bifurcation is responsible for the occurrence of the high-frequency intensity oscillations. However, Hopf bifurcation is only the necessary condition. The necessary and sufficient conditions are that Hopf bifurcation occurs and the limiting point of existence of a higher-order mode is above the stability boundary of a lower-order mode. The noise characteristics of the high-frequency oscillations can be measured using the HP 3048A phase and amplitude noise measurement system.

DTIC

Stochastic Processes; Millimeter Waves; Nonlinear Systems; Signals

19980202752 Department of the Navy, Washington, DC USA

Charge Amplifier for Blast Gauges

Weinhardt, Robert, Inventor, Department of the Navy, USA; Lindfors, Allen J., Inventor, Department of the Navy, USA; Rieger, James L., Inventor, Department of the Navy, USA; Dec. 23, 1997; 5p; In English

Patent Info.: Filed 20 Mar. 1995; US-Patent-Appl-SN-407460; US-Patent-5,701,101

Report No.(s): AD-D018780; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention is a charge amplifier that directly produces a low impedance voltage output proportional to the charge at its input. The invention consists of an operational amplified an input capacitor a feedback capadtor and a feedback resistor in a parallel configuration. The change amplifier of the present invention can be said to be a differentiator followed by an integrator so that the noisy differentiation process precedes the integration and thus the integration produces less signal degradation.

DTIC

Blasts; Impedance; Differentiators

19980202756 Department of the Navy, Washington, DC USA

Multiple, Parallel, Spatial Measurements of Electrical Phase

Levitt, Hal L., Inventor, Department of the Navy, USA; Tse, Anthony Y., Inventor, Department of the Navy, USA; Oct. 28, 1997; 13p; In English

Patent Info.: Filed 12 Jun. 1995; US-Patent-Appl-SN-489663; US-Patent-5,682,238

Report No.(s): AD-D018774; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A signal processing apparatus for providing accurate electrical phase difference measurement of multiple concurrent signal inputs is disclosed. Phase measurement of an individual signal input is accomplished utilizing an efficient spatial sampling scheme. In operation, measurement and reference wideband RF inputs, differing primarily in phase over frequency, are respective-

ly applied to two RF Channelizer components. Each Channelizer separates the composite input bandwidth into multiple time coincident frequency output channels. Corresponding pairs of output channels then phase modulate a common independent carrier which propagates to the detection plane of a photodetector array forming a spatial interference pattern along one axis for each frequency channel number. A preferred detector element scaling relative to the interference pattern affords efficient phase difference measurement incorporating three detector elements at each frequency channel Conversion of the preferred three detector element intensity values to relative signal phase is accomplished with an algorithm.
DTIC
Signal Processing; Electrical Measurement; Signal Measurement

19980202821 Oak Ridge National Lab., TN USA
Development of Practical High Temperature Superconducting Wire for Electric Power Applications
Hawsey, Robert A., Oak Ridge National Lab., USA; Sokolowski, Robert S., Intermagnetics General Corp., USA; Haldar, Pradeep, Intermagnetics General Corp., USA; Motowidlo, Leszek R., IGC Advanced Superconductors, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 624-632; In English; Also announced as 19980202795
Contract(s)/Grant(s): DE-AC05-84OR-21400; DE-FG02-92ER-81461; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The technology of high temperature superconductivity has gone from beyond mere scientific curiosity into the manufacturing environment. Single lengths of multifilamentary wire are now produced that are over 200 meters long and that carry over 13 amperes at 77 K. Short-sample critical current densities approach 5 x 10(exp 4) A/sq cm at 77 K. Conductor requirements such as high critical current density in a magnetic field, strain-tolerant sheathing materials, and other engineering properties are addressed. A new process for fabricating round BSCCO-2212 wire has produced wires with critical current densities as high as 165,000 A/sq cm at 4.2 K and 53,000 A/sq cm at 40 K. This process eliminates the costly, multiple pressing and rolling steps that are commonly used to develop texture in the wires. New multifilamentary wires with strengthened sheathing materials have shown improved yield strengths up to a factor of five better than those made with pure silver. Many electric power devices require the wire to be formed into coils for production of strong magnetic fields. Requirements for coils and magnets for electric power applications are described.
Author
Wire; Superconductivity; Superconductors (Materials); Technology Assessment; Manufacturing; High Temperature

19980202824 BICC Telecommunication Cables Ltd., Superconductivity Group, Hebburn, UK
High Temperature Superconductors as a Technological Discontinuity in the Power Cable Industry
Beales, T. P., BICC Telecommunication Cables Ltd., UK; McCormack, J. S., BICC Telecommunication Cables Ltd., UK; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 650-660; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The advent of superconductivity above 77 K represents to the power cable industry a technological discontinuity analogous to that seen in the copper telecommunications industry by the arrival of optical fibres. This phenomenon is discussed along with technical criteria and performance targets needed for high temperature superconducting wire to have an economic impact in transmission cables.
Author
High Temperature Superconductors; Power Lines; Wire; Industries

19980202825 State Univ. of New York at Buffalo, Superconductive Materials Lab., Amherst, NY USA
Improvements of Critical Current Density in Thallium-Based (Tl,Bi)SR(1.6)Ba(0.4)Ca2Cu3O(x) Superconductors
Ren, Z. F., State Univ. of New York at Buffalo, USA; Wang, C. A., State Univ. of New York at Buffalo, USA; Wang, J. H., State Univ. of New York at Buffalo, USA; Miller, D. J., Argonne National Lab., USA; Goretta, K. C., Argonne National Lab., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 661-672; In English; Also announced as 19980202795
Contract(s)/Grant(s): W-31-109-eng-38; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Epitaxial (Tl,Bi)SR(1.6)Ba(0.4)Ca2Cu3O(x) ((Tl,Bi)-1223) thin films on (100) single crystal LaAlO3 substrates were synthesized by a two-step procedure. Phase development, microstructure, and relationships between film and substrate were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). Resistance versus temperature, zero-field-cooled and field-cooled magnetization, and transport critical current density (J(sub c)) were measured.

The zero-resistance temperature was 105-111 K. J(sub c) at 77 K and zero field was > 2 x 10(exp 6) A/sq cm. The films exhibited good flux pinning properties.
Author
Current Density; Thallium; Superconductors (Materials); Epitaxy

19980202893 Farr Research, Albuquerque, NM USA
Minimizing Dispersion in a Transverse Electromagnetic Waveguide Bend by a Layered Approximation of a Graded Dielectric Material ***Final Report, Mar. - Sep. 1997***
Bigelow, W. Scott, Farr Research, USA; Farr, Everett G., Farr Research, USA; Sep. 1997; 20p; In English
Contract(s)/Grant(s): F29601-97-C-0078; AF Proj. 3005
Report No.(s): AD-A341706; AFRL-DE-PS-TR-1998-1007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Waveguide bends pose a problem for high-voltage ultra-wideband systems or for any transmission-line system with low-loss/fast-risetime requirements, since only a straight section of conventional transmission line can support the pure transverse electromagnetic mode necessary to preserve the risetime of a transmitted pulse. We consider alternative concepts for compensation of waveguide bends. One concept, a graded dielectric strip line bend, is built and tested. by reducing the dispersion of a transmitted voltage step, this strip line bend demonstrates the principle of compensation of a waveguide bend by a graded dielectric lens.
DTIC
Dielectrics; Electromagnetism; Dispersion; Grade; Waveguides

19980202909 Technische Univ., Eindhoven, Netherlands
WOCSDICE 97: 21st Workshop on Compound Semiconductor Devices and Integrated Circuits
May 1997; 143p; In English; 21st; Compound Semiconductor Devices and Integrated Circuits, 25-28 May 1997, Scheveningen, Netherlands
Contract(s)/Grant(s): N68171-97-M-5305
Report No.(s): AD-A341225; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
Partial contents: ”Reliability and degradation of HEMTs and HBTs; ”High Temperature Operation of GaAs Based HFET Structure Containing Layers Grown at Low Temperature”; ”Application of Semiconductor Interface Modelling to Reliability Characterisation”; Metal probe technique for characterisation of semiconductor materials used in optoelectronic devices”; ”A Novel Approach for Determining the Reliability of AlGaAs/GaAs HBTs from Low-Frequency Noise Characteristics”; Optoelectronics; ”Photonic Integrated Circuits for multiwavelength applications”; ”Polarization independent InGaAs/InP chopped quantum well interferometric space switch at 1.55 pm”; ”Design and analysis of a 1 x 8 wavelength division multiplexer based on the self-imaging theory”; ”Design and analysis of a 1 x 32 tapered coupler based on the self-imaging theory”.
DTIC
Integrated Circuits; Semiconductor Devices; Conferences; Reliability; Degradation

19980202914 Rome Air Development Center, Griffiss AFB, NY USA
Implementation of the MIMIC Robust Design Technique, ***Dec. 1994 - Sep. 1995***
Williamson, David C., Rome Air Development Center, USA; Thiem, Clare D., Rome Air Development Center, USA; Oct. 1997; 45p; In English
Contract(s)/Grant(s): Proj-P51M
Report No.(s): AD-A341419; RL-TR-97-153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The impact of temperature on the performance of microwave/millimeter wave monolithic integrated circuits (MMICs) is examined in this report. Using simulation software resident at Rome Laboratory, engineers explored not only the temperature sensitivity of an actual circuit, but also the integration of the software. The Robust Design initiative was conducted by Rome Laboratory under the auspices of the Defense Advanced Research and Project Agency Tri-Service Microwave/Millimeter Wave Monolithic Integrated Circuits Program. All work described in this report was conducted in-house at Rome Laboratory.
DTIC
Computer Programs; Millimeter Waves; Microwaves; Integrated Circuits; Design Analysis; Software Engineering

19980202927 Department of the Navy, Washington, DC USA
Multi-Octave, High Dynamic Range Operation of Low-Biased Modulators by Balanced Detection
Burns, William K., Inventor, Department of the Navy, USA; Moeller, Robert P., Inventor, Department of the Navy, USA; Gopalakrishnan, Ganesh K., Inventor, Department of the Navy, USA; Jul. 01, 1997; 11p; In English; Supersedes US-Patent-Appl-SN-508119, AD-D017799

Patent Info.: Filed 27 Jul. 1995; US-Patent-Appl-SN-508119; US-Patent-5,644,665
Report No.(s): AD-D018777; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical link is disclosed that is operated by a balanced detection technique so as to extend its linear dynamic range, yet substantially eliminate even order harmonic distortion of the modulated signal. The modulator comprises two parallel arranged Mach-Zehnder interferometers that respectively have a steady state DC voltage bias applied so that the operating points of the Mach-Zehnder interferometers are selected to produce two separate modulated signals one of which is later phase shifted by a phase shift device so as to provide an output that is combined with the other modulated signal in such a manner so as to cause a subtraction, leaving the final output signal substantially free of any unwanted even order harmonic components in order to provide for a multi-octave response characteristic.

DTIC

Light Modulators; Octaves; Bias; Modulators; Detection; Dynamic Range

19980203115 North Carolina State Univ., Materials Science and Engineering Dept., Raleigh, NC USA

Interface Properties of Wide Bandgap Semiconductor Structures ***Final Report, 1 Jul - 31 Dec. 1997***

Davis, R. F., North Carolina State Univ., USA; Bedair, S., North Carolina State Univ., USA; Bernholc, J., North Carolina State Univ., USA; Nemanich, R. J., North Carolina State Univ., USA; Sitar, Z., North Carolina State Univ., USA; Dec. 1997; 148p; In English

Contract(s)/Grant(s): N00014-92-J-1477

Report No.(s): AD-A340343; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Exposure of selected areas of particular GaN samples with He-Cd laser light (3.8 eV) revealed a persistent and marked decrease in the near band edge photoluminescence (PL) intensity emitted from these areas. This ability to modulate PL emission intensity at individual points in these materials can be exploited as a method for optical data storage. A means of erasing information stored using this effect has also been investigated using lower energy (approx. 2 eV) photons. The microstructures and PL spectra were determined for In(x sub 2))Ga(1-x)N films (x less than or equal approx. 0.23) grown on substrates of a(6H)-SiC(0001) wafer/AlN buffer layer/GaN heterostructures by low pressure MOVPE at 780 C using nitrogen as the diluent and carrier gas and V/III ratios as low as 2,420. Indium droplets were not observed. The maximum InN content achievable at 45 Torr was approx. 13%. Increasing the deposition pressure to 90 Torr increased the maximum InN content to approx. 23%. Room temperature and 12 K PL spectra of the films revealed single-feature, Near Band Edge (NBE) emission with increasing full width at half maximum (FWHM) values with increasing infraction. The PL NBE FWHM for an In(0.23)Ga(0.77)N film at 12 K was 103 meV. InGaN films, 0.3 to 0.5 mm thick, in the 0-50% InN composition range have been analyzed by q-2q on, transmission electron microscopy and selected area diffraction for the occurrence of phase separation.

DTIC

Photoluminescence; Energy Gaps (Solid State); Transmission Electron Microscopy; Semiconductor Devices; Optical Memory (Data Storage); Laser Outputs

19980203137 Hughes Research Labs., Malibu, CA USA

Electro-Optic Computing Architectures: Components and System Design and Analysis ***Final Report, Jul. 1993 - Jul 1997***

Efron, U., Hughes Research Labs., USA; Esener, S., Hughes Research Labs., USA; Wu, C. S., Hughes Research Labs., USA; Marchand, P. J., Hughes Research Labs., USA; Sayyah, K., Hughes Research Labs., USA; Feb. 1998; 110p; In English

Contract(s)/Grant(s): F30602-93-C-0173; AF Proj. A275

Report No.(s): AD-A341187; RL-TR-97-229; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The objective of the Electro-Optic Computing Architecture (EOCA) program was to develop multi-function electro-optic interfaces and optical interconnect units to enhance the performance of parallel processor systems and form the building blocks for future electro-optic computing architectures. Specifically, three multi-function interface modules were targeted for development - an Electro-Optic Interface (EOI), an Optical Interconnection Unit (OIU), and a Space-Time Compander (STC). Electro-optic 3-D interconnection module stacks were assembled, allowing for system global communication and fast efficient data routing and sorting. The achieved goal of the system study, to identify and analyze all the architectural implications due to the addition of optical based free-space interconnects in locally connected processor arrays, is leading to new highly optimized 3-D electro-optic computer processing networks.

DTIC

Optical Equipment; Architecture; Optical Switching; Architecture (Computers); Electro-Optics; Design Analysis; Optical Computers

19980203150 Optivision, Inc., Palo Alto, CA USA
Potentialities of Coherent Systems in RF Photonics ***Final Report, Apr - Jul. 1997***
Weverka, Robert T., Optivision, Inc., USA; Feb. 1998; 23p; In English
Contract(s)/Grant(s): F30602-97-C-0108; AF Proj. 4600
Report No.(s): AD-A341345; AFRL-SN-RS-TR-1998-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mutually coherent RF photonic remoting is compared with mutually incoherent RF photonic systems. Current multichannel RF photonic systems for phased array antennas are implemented with mutually incoherent sources. Additional photonic processing operations with these systems cannot take advantage of courant fan in gain and suffer the DC bias build up well known in incoherent optical signal processing. Mutually coherent RF photonic systems are investigated and shown to have higher gain and higher dynamic range than incoherent systems. The trade-off between subarray partitioning size and link dynamic range is also studied.
DTIC
Coherent Radiation; Photonics; Phased Arrays; Radio Frequencies; Optical Data Processing; Photometers

19980203163 Virginia Univ., Virginia Inst. for Microelectronics, Charlottesville, VA USA
1997 International Semiconductor Device Research Symposium ***Final Report, 1 Aug. 1997 - 31 Jul. 1998***
Hull, Robert, Virginia Univ., USA; Jan. 1998; 658p; In English; 4th, 10-13 Dec. 1997, Charlottesville, VA, USA
Contract(s)/Grant(s): DAAG55-97-1-0365
Report No.(s): AD-A344411; ARO-37600.1-EL-CF; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This volume contains the Proceedings of the Fourth International Semiconductor Device Research Symposium (ISDRS-97, Charlottesville, Virginia, December 10-13, 1997). The goal of this international meeting is to provide a congenial forum for the exchange of information and new ideas for researchers from university, industry and government laboratories in the field of semiconductor devices and device physics. Our other goal is to make this conference truly international. to achieve this, the symposium has sub-committees in Asia, Europe, Japan and the former Soviet Union. This conference is organized in cooperation with the IEEE MTT Society, the United States National Committee of URSI and the Russian Physical Society.
DTIC
Physics; Optoelectronic Devices; Field Effect Transistors; Metal Oxide Semiconductors; Carrier Transport (Solid State)

19980203175 NASA Ames Research Center, Moffett Field, CA USA
Contactless Magnetic Slip Ring
Kumagai, Hiroyuki, Inventor, NASA Ames Research Center, USA; Deardon, Joe D., Inventor, NASA Ames Research Center, USA; Nov. 25, 1997; 14p; In English
Patent Info.: Filed 3 Jul. 1995; NASA-Case-ARC-12072-1-LE; US-Patent-5,691,687; US-Patent-Appl-SN-520865; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A contactless magnetic slip ring is disclosed having a primary coil and a secondary coil. The primary and secondary coils are preferably magnetically coupled together, in a highly reliable efficient manner, by a magnetic layered core. One of the secondary and primary coils is rotatable and the contactless magnetic slip ring provides a substantially constant output.
Official Gazette of the U.S. Patent and Trademark
Ring Structures; Electric Contacts; Electric Power Transmission; Electric Coils

19980203199 Massachusetts Inst. of Tech., Research Lab. of Electronics, Cambridge, MA USA
A Theoretical Probe into the Electronic, Geometric, and Dynamic Properties of Semiconductors ***Annual Report, 1 Mar. 1997 - 28 Feb. 1998***
Joanopoulos, John J., Massachusetts Inst. of Tech., USA; Mar. 30, 1998; 9p; In English
Contract(s)/Grant(s): N00014-97-1-0545
Report No.(s): AD-A341581; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For the past several years there has been a major international effort on the heteroepitaxial growth of compound tetrahedrally coordinated semiconductors on Si substrates by MBE, MOCVD, etc.; on the fabrication of devices and circuits in these layers; and on the monolithic integration of such components with Si circuits fabricated on the same wafer. This effort is based on the significant potential that epitaxial growth of dissimilar semiconductor materials holds for technological applications. Nevertheless, relatively little theoretical work has been performed to understand the fundamental interactions and global issues governing the initial stages of growth and the structure of the first few mono-layers in these systems.
DTIC
Electronics; Probes; Geometry; Dynamic Characteristics; Semiconductors (Materials); Tetrahedrons

19980203202 Rochester Univ., Dept. of Electrical Engineering, NY USA

Engineered Semiconductor Nanostructures for Enhanced Nonlinear Optical Properties in the Infrared ***Final Report, Aug. 1992 - Dec. 1997***

Fauchet, Philippe M., Rochester Univ., USA; Mar. 26, 1998; 6p; In English

Contract(s)/Grant(s): N00014-92-J-4063

Report No.(s): AD-A341576; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

GaAs and InGaAs superlattices have been grown by molecular beam epitaxy. Doping was done either in the quantum wells or throughout the superlattices. The quantum wells were first characterized by conventional methods such as PL, FTIR, or Raman spectroscopy. The free electron laser (or another subpicosecond laser source tunable in the mid-infrared) was used to perform second harmonic generation (SHG) measurements and differential transmission measurements using the pump-probe configuration. The results were analyzed using the simplest realistic models available in the literature as well as the most advanced numerical models through collaborations. All measurements were performed in the 3-5 m spectrum region. We have measured for the first time (1) SHG enhancement on resonance with intersubband transitions in the valence band, (2) the hot hole relaxation in p-type quantum wells, and (3) the hot electron relaxation in n-type quantum wells.

DTIC

Harmonic Generations; Hot Electrons; Indium Gallium Arsenides

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.

19980202675 NASA Lewis Research Center, Cleveland, OH USA

The Effect of Vortex Generators on a Jet in a Cross-Flow

Zaman, K. B. M. Q., NASA Lewis Research Center, USA; Foss, J. K., National Academy of Sciences - National Research Council, USA; Physics of Fluids; Jan. 1997; ISSN 1070-6631; Volume 9, No. 1, pp. 106-114; In English

Report No.(s): NASA/TM-97-207881; NAS 1.15:207881; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

The effect of vortex generators in the form of tabs on the penetration and spreading of a jet in a cross-flow has been studied experimentally. It is found that the tab has very little effect when placed on the leeward side, i.e., on the downstream edge of the jet nozzle relative to the free-stream flow. A study of the static pressure distribution reveals significantly lower pressures on the leeward side. Thus, when placed on that side the tab does not produce a ”pressure hill” of sufficient magnitude that is the primary source of streamwise vorticity in the flow field over the tab. This qualitatively explains the ineffectiveness. In comparison, there is a significant effect on the flow field when the tab is placed on the windward side, The sense of vorticity generated by the tab in the latter configuration is opposite to that of the bound vortex pair that otherwise characterizes the flow. Thus, the strength of the bound vortex pair is diminished and the jet penetration is reduced.

Author

Flow Distribution; Pressure Distribution; Vortex Generators; Cross Flow; Free Flow; Penetration; Free Jets; Wind Tunnel Tests; Jet Flow

19980202698 State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA

Stochastic Modeling and Simulation of Multiphase Reacting Turbulent Flows with Complex Chemistry ***Final Report, Apr. 1994 - May 1998***

Givi, Peyman, State Univ. of New York, USA; Madnia, Cyrus K., State Univ. of New York, USA; Taulbee, Dale B., State Univ. of New York, USA; Mar. 1998; 305p; In English

Contract(s)/Grant(s): N00014-94-1-0667

Report No.(s): AD-A341738; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Two physical phenomena have been the primary subject of investigation: (1) multiphase transport in turbulence, (2) realistic chemistry in large scale numerical simulation of turbulent combustion. In addition, two other phenomena have also been considered: (3) scalar missing in turbulence, and (4) magnetohydrodynamic turbulence. This Final Report provides a summary of our accomplishments in research on each of the above four problems.

DTIC

Stochastic Processes; Models; Multiphase Flow; Computerized Simulation

19980202742 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

Low Dissipative High Order Shock-Capturing Methods Using Characteristic-Based Filters

Yee, H. C., NASA Ames Research Center, USA; Sandham, N. D., Queen Mary and Westfield Coll., UK; Djomehri, M. J., Calspan Corp., USA; May 1998; 60p; In English

Contract(s)/Grant(s): NCC2-1006

Report No.(s): NASA/CR-1998-208237; NAS 1.26:208237; RIACS-TR-98-11; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An approach which closely maintains the non-dissipative nature of classical fourth or higher-order spatial differencing away from shock waves and steep gradient regions while being capable of accurately capturing discontinuities, steep gradient and fine scale turbulent structures in a stable and efficient manner is described. The approach is a generalization of the method of Gustafsson and Olsson and the artificial compression method (ACM) of Harten. Spatially non-dissipative fourth or higher-order compact and non-compact spatial differences are used as the base schemes. Instead of applying a scalar filter as in Gustafsson and Olsson, an ACM like term is used to signal the appropriate amount of second or third-order TVD or ENO types of characteristic based numerical dissipation. This term acts as a characteristic filter to minimize numerical dissipation for the overall scheme. For time-accurate computations, time discretizations with low dissipation are used. Numerical experiments on 2-D vortical flows, vortex-shock interactions and compressible spatially and temporally evolving mixing layers showed that the proposed schemes have the desired property with only a 10% increase in operations count over standard second-order TVD schemes. Aside from the ability to accurately capture shock-turbulence interaction flows, this approach is also capable of accurately preserving vortex convection. Higher accuracy is achieved with fewer grid points when compared to that of standard second-order TVD or ENO schemes. To demonstrate the applicability of these schemes in sustaining turbulence where shock waves are absent, a simulation of 3-D compressible turbulent channel flow in a small domain is conducted.

Author

Shock Wave Interaction; Spatial Resolution; Dissipation; TVD Schemes; Turbulent Flow; Essentially Non-Oscillatory Schemes

19980202743 Erciyes Univ., Muhendislik Fakultesi, Kayseri, Turkey

Laminar Flow in Porous Tubes at High Extraction Rates

Yibas, B. S., Erciyes Univ., Turkey; Altintop, N., Erciyes Univ., Turkey; Mechanical Engineering Bulletin; Dec. 1988; ISSN 0379-5527; Volume 19, Nos. 3 and 4, pp. 43-49; In English; ISBN 3-1778-00010-7122; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Previous studies of incompressible flow in porous channels and tubes have been fairly extensive, especially in the case where classes of similar solutions could be derived. The effects of uniform extraction or injection on the velocity profiles and pressure distribution in channels with parallel walls have been studied over a wide range of possible conditions and appear to present few anomalies. In the case of porous tubes, however, the literature indicates that the effect of suction is dramatically different both from the effect of injection and the effect of suction in channels. Indeed, one is left with the impression that suction above a small limiting value leads to a complete breakdown of the flow, inflections and reversals in the velocity profile, and the development of turbulence. There appears to be no indication that sufficiently high rates of suction will enable a stable laminar flow regime to be reestablished. Because this conclusion appeared both to be intuitiveLY unreasonable and to exert an inhibiting influence on the development of certain engineering devices, such as condensers, absorbers and dust precipitators, it has been reexamined in this study. Following a general discussion of the basic theory and a regression into the realm of mathematically interesting but impractical solutions it will be shown that stable solutions do indeed exist at high extraction rates.

Author

Laminar Flow; Porosity; Extraction; Injection; Incompressible Flow; Dust

19980202966 Bristol Univ., Dept. of Aerospace Engineering, UK

Computation, analysis and theory of two-phase flows

Guha, A., Bristol Univ., UK; The Aeronautical Journal; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 71-82; In English; Also announced as 19980202964

Report No.(s): Paper-2266; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The non-equilibrium fluid mechanics and thermodynamics of two-phase vapor-droplet and gas-particle flow are considered. The formation of the droplets as well as their subsequent interaction with the vapor are discussed. Five topics have been given particular attention: (1) CFD application to unsteady condensation waves; (2) CFD application to shock waves moving through a vapor-droplet mixture; (3) a new theory of nucleation of water droplets in steam turbines based on Monte Carlo simulation (steam turbines are responsible for 80% of global electricity production and the presence of moisture significantly reduces the turbine

efficiency costing 50M pounds per annum in the UK alone); (4) a unified theory for the interpretation of total pressure and total temperature in two-phase flows; and (5) a unified theory of particle transport in a turbulent flowfield.
Author
Two Phase Flow; Gas Flow; Computational Fluid Dynamics; Drops (Liquids); Unsteady Flow; Shock Waves; Nucleation; Turbulent Flow; Liquid-Vapor Equilibrium

19980202968 Bristol Univ., Dept. of Aerospace Engineering, UK
A 2D navier-stokes method for unsteady compressible flow calculations on moving meshes
Gaitonde, A. L., Bristol Univ., UK; Jones, D. P., Bristol Univ., UK; Fiddes, S. P., Bristol Univ., UK; Golden Jubilee; Special Issue to Commemorate the 50th Anniversary of the Department of Aerospace Engineering, Bristol University; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 89-97; In English; Also announced as 19980202964
Report No.(s): Paper-2224; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A moving mesh method for the computation of compressible viscous flow past deforming and moving aerofoils is described. It is based on a well established time-marching finite-volume scheme, which has been widely used for steady compressible flows. An implicit realtime discretization is used and the equations are integrated via a dual-time scheme. This involves the introduction of derivatives of a fictitious pseudo time. The solution at each real-time step involves seeking solutions which are steady-state solutions in pseudo time. This approach decouples the stability and accuracy limitations of the scheme and permits large real-time steps to be chosen. Also, well-proven convergence acceleration techniques developed for steady flows such as local-time stepping, residual averaging and multigrid may be used in the pseudo-time stepping scheme without compromising real-time accuracy. A sequence of body-conforming grids and corresponding grid speeds is required, where the inner and outer boundaries of the grid move independently. The required grids and speeds are found using a transfinite interpolation technique. Applications of the method to external compressible flows are shown, including results from a parallel version of the computer program.
Author
Two Dimensional Flow; Navier-Stokes Equation; Compressible Flow; Unsteady Flow; Computational Grids; Finite Volume Method; Time Marching

19980203011 Stanford Univ., Environmental Fluid Mechanics Lab., Stanford, CA USA
The Structure of Turbulence and Other Motions Beneath an Air-Water Interface ***Final Report, 1 Nov. 1993 - 31 May 1997***
Monismith, Stephen G., Stanford Univ., USA; Street, Robert L., Stanford Univ., USA; Aug. 31, 1997; 9p; In English
Contract(s)/Grant(s): N00014-94-1-0190
Report No.(s): AD-A341108; EFML-97-1; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The structure of turbulence and other motions beneath an air-water interface had a performance period from 11/01/93 to 05/31/97. Both physical experiments and numerical simulation experiments were used to study three-dimensional, unsteady, real fluid flows beneath the air-water interface. The goals were to develop: (1) an understanding of the flow physics, and (2) a numerical simulation tool that allows accurate prediction of the motion from a specified set of initial conditions. This report summarizes our progress and cites the relevant references. The focus of the numerical work was the kinematics of the interaction between surface waves and a turbulent current. The numerical method produces a time-accurate simulation of an unsteady turbulent free-surface flow in three space dimensions. The simulations are large-eddy simulations LES, employing a dynamic two-parameter model, new treatment of the kinematic boundary condition in mapped space, and a moving boundary fitted grid. A method of domain decomposition to enhance near surface resolution was also demonstrated.
DTIC
Air Water Interactions; Fluid Dynamics; Turbulence; Dynamic Models; Turbulence Models; Numerical Analysis; Turbulent Flow

19980203012 Naval Postgraduate School, Monterey, CA USA
Testing and Analysis of a Transonic Axial Compressor
Grossman, Bart L., Naval Postgraduate School, USA; Sep. 1997; 119p; In English
Report No.(s): AD-A341113; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A test program to evaluate a new transonic axial compressor stage was conducted. The stage was designed (by Nelson Sanger of NASA Lewis) relying heavily on Computational Fluid Dynamics (CFD) techniques while minimizing conventional empirical design methods. The stage was installed in the NPS Transonic Compressor Test Rig and instrumented with fixed temperature and pressure probes. A new PC-based data acquisition system was commissioned and programmed for stage performance measurements. These were obtained at 50, 60, 65, 70, and 80% of the design speed before failure of the spinner retaining bolt led to the loss of the stage. The flow through the rotor was analyzed and the rotor performance predicted using a 3-dimensional viscous code

(RVC3D). The predicted rotor performance agreed qualitatively and was numerically consistent with the measured stage performance.
DTIC
Transonic Flow; Computational Fluid Dynamics; Transonic Compressors; Turbocompressors

19980203128 Mississippi State Univ., Engineering Research Center, Mississippi State, MS USA
Hybrid Techniques in Computational Fluid Dynamics ***Final Report, 1 Dec. 1993 - 30 Nov. 1997***
Soni, Bharat K., Mississippi State Univ., USA; Jan. 26, 1998; 136p; In English
Contract(s)/Grant(s): F49620-94-1-0060
Report No.(s): AD-A341019; MSSU-EIRS-ERC-98-2; AFRL-SR-BL-TR-98-0296; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In the spirit of the Air Force Office of Scientific Research's (AFOSR) initiative to promote University-Industry Collaborative Research, a collaborative project entitled, Hybrid Techniques in Computational Fluid Dynamics (CFD) has been executed by the National Science Foundation Engineering Research Center for Computational Field Simulation (NSF ERC) at Mississippi State University. The industrial participants include McDonnell Douglas Company, Boeing Company, and Teledyne Brown Engineering Company. The research and development activities of this effort are focused on the advancement of methodologies to increase the efficiency, quality, and productivity of an overall CFD simulation associated with geometrically complex configurations. The progress realized in the aforementioned development is presented in this final report. Progress concerning efforts designed to improve the efficiency and applicability of the CFD to geometrically complex configurations utilizing hybrid techniques is presented. This progress has been brought about through the developments and enhancements in hybrid grid generation methodology and solution algorithms for associated Euler and Navier-Stokes equations. In particular, the enhancement of the two and three dimensional hybrid grid system and CFD simulation solver is presented. The development of the three dimensional hybrid grid system and solution system allowing viscous effects with complex examples is presented to demonstrate the success of these methodologies.
DTIC
Computational Fluid Dynamics; Procedures; Computational Grids; Grid Generation (Mathematics)

19980203164 NASA Lewis Research Center, Cleveland, OH USA
Apparatus for Measuring Ambient Pressure within a Gaseous Flow Field
Porro, A. Robert, Inventor, NASA Lewis Research Center, USA; Ernst, Michael A., Inventor, NASA Lewis Research Center, USA; May 26, 1998; 7p; In English
Patent Info.: Filed 27 Feb. 1997; NASA-Case-LEW-16348-1; US-Patent-5,756,892; US-Patent-Appl-SN-813582; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The invention as disclosed herein teaches apparatus whereby the instantaneous dynamic static pressure and the steady-state static pressure may be simultaneously measured within a supersonic or subsonic gaseous fluid flow field. The dynamic static pressure is measured by an electronic transducer and the steady-state static pressure is measured by pneumatic means.
Official Gazette of the U.S. Patent and Trademark
Pressure Measurement; Dynamic Pressure; Static Pressure; Measuring Instruments; Fluid Flow; Flow Distribution

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.

19980202064 Space Telescope Science Inst., Baltimore, MD USA
NICMOS cycle 7 calibration plan and beyond
Colina, Luis, Space Telescope Science Inst., USA; Storrs, Alex, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 259-262; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This document summarizes the various calibration programs that form the basis of the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) Cycle 7 calibration plan. Specific calibration plans to support the NIC3 campaign are also described. Author

Calibrating; Near Infrared Radiation; Cameras; Detectors; Image Processing

19980202318 Maryland Univ., School of Medicine, Baltimore, MD USA

Receptor Based Biosensor ***Final Report, Apr. 1989 - Apr. 1993***

Eldefrawi, M. E., Maryland Univ., USA; Eldefrawi, A. T., Maryland Univ., USA; Rogers, K. R., Maryland Univ., USA; Anis, N. A., Maryland Univ., USA; Valdes, J. J., Edgewood Research Development and Engineering Center, USA; Dec. 1997; 40p; In English

Contract(s)/Grant(s): DAAA15-89-C-0007

Report No.(s): AD-A340545; ERDEC-CR-246; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Biosensors were developed and used for detection and monitoring of chemicals, drugs, and toxins by combining the sensitive and selective recognition capabilities of receptors, enzymes, and antibodies with signal transduction and amplification properties of either electronic or optical microsensors. Nicotinic acetylcholine receptor, acetylcholinesterase, and antibodies against environmental pollutants were used as biological elements. Different physical transducers were used including electrochemical (potentiometric, amperometric), optical (fiber optic) and mass (surface plasmon resonance).

DTIC

Bioinstrumentation; Analytical Chemistry; Detection; Chemical Elements; Contaminants; Drugs; Toxins and Antitoxins; Receptors (Physiology); Enzymes; Antibodies

19980202416 Stanford Univ., Dept. of Electrical Engineering, Stanford, CA USA

Sub-Micron Lithography with the Atomic Force Microscope ***Annual Report, 1 Jan. - 31 Dec. 1997***

Quate, Calvin F., Stanford Univ., USA; Edwards, Leland T., Stanford Univ., USA; Minne, Steve, Stanford Univ., USA; Apr. 08, 1998; 19p; In English

Contract(s)/Grant(s): N00014-96-1-0771

Report No.(s): AD-A342660; 96PR05481-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This was a year or progress where we consolidated our gains with parallel arrays of cantilevers, fabricating operating devices (pMOSFETs) using scanning probes as the lithography tool and for in-depth studies of the response of E-beam resist when exposed with electrons from the scanning tips. Our report is divided as follows: (1) High speed atomic force microscopy with parallel arrays of cantilevers; (2) Fabrication of pMOSFET's with SPL Lithography; and (3) Lithography with Hybrid AFM/STM Probes.

DTIC

Electron Beams; Lithography; Electrons; Field Effect Transistors

19980202751 Department of the Navy, Washington, DC USA

Optical Sensor System Utilizing Bragg Grating Sensors

Kersey, Alan D., Inventor, Department of the Navy, USA; Oct. 21, 1997; 17p; In English

Patent Info.: Filed 28 Jun. 1996; US-Patent-Appl-SN-672910; US-Patent-5,680,489

Report No.(s): AD-D018781; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical system for detecting perturbations indicative of the performance of the piece of equipment being monitored is disclosed. The optical system comprises sensors each of which use Bragg gratings induced therein and wherein the Bragg gratings are arranged into a preselected distribution and each Bragg grating returns, when subjected to incident light, a narrowbeam signal identified by a predetermined wavelength. The optical system utilizes at least one interferometer whose operation is interlinked with optical multiplexing techniques, such as differentiate cross multiplying and time division multiplexing.

DTIC

Perturbation; Bragg Gratings; Detection; Optical Measuring Instruments

19980203096 NASA Johnson Space Center, Houston, TX USA

Particle Velocity Measuring System

Arndt, G. Dickey, Inventor, NASA Johnson Space Center, USA; Carl, James R., Inventor, NASA Johnson Space Center, USA; Apr. 21, 1998; 13p; In English

Patent Info.: Filed 9 Nov. 1995; NASA-Case-MSC-22451-1; US-Patent-5,741,979; US-Patent-Appl-SN-556241; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Method and apparatus are provided for determining the velocity of individual food particles within a liquid/solid food mixture that is cooked by an aseptic cooking method whereby the food mixture is heated as it flows through a flowline. At least one upstream and at least one downstream microwave transducer are provided to determine the minimum possible travel time of the fastest food particle through the flowline. In one embodiment, the upstream detector is not required. In another embodiment, a plurality of small dipole antenna markers are secured to a plurality of food particles to provide a plurality of signals as the markers pass the upstream and downstream transducers. The dipole antenna markers may also include a non-linear element to reradiate a harmonic frequency of a transmitter frequency. Upstream and downstream transducers include dipole antennas that are matched to the impedance of the food slurry and a signal transmission cable by various impedance matching means including unbalanced feed to the antennas.
Official Gazette of the U.S. Patent and Trademark
Velocity Measurement; Transducers; Microwave Equipment; Flow Velocity; Food; Solid Solutions; Food Processing; Particles; Multiphase Flow

19980203171 NASA Johnson Space Center, Houston, TX USA
Accelerometer Method and Apparatus for Integral Display and Control Functions
Bozeman, Richard J., Jr., Inventor, NASA Johnson Space Center, USA; Apr. 07, 1998; 7p; In English; Division of US-Patent-Appl-SN-901626, filed 19 Jun. 1992
Patent Info.: Filed 16 Nov. 1994; NASA-Case-MSC-21961-2; US-Patent-5,736,970; US-Patent-Appl-SN-342453; US-Patent-Appl-SN-901626; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Method and apparatus for detecting mechanical vibrations and outputting a signal in response thereto is discussed. An accelerometer package having integral display and control functions is suitable for mounting upon the machinery to be monitored. Display circuitry provides signals to a bar graph display which may be used to monitor machine conditions over a period of time. Control switches may be set which correspond to elements in the bar graph to provide an alert if vibration signals increase in amplitude over a selected trip point. The circuitry is shock mounted within the accelerometer housing. The method provides for outputting a broadband analog accelerometer signal, integrating this signal to produce a velocity signal, integrating and calibrating the velocity signal before application to a display driver, and selecting a trip point at which a digitally compatible output signal is generated.
Official Gazette of the U.S. Patent and Trademark
Accelerometers; Structural Vibration; Vibration Measurement; Signal Detection

36
LASERS AND MASERS

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

19980201923 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Time Resolved Photoluminescence Spectra of a Mid-Infrared Multiple Quantum Well Semiconductor Laser
Franz, Anthony L., Air Force Inst. of Tech., USA; Dec. 1997; 119p; In English
Report No.(s): AD-A339045; AFIT/GAP/ENP/97D-04; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Recombination mechanisms in mid-IR semiconductor lasers are strongly dependent on the carrier density of the active region. The objective of this research is to improve previous carrier density estimates through the incorporation of spectral information. One hundred PhotoLuminescence (PL) spectra were calculated for a variety of carrier densities. Calculations were made for an InAsSb/InAlAsSb multiple quantum well laser sample assuming parabolic bands. The widths of the calculated spectral profiles were tabulated as a function of carrier density. Actual spectra were measured using the Ultrafast Mid-Infrared Photoluminescence System, which uses upconversion to measure the PL intensity in time steps smaller than 1 ps. PL spectra were obtained at 30 times, ranging from 100 ps to 3 ns. Spectral widths were measured and tabulated as a function of time. Combining the plot of calculated spectral width vs. carrier density with the plot of measured spectral width vs. time, we were able to describe the variation of carrier density with time. The carrier density vs. time plot thus generated agreed with earlier measurements by Cooley for low carrier densities. The discrepancy at higher carrier densities could be due to changing experimental conditions or the break down of the parabolic band approximation.
DTIC
Quantum Wells; Semiconductor Lasers; Time Functions; Time Dependence; Photoluminescence; Infrared Radiation

19980202415 Rome Air Development Center, Griffiss AFB, NY USA

Passively Mode-Locked Erbium-Doped Fiber Lasers Using Multiple Quantum Well Saturable Absorbers ***Final Report, Oct. 1995 - Aug. 1997***

Hayduk, Michael J., Rome Air Development Center, USA; Mar. 1998; 133p; In English

Contract(s)/Grant(s): AF Proj. 4600

Report No.(s): AD-A342029; RL-TR-97-198; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An experimental study of the mode-locking process in erbium-doped fiber lasers (EDFL's) operating at 1.55 microns using multiple quantum well saturable absorbers is presented. The self-starting passively mode-locked laser was constructed in a Fabry-Perot configuration using the saturable absorber as the back reflector of the cavity. Picosecond pulses that range from 14.2 to 38.8 ps were generated using a series of saturable absorbers. The pulse widths were dependent upon the optical properties of the saturable absorber used as the mode-locking element. The output power of the EDFL varied from 0.2 to 6.7 mW and was also dependent upon the saturable absorber used in the cavity. Soliton mode-locking using saturable absorbers was the mechanism responsible for the generation of the picosecond pulses by the EDFL. The long-lived carrier lifetime in the quantum wells was the primary optical property of the saturable shorter that determined the final pulse width.

DTIC

Fiber Optics; Optical Properties; Doped Crystals; Erbium; Fiber Lasers

19980202503 Naval Postgraduate School, Monterey, CA USA

Simulations of LANL Regenerative MW Free Electron Laser Amplifier

Nguyen, Richard T., Naval Postgraduate School, USA; Dec. 1997; 54p; In English

Report No.(s): AD-A342024; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The development of a speed-of-light hard-kill weapon system for military applications represents a significant advancement in technology over present conventional kinetic weapon systems. Over the past two decades, the US Navy has successfully developed a megawatt-class chemical laser; however, under some maritime environments, the high power beam propagation was unable to delivery sufficient energy to kill a modern anti-ship missile (ASM) due to significant atmospheric absorption and the resulting thermal blooming process. A critical problem to resolve for the shipboard high-energy laser weapon systems is to develop a shipboard-compatible megawatt-class laser weapon at a wavelength where the atmospheric absorption is smallest. The megawatt-class Free Electron Laser (EEL) has significant advantages over conventional weapon systems and other chemical high-energy laser systems. Infinite magazine, rapid response, and wavelength tunability make the EEL a suitable and desirable shipboard weapon system. This thesis divides into four chapters. Chapters I and II introduce the EEL and background theory of the EEL. Chapter III explores the analysis of the LANL Regenerative MW EEL Amplifier design and optimizes its efficiency. Lastly, chapter IV summarizes the feasibility of achieving the desired efficiency.

DTIC

Free Electron Lasers; Laser Weapons; Weapon Systems

19980202902 Naval Research Lab., Washington, DC USA

Precision-Scale Explosion Experiments Using Laser-Driven Shocks ***Interim Report***

Grun, J., Naval Research Lab., USA; Barthel, J. R., Naval Research Lab., USA; Burris, R., Naval Research Lab., USA; Crawford, J., Naval Research Lab., USA; Evans, K., Naval Research Lab., USA; Mar. 13, 1998; 15p; In English; Prepared in collaboration with Maxwell Lab., Inc., La Jolla, CA, Southwest Texas State Univ., San Marcos, TX, Sachs Freeman Associates, Landover, MD, Kohlberg Associates, Inc., Alexandria, VA, RSI, Lanham, MD, and APS, College Park, MD.

Report No.(s): AD-A341563; NRL/MR/6190--98-8125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Naval Research Laboratory uses shock initiated by a powerful laser pulse to perform precision scale measurements of hydrodynamic phenomena relevant to nuclear and conventional explosions, and to supernovae. A pulse from NRL's 1.3-kJ Pharos III laser is focused onto the surface of a period sized piece of material placed in ambient gas. The laser heats the material to a few hundred eV creating a miniature explosion which launches a shock with multi-kilobar pressures and material flows with Mach number of a few hundred. This method has been used to perform the first measurements on a shock instability in a uniform ambient, the first measurements of shock decursors, and detailed measurements of shock precursors.

DTIC

Explosions; Pulsed Lasers; Experimentation; Precision; Thermal Shock

19980203087 NASA Langley Research Center, Hampton, VA USA

HO:LULF and HO:LULF Laser Materials

Barnes, Norman P., Inventor, NASA Langley Research Center, USA; Morrison, Clyde A., Inventor, NASA Langley Research

Center, USA; Filer, Elizabeth D., Inventor, NASA Langley Research Center, USA; Jani, Mahendra G., Inventor, NASA Langley Research Center, USA; Murray, Keith E., Inventor, NASA Langley Research Center, USA; Lockard, George E., Inventor, NASA Langley Research Center, USA; Apr. 21, 1998; 15p; In English
Patent Info.: Filed 7 Sep. 1995; NASA-Case-LAR-15275-1; US-Patent-5,742,632; US-Patent-Appl-SN-524861; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A laser host material LULF (LuLiF4) is doped with holmium (Ho) and thulium (Tm) to produce a new laser material that is capable of laser light production in the vicinity of 2 microns. The material provides an advantage in efficiency over conventional Ho lasers because the LULF host material allows for decreased threshold and upconversion over such hosts as YAG and YLF. The addition of Tm allows for pumping by commonly available GaAlAs laser diodes. For use with flashlamp pumping, erbium (Er) may be added as an additional dopant. For further upconversion reduction, the Tm can be eliminated and the Ho can be directly pumped.
Official Gazette of the U.S. Patent and Trademark
Laser Materials; Doped Crystals; Lutetium Compounds; Lithium Compounds; Fluorine Compounds; Laser Outputs; Light Beams; Additives

19980203094 Florida Univ., Div. of Sponsored Research, Gainesville, FL USA
Proposal for partial support of Symposium #532: Laser Control of Electrons and Molecules, at the 5th Chemical Congress of North America ***Final Report, 1 Nov. 1997 - 30 Sep. 1998***
Krause, Jeffrey L., Florida Univ., USA; Mar. 13, 1998; 12p; In English; 5th, 11-15 Nov. 1996, Cancun, Mexico
Contract(s)/Grant(s): N00014-98-1-0104
Report No.(s): AD-A343498; 5741-431-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this grant to provide partial support for Symposium #532 at the 5th Chemical Congress of North America, which was held Nov. 11-15, 1997, in Cancan, Mexico. The Chemical Congress is a major international meeting, co-sponsored by the Chemical Societies of Canada, Mexico and the USA. The title of Symposium #532 was 'Laser Control of Electronics and Molecules'. This was one of the most comprehensive and influential meetings of the year in the rapidly evolving field of quantum control. Twenty one scientists from Canada and the USA, representing both theory and experiment, presented invited talks at the Symposium.
DTIC
Quantum Theory; Lasers; Molecular Dynamics; Electrons; Conferences; Molecules; Quantum Well Lasers

19980203104 Cornell Univ., Ithaca, NY USA
Violet/Ultraviolet Semiconductor Injection Lasers Using GaN-Based Materials ***Final Report, Jan. 1996 - Jan 1997***
Schaff, William J., Cornell Univ., USA; Mar. 1998; 19p; In English
Contract(s)/Grant(s): F30602-96-2-0037; AF Proj. 4600
Report No.(s): AD-A341499; AFRL-SN-RS-TR-1998-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The GaN material system was examined for the growth of semiconductor injection lasers for high density optical interconnect applications. The effort focused on the growth, via molecular beam epitaxy, of GaN buffers and epitaxial layers on sapphire substrates. Substrate temperature, growth rate, and nitrogen power and flow rate were varied during buffer and epilayer growth to determine optimal parameters. RGA source pressures, RHEED, and substrate temperature, were monitored during growth, followed by mobility, photoluminescence, and X-ray measurements for good samples. The best recipe involved low temperature, low buffer growth rate followed by high temperature buffer anneal, followed by higher temperature, high mobility quality epilayer growth. Mobilities as high as 200 sq cm/V sec were measured. However, due to the lack of a matching substrate, the high defect densities obtained precluded the demonstration of a lasing structure.
DTIC
Injection Lasers; Semiconductor Lasers; Ultraviolet Lasers; Gallium Nitrides; Molecular Beam Epitaxy; Optical Interconnects

19980203122 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Performance of Imaging Laser Radar in Rain and Fog
Campbell, Kathleen M., Air Force Inst. of Tech., USA; Mar. 1998; 113p; In English
Report No.(s): AD-A340965; AFIT/GM/ENP/98M-07; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Air Force is currently developing imaging laser radar systems (ladar) for use on precision guided munitions and other imaging systems. Scientists at Eglin Air Force Base, in conjunction with Wright Laboratories, are testing a 1.06 micron wavelength ladar system and need to understand the weather effects on the ladar images. As the laser beam propagates through the atmosphere, fog droplets and raindrops can cause image degradation, and these image degradations are manifested as either drop-

outs or false returns. An analysis of the dropouts and false returns helped to quantify the performance of the system in adverse weather conditions. Statistical analysis of the images showed non-linear relationships existed between variables, plus graphical analysis demonstrated the behavior of the dropouts and false returns with changing weather conditions. Statistical control charts identified the weather as a significant influence on the quality of the ladar images. by focusing on the false return data, a study of mean free path and the survival equation was accomplished. The mean free path was derived from the rainfall rate, and this mean free path was used in the survival equation to calculate an expected number of false returns for an image. This work led to the hypothesis that raindrops with a diameter of 3.0 mm and larger were causing the false returns seen in the images. However, further analysis revealed that a 3.0-mm raindrop was not capable of scattering enough energy to be detected by the system. It was then hypothesized that the system detector was also picking up solar spectrum energy scattered by raindrops, and that this detector was unable to distinguish between solar energy and laser energy scattered by raindrops.
DTIC
Optical Radar; Laser Guidance; Imaging Techniques; Rain; Fog; Imaging Radar; Laser Range Finders

19980203129 Analytic Sciences Corp., San Antonio, TX USA
Long Term Effects Retinal Laser Lesions: Multifocal ERGs (Electroretinogram) and Vernier Visual Evoked Potentials (VEPs) ***Final Report, 1995-1997***
Schmeisser, Elmar T., Analytic Sciences Corp., USA; Mar. 1998; 23p; In English
Contract(s)/Grant(s): F33615-92-C-0017; AF Proj. 7757
Report No.(s): AD-A341024; AL/OE-TR-1997-0178; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Seven Cynomolgus Fasciculata who had graded laser lesions placed in one eye only 6 years previously were evaluated by electro-physiological recording techniques. All animal recordings were performed under IACUC approved protocols. The single q-switched pulses from a neodymium-YAG laser produced lesions of 4 types at the time of placement: no visible change, minimal visible lesions, ”white dot” lesions (localized circumscribed retinal blanching) and ”red dot” lesions (contained retinal hemorrhage). Single exposures had been made both foveally and at 5 degrees eccentricity in the parafovea superiorly, inferiorly and temporally. The multifocal (perimetric) electiroretinogram was recorded from specialized contact lenses through hospital grade amplifiers.
DTIC
Bioelectric Potential; Evoked Response (Psychophysiology); Hemorrhages

19980203132 Pennsylvania State Univ., University Park, PA USA
Theoretical Studies of Free Electron Laser Drive Physical Chemical and Ablative Reactions in Organic and Biological Materials ***Final Report, 25 May 1991 - 30 Apr. 1998***
Garrison, Barbara J., Pennsylvania State Univ., USA; Apr. 07, 1998; 6p; In English
Contract(s)/Grant(s): M00014-91-J-1946
Report No.(s): AD-A341115; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This project has covered a number of areas related to theoretically modelling FEL laser interactions with materials. In particular we have been interested in developing models for incorporation or the essential aspects of the laser interactions into a molecular dynamics (MD) model as the MD approach provides a microscopic picture of atomic motions.
DTIC
Free Electron Lasers; Chemical Reactions; Organic Materials; Ablative Materials; Molecular Dynamics

19980203146 Illinois Univ., Urbana, IL USA
DURIP1997 Femtosecond Vibrational Spectroscopy of Shock Waves in Materials ***Final Report, 1 Mar. 1997 - 28 Feb. 1998***
Dlott, Dana D., Illinois Univ., USA; Apr. 01, 1998; 2p; In English
Contract(s)/Grant(s): F49620-97-1-0151; AF Proj. 2303; AF Proj. 3484
Report No.(s): AD-A341311; AFRL-SR-BL-TR-98-0291; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The acquisition of a powerful femtosecond laser is discussed. The laser is to be used in making femtosecond time resolved measurements of shock waves in molecular materials, with the eventual application being understanding the sensitivity to shock initiation of energetic materials. After suitable negotiations, a CPA 10 laser from Clark-MXR Corporation was selected and ordered. to save money, some parts and diagnostic equipment were ordered and shipped to Clark for inclusion in the finished system. The laser was delivered in Oct. 1997. In the last several months, warranty repairs and improvements were made on the laser and the experimental set up is being constructed.
DTIC
Shock Waves; Laser Spectroscopy; Vibrational Spectra; Spectroscopic Analysis

19980203155 Duke Univ., Dept. of Physics, Durham, NC USA

Instrumentation for the Accurate Measurement and Control of Optical Phase ***Final Report, 1 Nov. 1995 - 31 Oct. 1997***

Madey, John M., Duke Univ., USA; Mar. 16, 1998; 14p; In English

Contract(s)/Grant(s): F49620-96-1-0011

Report No.(s): AD-A341445; FELL-DURIP95-313-6017-98; AFRL-SR-BL-TR-98-0276; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Free electron lasers hold a unique place in laser physics as high power, broadly tunable sources of optical radiation with unprecedented spectral resolution. These sources are also capable of generating spectrally pure isolated optical pulses and pulse trains which are particularly well suited to spectroscopic applications conveying the capability for detection and analysis at extreme levels of sensitivity. These sources can also uniquely generate high power amplitude and/or phase squeezed state radiation. The objective of this grant was to acquire and upgrade instrumentation for the accurate measurement and control of optical phase of the infrared and ultraviolet free electron laser (FEL) systems at Duke University, thereby enhancing the breadth of capabilities of these sources for supporting the DoD-sponsored research programs of the Laboratory and of our collaborating institutions. The instrumentation and equipment acquired with funds from this grant include a Fox-Smith Laser Resonator, infrared optical and data acquisition instrumentation, and VUV/XUV optics and instrumentation. A technical paper, ”High-Power, Fox-Smith Resonator for Tunable, Phase-Locked Operation of an Infrared Free-Electron Laser”, by Eric B. Szarmes, is attached to the report.

DTIC

Free Electron Lasers; Optical Radar; Resonators; Optical Measurement; Optical Resonators; Phase Locked Systems; Ultraviolet Lasers; Laser Outputs; Infrared Lasers; Electromagnetic Pulses

19980203201 State Univ. of New York, Inst. of Technology, Utica, NY USA

Ultrafast Polarization Switching Dynamics in Vertical-Cavity Surface-Emitting Lasers ***Final Report, Jan. 1996 - Jun. 1997***

Richardson, Dean, State Univ. of New York, USA; Binder, Rolf, State Univ. of New York, USA; Mar. 1998; 19p; In English

Contract(s)/Grant(s): F30602-96-2-0031; AF Proj. 4600

Report No.(s): AD-A341577; AFRL-SN-RS-TR-1998-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The interaction of circularly polarized femtosecond laser pulses with commercial vertical-cavity surface emitting lasers (VCSELs) was studied using a pump-probe configuration in connection with an autocorrelation setup for time-resolving anticipated polarization changes in the VCSEL output. In addition, extensive theoretical modeling was performed to gain greater insights into the physical bases for output polarization in VCSELs. The objective of these efforts was to determine if VCSEL output polarization could be switched on a picosecond time scale, and if the polarization of multiple elements in a VCSEL array could be externally controlled and ’pinned’ to a particular desired orientation. The theoretical modeling was completed. Experimental verification of the model could not be carried out because the VCSELs available at the time did not have high enough output power.

DTIC

Surface Emitting Lasers; Laser Cavities; Autocorrelation; Pulsed Lasers; Optical Communication; Picosecond Pulses

19980203203 Rome Air Development Center, Griffiss AFB, NY USA

Blue Emitting Fiber Lasers ***Final Report, Mar. 1996 - Sep. 1997***

Weist, Todd E., Rome Air Development Center, USA; Hinkel, Daniel S., Rome Air Development Center, USA; Whitcomb, Kevin, Rome Air Development Center, USA; Feb. 1998; 43p; In English

Contract(s)/Grant(s): Proj-2300; AF Proj. 4600

Report No.(s): AD-A341571; RL-TR-97-197; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of thulium doped fluorozirconate fiber as a blue laser gain material was studied by investigating the optically active transitions, the optimal laser cavity configuration, and the appropriate gain length when excited by 785 and 1047 nm. Laser-induced fluorescence allowed the thulium energy locations to be determined with a least squares fit producing values for the Slater integrals, F2 = 416.52, F4 = 66.5459, and F6 = 5.32902, and the spin-orbit constant, zeta = -1305.51. Wavelength dependent cross sections and the decay times of recorded transitions were also determined. A model was developed to calculate the small signal gain of the fiber and to compare different cavity configurations. A cut back experiment produced an optimal fiber length of 2.4 m which differed from the calculation. Also, the trend in the cut back data does not follow the form predicted by the model. It is believed that spectral competition, which was not included In the model, may explain these deviations. However, the model does show the cavity configuration with both lasers coupled through the back mirror and both mirrors butted to the ends of the fiber as optimal for gain produced and controllability of the blue laser output.

DTIC

Light Emitting Diodes; Thulium; Doped Crystals; Laser Applications; Laser Outputs; Least Squares Method; Diodes

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MECHANICAL ENGINEERING

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

19980202177 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Furnace Butt Welded Pipe for Small Sign Supports, *Oct. 1996 - Oct. 1997*
Buth, C. E., Texas A&M Univ., USA; Bligh, R. P., Texas A&M Univ., USA; Menges, W. L., Texas A&M Univ., USA; Nov. 1997; 54p; In English
Report No.(s): PB98-137003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

TXDOT plans and specifications currently do not allow use of furnace butt welded pipe for sign supports. Use of this type pipe, if it is suitable and demonstrates acceptable performance for small sign supports would result in significant cost savings. Samples of furnace butt welded and electrical resistance welded, 51 mm I.D. schedule 40 pipe were subjected to static bending tests. Selected samples of furnace butt welded pipe were also used in pendulum and full-scale vehicle crash tests. Researchers found that furnace butt welded pipe meeting ASTM A53 and having a yield strength of at least 240 Mpa demonstrates acceptable performance for small sign supports.
NTIS
Pipes (Tubes); Bend Tests; Impact Tests; Welded Joints; Butt Joints; Static Tests; Supports

19980202461 CALSTART, Burbank, CA USA
Electric and Hybrid Vehicle Technologies *Quarterly Report, 1 Jan. - 31 Mar. 1998*
Mar. 1998; 335p; In English
Contract(s)/Grant(s): MDA972-95-2-0011
Report No.(s): AD-A342766; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This report discusses electric and hybrid vehicle technologies. Specific topics include: (1) hybrid electric bus, (2) hybrid vehicle turbogenerator, (3) emissions study, (4) electric vehicles, (5) flywheels, (6) hybrid propulsion, (7) electric generators, and (8) charging systems.
DTIC
Electric Propulsion; Hybrid Propulsion; Gas Turbines; Electric Generators

19980202549 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA
Non-Gimbaled Antenna Pointing-Summary of Results and Analysis
Horan, Stephen, New Mexico State Univ., USA; Mar. 23, 1998; 57p; In English
Contract(s)/Grant(s): NAG5-1491
Report No.(s): NASA/CR-1998-207912; NAS 1.26:207912; NMSU-ECE-98-001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Based on the experiments run and the analysis performed, we make the following conclusions: 1. The concept of using a fixed antenna system to support a data link through the constellation TDRS satellites in the Space Network offers an alternative to the direct data distribution to a fixed ground station model for data transport. The concept allows for access when the user satellite has an ascending node or descending node of its orbit in the vicinity of a TDRS subsatellite point. 2. The duration of the contact will be a function of the antenna Half Power Beam Width, orbital inclination angle, and orbital altitude. The HPBW is the primary determinant of the contact duration, the orbital inclination is the second largest contributor to determining the contact duration, and the orbital altitude contributes the least to the contact time. The cases studied here are only for circular orbits. Highly-elliptical orbits were not studied. 3. There will be a trade-off between system antenna parameters, communications transmission power, contact time, and data rate. To achieve a desired data throughput, e.g. 10 kbps equivalent continuous throughput, the required data rate and contact time will be coupled. As the contact time increases, the required data rate to support the throughput will decrease. However, to increase the contact time, one will need to use an antenna with a wider HPBW and lower gain. As the antenna gain decreases, the required transmission power will need to increase to support the transmission. The system designer will need to look at all parameters to decide what is the appropriate data rate, transmission power, antenna gain, and antenna HPBW necessary to support the required service at the desired grade of service. 4. The use of a fixed antenna on inertially-stabilized satellites holds promise as a communications technique. The antenna needs to have a HPBW in excess of 12.4 ? to maintain contact over the pass. The contact duration at best case will be close to one-half of the orbital period. Wider HPBW antennas will permit coverage on several consecutive orbits and partial coverage on several orbits per day. 5. On inertially-stabilized satellites, the fixed antenna

will not give contact on every orbit. Contact with a given TDRS occurs only on those orbits where the antenna is pointed at the TDRS when the satellite is in the vicinity of the TDRS subsatellite point.
Author
Antenna Radiation Patterns; Antenna Design; Circular Orbits; Elliptical Orbits; Orbit Calculation

19980202669 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Inst. of Applied Physics, Delft, Netherlands
Assumed Uniform Force Distributions for the Estimation of Vibrational Power Transmission in Built-up Systems Involving Box-Like Sections
Fulford, R. A., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Petersson, B. A. T., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Dec. 03, 1997; 62p; In English
Contract(s)/Grant(s): A97/KM/132
Report No.(s): TNO-TPD-HAG-RPT-970168; TD-97-0323; Copyright; Avail: Issuing Activity (TNO, Inst. of Applied Physics, Stieltfesweg 1, P. O. Box 155, 2600 AD Delft, Netherlands); US Sales Only, Hardcopy, Microfiche

For the vibratory analysis of built-up structures, traditional point-like connections cannot be applied where the interface is large and the wavelength small. Instead, the spatially distributed wavefield has to be accounted for whereby the interface has to be considered as either a surface or, for a one dimensional contact, a line. to analyse such, the traditional approach is to rely upon numerical methods such as the Finite Element Method. These approaches are limited however, in that they reveal little about the physics of the systems. As an alternative, this report considers the development of a method whereby the spatially distributed properties of a line contact can, with the salient physics retained, be included in simplified mathematical models. The basis of the method is to describe the spatial properties with respect to Fourier components and hypothesize that the first order, i.e. uniform, component is most influential. Via an assumed uniform force distribution, the approach is applied, with some promise, to the problem of predicting the vibratory power transmission between a box and a plate.
Author
Force Distribution; Structural Analysis; Finite Element Method; Structural Vibration; Mathematical Models; Boxes (Containers)

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19980202070 Space Telescope Science Inst., Baltimore, MD USA
NICMOS data quality control and paper products
Ritchie, C., Space Telescope Science Inst., USA; Bushouse, H., Space Telescope Science Inst., USA; Colina, L., Space Telescope Science Inst., USA; Calzetti, D., Space Telescope Science Inst., USA; Skinner, C., Space Telescope Science Inst., USA; Storrs, A., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 287-296; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Hubble Space Telescope (HST) pipeline routinely creates hardcopy products, or paper products, for all data. These products are used both to provide hardcopy output for the GOs and also by the Contact Scientists for data quality evaluation. The products must therefore be general enough to support both sets of users. This presentation provides an introduction to the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) paper products. A set of paper products summarizes a set of exposures, typically a single visit in a proposal. The pages are separated into visit-level and exposure-level pages. The visit-level pages include the cover page, explanatory notes, and tables summarizing the details of the observations. These are followed by the exposure-level pages which include a picture of each calibrated (cal) exposure followed by a data quality summary and a calibration reference file summary for that exposure. For associated data, there is first a picture of the mosaicked (mos) image. For associations with a pattern, this is followed by a cartoon of the observing pattern and on-target and background individual images. All associated exposures also have stamp-sized pictures of each of the calibrated images in that association.
Author
Quality Control; Calibrating; Exposure; Image Processing; Data Management

19980202305 Syracuse Univ., School of Computer and Information Science, NY USA
Delay Fault and Stuck-At Fault Test Generation Using Multiprocessing ***Final Report, Aug. 1994 - Dec. 1996***
Wu, Chien–Hsing, Syracuse Univ., USA; Hartmann, Carlos R., Syracuse Univ., USA; Oct. 1997; 49p; In English
Contract(s)/Grant(s): F30602-94-1-0005; AF Proj. 4600

Report No.(s): AD-A339149; RL-TR-97-230; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Digital logic circuits must be tested to assure their correct behavior at the desired clock rate. This report describes an algorithm for generating tests for path delay faults; these faults are models of the faulty switching behavior of digital circuits. The path delay fault test generation system developed here is based on an extension to the Sixteen valued Maximized Propagation Lowered Enumeration (SIMPLE) algorithm, which was originally developed for stuck-at faults test generation. The extension of SIMPLE resulted in a powerful path delay fault test generator with the ability to identify nearly every non-robustly detectable fault in a circuit without resorting to the enumeration phase. A parallel implementation of the test generator was developed using the Parallel Virtual Machine (PVM) communication package.

DTIC

Parallel Processing (Computers); Logic Circuits; Electric Equipment Tests; Algorithms; Digital Electronics; Switching Circuits; Fault Detection

19980202658 Aerospace Corp., Technology Operations, El Segundo, CA USA

Modeling and Simulating Ultrasonic Wave Propagation in Layered Structures

Lhota, J. R., Aerospace Corp., USA; Mar. 01, 1998; 62p; In English

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A341045; TR-96(8565)-8; SMC-TR-98-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Launch vehicles and spacecraft have many bonded layered structures, such as the propellant insulation case assembly in solid rocket motors, multilayered printed circuit boards or solar array composite panels in satellites. NonDestructive Evaluation (NDE) techniques are used to ensure bond integrity as part of standard quality assurance programs and/or to restore confidence when an unusual event occurs that may have compromised the hardware. Ultrasonic techniques are among the most common and powerful NDE techniques used to probe bond integrity; however, beyond a single layer, the signals can become very complex. This signal complexity often makes it difficult to determine inspection feasibility without performing expensive and time consuming tests on representative hardware samples with simulated flaws. Under the NDE MOIE program, a powerful, flexible, and user friendly modeling program was developed using LabView TM to: (1) simulate the propagation of ultrasonic waves through multilayered structures, and (2) generate the oscilloscope signals one would expect to observe. In this report, the modeling program is described in detail, and sample results from a program simulation are compared with those of an associated experiment. The program's use of LabView TM's virtual instrument structure eases program modification update and provides instant cross-platform compatibility. This simulation capability has already been utilized to support a number of programs, including Titan, Milstar and special programs.

DTIC

Bonded Joints; Launch Vehicles; Ultrasonic Radiation; Simulation; Wave Propagation; Composite Structures

19980202818 Midwest Superconductivity, Inc., Lawrence, KS USA

Non-Destructive Testing (NDT) of Metal Cracks Using a High T(sub c) rf-SQUID and Eddy Current Method

Lu, D. F., Midwest Superconductivity, Inc., USA; Fan, Chang–Xin, Midwest Superconductivity, Inc., USA; Ruan, J. Z., Midwest Superconductivity, Inc., USA; Han, S. G., Kansas Univ., USA; Wong, K. W., Kansas Univ., USA; Sun, G. F., Kansas Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 594-600; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A SQUID is the most sensitive device to detect change in magnetic field. A non-destructive testing (NDT) device using high temperature SQUIDs and the eddy current method will be much more sensitive than those currently used eddy current systems, yet much cheaper than one with low temperature SQUIDS. In this paper, we present our study of such a NDT device using a high temperature superconducting rf-SQUID as a gradiometer sensor. The result clearly demonstrates the expected sensitivity of the system, and indicates the feasibility of building a portable HTS SQUID NDT device with the help from cryocooler industry. Such a NDT device will have a significant impact on metal corrosion or crack detection technology.

Author

Nondestructive Tests; Cracks; High Temperature; Eddy Currents; Squid (Detectors)

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STRUCTURAL MECHANICS

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

19980202319 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Finite Element Analysis of l2OOcfm and 6OOcfm Gas Filter Housings ***Final Report, Apr. - May 1996***
Colclough, Stephen J., Edgewood Research Development and Engineering Center, USA; Feb. 1998; 29p; In English
Contract(s)/Grant(s): DA Proj. 104-63884-DC-04
Report No.(s): AD-A340547; ERDEC-TR-468; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 1200cfm and 6OOcfm gas filter housings were investigated using finite element analysis techniques to examine if ASTM A554, Type 304 stainless steel (yield strength = 25,000 lb/sq in) could be substituted for the currently specified AMS5563, Type 304 stainless steel (yield strength = 75,000 lb/sq in). The factor of safety for the l200cfm filter housing was determined to be 7.9 for the AMS5563 steel and 2.6 for the proposed ASTM A554 steel. The factor of safety for the 600cfm filter was determined to be 26.3 for the AMS5563 steel and 8.7 for the proposed ASTM A554 steel. The analysis results show that the fully loaded filter housings can be stacked at least two units high for the l2OOcfm and 6OOcfm gas filters. The analysis results also show that the support arrangement does not affect the maximum stresses or deflections.
DTIC
Finite Element Method; Fluid Filters; Housings; Gases

19980202320 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Test Report on an Anchor Fitting for ISO-Type Corner Castings ***Final Report***
Hatch, William G., Naval Facilities Engineering Service Center, USA; Dec. 1997; 28p; In English
Report No.(s): AD-A340552; NFESC-TM-2275-AMP; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report addresses the development of a removable anchor that can be inserted into an ISO corner casting to convert it to a load-certifiable attachment point. This development was undertaken as part of a design for sea state 3 lighter connectors, specifically for the marriage bridle rigging. The ISO anchor was developed in consideration of the following characteristics: minimum ultimate strength of 90,000 pounds and a safe working load (SWL) of 15,000 pounds with a safety factor of 6; load to be applied along the deck in shear and at various radial angles relative to the ISO comer casting; installable in less than 5 minutes by one person using only hand tools. A concept resulted in a threaded insert that has the potential of being used for hoist ring attachments as well as any equipment or operation that requires a robust, quickly installed anchor point. This report describes the concept evolution through three prototype stages, documenting the load testing, fit and function of each variation. The final design is being incorporated int o the deck rigging parts list for the sea state 3 connector Logistics Engineering Advanced Demonstration.
DTIC
Anchors (Fasteners); Load Tests; Fitting; Connectors; Loads (Forces); Inserts

19980202533 NASA Lewis Research Center, Cleveland, OH USA
Progressive Fracture and Damage Tolerance of Composite Pressure Vessels
Chamis, Christos C., NASA Lewis Research Center, USA; Gotsis, Pascal K., NASA Lewis Research Center, USA; Minnetyan, Levon, Clarkson Univ., USA; 1997; 8p; In English; International Composites Expo 1997, 1997
Report No.(s): NASA/TM-97-208142; NAS 1.15:208142; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Structural performance (integrity, durability and damage tolerance) of fiber reinforced composite pressure vessels, designed for pressured shelters for planetary exploration, is investigated via computational simulation. An integrated computer code is utilized for the simulation of damage initiation, growth, and propagation under pressure. Aramid fibers are considered in a rubbery polymer matrix for the composite system. Effects of fiber orientation and fabrication defect/accidental damages are investigated with regard to the safety and durability of the shelter. Results show the viability of fiber reinforced pressure vessels as damage tolerant shelters for planetary colonization.
Author
Fracturing; Damage; Tolerances (Mechanics); Pressure Vessels; Durability; Fiber Composites

19980202588 Washington Univ., Center for Computational Mechanics, Saint Louis, MO USA
Research on the p- and hp-Versions of the Finite Element Method ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Szabo, Barna A., Washington Univ., USA; Apr. 01, 1998; 27p; In English
Contract(s)/Grant(s): F49620-95-1-0196

Report No.(s): AD-A341253; WU/CCM-98/03; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final technical report presents a summary of a three years project in which the mathematical basis of failure criteria for metals and composite materials was investigated. The investigation covered criteria associated with crack formation and structural instability. The main results are: (a) General procedures for the determination of mathematical functions that model the conditions for crack formation at critical points were developed and implemented into a generally available computer code. (b) Mathematical models for buckling failure were formulated, implemented and their properties clarified.

DTIC

Finite Element Method; Crack Propagation; Composite Materials; Crack Initiation; Metals; Cracking (Fracturing); Structural Failure

19980202664 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Inst. of Applied Physics, Delft, Netherlands

Lateral Force and Moment Excited Thick Plates

Petersson, B. A. T., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Oct. 22, 1997; 94p; In English

Contract(s)/Grant(s): A97/KM/134

Report No.(s): TPD-HAG-RPT-970143; TD-97-0319; Copyright; Avail: Issuing Activity (TNO-Inst. of Applied Physics, Stieltjesweg 1, 2628 CK, Delft, The Netherlands); US Sales Only, Hardcopy, Microfiche

The cross-coupling between on the one hand, a lateral moment and a lateral translational velocity and, on the other, a lateral force and a lateral rotational velocity at an excited interface is studied for an arbitrarily thick plate. Complete descriptions are developed for the two associated point-cross mobility elements. In addition, the point mobility is established relating to a lateral force excitation at one of the free surfaces of the plate. From the theoretical results it can be concluded that reciprocity with respect to the point-cross mobility elements is strictly, only valid in the hypothetical case of point excitation. The numerical results demonstrate, however, that reciprocity can be invoked in an approximate sense also for realistic excitation conditions. Moreover, it is shown that a reduction of a lateral force excitation, remote from the neutral layer, to a combined force and moment excitation at the neutral layer is not applicable except for very small Helmholtz numbers. Finally, it is concluded that the volumetric near-field affects the point-cross mobilities for plate-like structures and that in contrast to the axial point force mobility of a deep beam, a closed form description of the influence of the volumetric nearfield is established for the lateral force mobility of a plate.

Author

Cross Coupling; Near Fields; Thick Plates; Wave Propagation; Impedance

19980202700 Army Research Lab., Aberdeen Proving Ground, MD USA

Determination of the Yield Strength of a Molybdenum Jet ***Final Report, Sep. 1995 - Jun. 1997***

Lampson, Miles L., Army Research Lab., USA; Summers, Richard L., Army Research Lab., USA; Mar. 1998; 84p; In English

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

Report No.(s): AD-A341708; ARL-TR-1639; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The strength of the metal in a shaped charge jet influences its length at breakup, its penetration rate into a target, and its ability to resist aerodynamic forces in flight. The response of a jet to an imposed centrifugal force can be used to estimate its yield strength. Copper was the first metal studied by this technique, and the strength determined by Karpp using a hoop model was approximately 100 MPa. We have studied molybdenum using the same experimental technique and analyzed the data using a hoop, a disk, and a cylinder model of the jet. The yield strength and its associated uncertainty were estimated from the observed kinematics of the portion of the jet fragmented by the centrifugal force and the computed jet spin rate.

DTIC

Yield Strength; Jets; Molybdenum; Shaped Charges

42
GEOSCIENCES (GENERAL)

19980202336 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analyzing Horizontal Distances Between WSR-88D Thunderstorm Centroids and Cloud-to-Ground Lightning Strikes

Renner, Steve L., Air Force Inst. of Tech., USA; Mar. 1998; 135p; In English

Report No.(s): AD-A340761; AFIT/GM/ENP/98M-09; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

On April 29, 1996, lightning struck the airfield at Hurlburt Field, FL, killing one Airman and injuring ten others. This cloud to ground lightning strike hit eight minutes after a lightning advisory was canceled. At the time of the strike, thunderstorms were

observed 7 to 10 miles north and south of the airfield. The incident raised questions about Air Force Weather Agency's lightning criteria. Soon after the incident, a Lightning Safety Review Panel was assembled to determine the adequacy of lightning advisories. One of the questions posed to the panel was could an incident like Hurlburt happen again? The review panel could not answer that question due to the lack of documented research on how far lightning can travel horizontally before striking the ground. This thesis used the WSR-88D Algorithm Testing and Display System (WATADS) and the default parameters of the WATADS's Storm Cell Identification and Tracking (SCIT) Algorithm to identify thunderstorm centroids. Lightning strike data contain ing nearly 50,000 cloud to ground strikes was obtained through the National Climatic Data Center (NCDC). Horizontal distances were then computed between these storm centroids and cloud to ground lightning strikes. This research discovered that average distances between thunderstorm centroids and lightning strikes vary with season and location. In addition, nearly 75% of all lightning strikes occurred within 10 nautical miles of thunderstorm centroids.
DTIC
Thunderstorms; Lightning; Weather Forecasting; Doppler Radar; Climatology

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.

19980201894 Geological Survey, Water Resources Div., Columbus, OH USA
Water Resources Data for Ohio, Water Year 1997, Volume 2, St. Lawrence River Basin and Statewide Project Data ***Annual Report, 1 Oct. 1996 - 30 Sep. 1997***
Shindel, H. L., Geological Survey, USA; Mangus, J. P., Geological Survey, USA; Trimble, L. E., Geological Survey, USA; Apr. 1998; 448p; In English
Report No.(s): PB98-144595; USGS/WDR/OH-97/2-Vol-2; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche
This report, in two volumes, contains records for water discharge at 122 gaging stations and 57 partial-record sites; water levels at 279 observation wells and 23 crest stage gages; and water quality at 19 gaging stations, 333 observation wells, and 57 partial record sites. Also included are data from miscellaneous and synoptic sites. contains records for water
NTIS
Water Resources; Water Quality; Ohio; Ground Water; Hydrology; Surface Water

19980202663 National Environmental Satellite Service, Microwave Sensing Group, Camp Springs, MD USA
Comparisons between SSM/I, SSMT/2 and Radar Measurements over the USA
Grody, Norman C., National Environmental Satellite Service, USA; Weng, Fuzhong, Caleum Research Corp., USA; Ferraro, Ralph, National Environmental Satellite Service, USA; Eighth Conference on Satellite Meterology and Oceanograhy; 1996; 6p; In English; 8th; Conference on Satellite Meteorology and Oceanography, 28 Jan. - 2 Feb. 1996, Atlanta, GA, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This paper focuses on the rain detection over the USA, and compares radar measurements with the measurements obtained from the Special Sensor Microwave Imager (SSM/I) and the Special Sensor Microwave Temperature -2 (SSMT/2). The SSMT/I is a conical scanning microwave radiometer having dual polarized channels at 19, 37 and 85 GHz and a single polarization channel at 22 GHz. Earth radiation measurements are obtained at a constant incident angle of 53.1 degrees so that the field of view remains constant for a given channel., it varies proportional to the frequency, ranging from 60 km at 19 GHz to 13 km at 85 GHz. The SSMT/2 contains five single polarized channels at 91, 150, 183+/-1, 183+/-3, 183+/-7 GHz, and scans cross-track with the incident angle varying between 0 and 47.5 degrees. At nadir the field of view is 50 km at 183 GHz and decrease in proportion to frequency. Derived from text
Rain; Radar Detection; Remote Sensing; Microwave Imagery; Temperature Profiles; Brightness Temperature; Radar Measurement

19980202720 Naval Air Weapons Station, China Lake, CA USA
Coso Monitoring Program ***Final Report, Oct. 1996 - Sep. 1997***
Lager, S. D., Naval Air Weapons Station, USA; Johnson, B. R., Naval Air Weapons Station, USA; Dec. 1997; 51p; In English
Report No.(s): AD-A341103; NAWS-CP-TP-010; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (Coso KGRA). A substantial body of reports has been established on this project (15 technical publica-

tions) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation; the reader is referred to the 1993/1994 summary report (NAWS-CL TP 006) for detailed descriptions of the overall project and the individual sites monitored.
DTIC
Geothermal Resources; Water Resources; Geothermal Technology

19980202874 Finnish Geodetic Inst., Kirkkonummi, Finland
SAR Images and Ancillary Data in Crop Species Interpretation
Matikainen, Leena, Finnish Geodetic Inst., Finland; Karjalainen, Mika, Finnish Geodetic Inst., Finland; Kuittinen, Risto, Finnish Geodetic Inst., Finland; 1998; ISSN 0355-1962; 53p; In English; Original contains color illustrations
Report No.(s): FGI-98-1; ISBN 951-711-216-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A method for crop species interpretation was developed and tested. The idea of the method is to use multisource and multitemporal data, especially SAR images, and repeat the interpretation several times during the growing season as new images become available. Preliminary prediction about probable crop species is made, using information on species grown during the previous year. This prediction is based on knowledge of crop rotation and agricultural statistics for the area. The next data source included in the interpretation is a SPOT image from the spring or previous autumn, which can be used to distinguish grasslands, spring crops and winter crops from each other with relative accuracy. The interpretation is then improved by using SAR images, which can be obtained throughout the growing season and under all weather conditions. The accuracy of the interpretation increases as new images are added, but some information on crop species is already obtained early in the growing season. A rule-based approach based on the Dempster-Shafer theory of evidence is used to combine evidence from the various data sources in the interpretation. The method was tested in a study area situated near Seinajoki in western Finland. A SPOT image from spring 1996 and four SAR images from summer 1996 were used. The interpretation was made parcel by parcel. Information on crop species grown in the parcels in 1995 and 1996 was obtained from MARS Rapid Estimates data. The SAR images were classified using the maximum likelihood classification method, and the classification results were then used in addition to the other data sources as input data in rule-based interpretation. The method appears feasible and, as expected, the accuracy improved as new SAR images and other data sources were included in the interpretation. The best overall accuracy, 83%, was obtained when all the data sources were used. When using the SAR images alone, the accuracy varied from 33% to 72%, depending on the number of images.
Author
Synthetic Aperture Radar; Radar Imagery; Maximum Likelihood Estimates; Remote Sensing; Crop Identification; Crop Inventories

19980202875 Finnish Geodetic Inst., Kirkkonummi, Finland
An Early Crop Yield Estimation Method for Finnish Conditions: The Crop Growth Monitoring System of the Joint Research Centre with and without Remotely Sensed and Other Additional Input Data
Kuittinen, Risto, Finnish Geodetic Inst., Finland; Ahokas, Eero, Finnish Geodetic Inst., Finland; Granqvist, Maria, Ministry of Agriculture and Forestry, Finland; Ikaeheimo, Esa, Ministry of Agriculture and Forestry, Finland; Heikinheimo, Martti, Finnish Meteorological Inst., Finland; Venaelaeinen, Ari, Finnish Meteorological Inst., Finland; Jaenne, Sami, Finnish Environment Inst., Finland; Keskisarja, Ville, Helsinki Univ. of Technology, Finland; Parmes, Eija, Technical Research Centre of Finland, Finland; Perdigao, Vanda, Joint Research Centre of the European Communities, Netherlands; vanderGoot, Erik, Joint Research Centre of the European Communities, Netherlands; 1998; ISSN 0355-1962; 119p; In English; Original contains color illustrations
Contract(s)/Grant(s): 10486-94-10FED-ISP-SF
Report No.(s): FGI-98-2; ISBN 951-711-217-3; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The Common Agricultural Policy (CAP) is one of the cornerstones of the European Union (EU). to carry out the CAP and make the decisions that this involves, up-to-date information on agriculture is vital. At the Joint Research Centre Monitoring of Agriculture with Remote sensing, the MARS-Project has been in progress since 1988. The aim of this project is to develop methods for inventorying crop species and areas, and predicting annual crop production, using remotely sensed data. This activity covered the countries of the European Union in 1994. It was considered that the activity could benefit Finland as a new member of the European Union and that the Joint Research Centre could obtain useful knowledge about the agriculture of Northern Europe if research activity could be started in Finland. of particular interest in the development work at the Joint Research Centre was the Crop Growth Monitoring System (CGMS) that was already being used at that time for crop production prediction inside the

Union. In 1994 a project proposal was prepared in Finland for implementing the CGMS within the Information Centre of the Ministry of Agriculture and Forestry (MMM-IC) and for developing the CGMS for use under Finnish conditions.
Derived from text
Crop Growth; Agriculture; Finland; Models; Crop Inventories; Leaf Area Index

19980202900 Woods Hole Oceanographic Inst., Dept. of Geology and Geophysics, MA USA
Stratigraphic Development of the Central Persian Gulf During the Neogene ***Final Report, 15 Feb. 1996 - 31 Jul. 1997***
Swift, Stephen A., Woods Hole Oceanographic Inst., USA; Apr. 07, 1998; 4p; In English
Contract(s)/Grant(s): N00014-96-1-0548
Report No.(s): AD-A341534; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Industry seismic reflection profiles shot in the 60's and early 70's in the central Persian (Arabian) Gulf are used to map two late Tertiary unconformities, and velocity data from a centrally located well is used to convert travel time to depth to the unconformities. The deeper horizon correlates with a regional unconformity at the end of the Eocene in most wells and dips monotonically to the northeast, whereas the shallower horizon is flatter and correlates with the mid-upper Miocene section in one well. Isopach maps based on wells indicate that sedimentation was relatively uniform across the region until the middle to late Miocene. Sediments deposited since the late Miocene thicken from 100-200 m on the Arabian side of the Gulf to greater than 1000 m near Iran reflecting deposition of sediments eroded from the rapidly uplifting Zagros fold belt. As a result of the rapid deposition, the velocity gradient in the upper 1 km decreases from tilde 4 km/sec per km near Arabia to about 2 km/sec per km on the Iranian side of the Gulf.
DTIC
Stratigraphy; Mapping; Reflection; Velocity Distribution; Seismographs; Data Acquisition

19980202995 Institute for the Study of Learning and Expertise, Palo Alto, CA USA
Improving Rooftop Detection in Aerial Images Through Machine Learning ***Final Report, 1 Jun. 1994 - 30 Nov. 1997***
Maloof, Marcus A., Institute for the Study of Learning and Expertise, USA; Langley, Pat, Institute for the Study of Learning and Expertise, USA; Binford, Thomas O., Institute for the Study of Learning and Expertise, USA; Sage, Stephanie, Institute for the Study of Learning and Expertise, USA; Apr. 01, 1998; 26p; In English
Contract(s)/Grant(s): N00014-94-1-0746
Report No.(s): AD-A341798; ISLE-TR-98-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, we examine the use of machine learning to improve a rooftop detection process, which is one step in a vision system that recognizes buildings in overhead imagery. We review the problem of analyzing aerial images and describe an existing vision system that automates the recognition of buildings in such images. After this, we briefly review two well known learning algorithms, representing different inductive biases, that we selected to improve rooftop detection. An important aspect of this problem is that the data sets are highly skewed and the cost of mistakes differs for the two classes, so we evaluate the algorithms under varying misclassification costs using ROC analysis. We report three sets of experiments designed to illuminate facets of applying machine learning to the image analysis task. One set of studies focuses on within image learning, in which both training and testing data are derived from the same image. Another addresses between image learning, in which training and testing sets come from different images. A final set investigates learning using all available images in an effort to determine the best performing method. Experimental results demonstrate that useful generalization occurs when training and testing on data derived from images that differ in location and in aspect. Furthermore, they demonstrate that, under most conditions and across a range of misclassification costs, a trained naive Bayesian classifier exceeded, by as much as a factor of two, the predictive accuracy of nearest neighbor and a handcrafted linear classifier, the solution currently used in the building detection system. Analysis of learning curves reveals that naive Bayes achieved superiority using as little as 6% of the available training data.
DTIC
Image Processing; Pattern Recognition; Aerial Photography; Radiation Measurement; Machine Learning; Image Analysis

19980203145 Woods Hole Oceanographic Inst., MA USA
Bio-Physical Models of Oceanic Population Dynamics 1994 Summer Study Program
Flierl, Glenn, Woods Hole Oceanographic Inst., USA; Olson, Donald, Woods Hole Oceanographic Inst., USA; Jan. 1997; 362p; In English; Bio-Physical Models of Oceanic Population Dynamics, 1994, Woods Hole, MA, USA
Contract(s)/Grant(s): N00014-92-J-1527; NSF OCE-9314484
Report No.(s): AD-A341296; WHOI-97-18; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

Bio-Physical Models of Oceanic Population Dynamics was the central theme of the 1994 summer program in Geophysical Fluid Dynamics (GFD) at the Woods Hole Oceanographic Institution. This unusual topic brought together mathematical popula-

tion biologists and geophysical fluid dynamicists and provided a new synthesis of ideas and methods for coupling these two broad and diverse fields. Lectures and seminars given by staff and visitors addressed the nature of physical controls on free-drifting or active swimming organisms in the oceans, the biological responses of marine populations to their physical environment and their own internal states, and the dynamics of coupled biophysical processes on marine populations. This volume includes write-ups of the principal lectures, abstracts of some seminars, and the reports of the fellows: research projects.
DTIC
Ocean Dynamics; Geophysics; Oceanography; Ocean Models; Biophysics; Oceans

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.

19980202553 Ship Research Inst., Tokyo, Japan
Calculation Using MCNP Code for Bremsstrahlung Photons Emitted From Radioisotope Battery
Ohashi, A., Ship Research Inst., Japan; Ueki, K., Ship Research Inst., Japan; Senda, T., Ship Research Inst., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 17-23; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

A radioisotope battery is one of the choices for energy sources for meteorological observation and the development of undersea and space. We considered a Strontium-90 (beta-decay, half-life: 28.8y) heat-source model of a radioisotope battery and improved it in two aspects; radiation dose reduction and improvement of thermal conductivity and adding functionally graded structure to the model. The present study reports the dose reduction on the surface of the heat source model and the analysis of Naumann and Waechter's experiment using a continuous energy Monte Carlo calculation code, MCNP 4A.
Author
Radioisotope Batteries; Dosage; Monte Carlo Method; Bremsstrahlung

19980202799 Martin Marietta Corp., Space Magnetics, San Diego, CA USA
Modular Transportable Superconducting Magnetic Energy Systems
Lieurance, Dennis, Martin Marietta Corp., USA; Kimball, Foster, Martin Marietta Corp., USA; Rix, Craig, Martin Marietta Corp., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 416-419; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Design and cost studies were performed for the magnet components of mid-size (1-5 MWh), cold supported SMES systems using alternative configurations. The configurations studied included solenoid magnets, which required onsite assembly of the magnet system, and toroid and racetrack configurations which consisted of factory assembled modules. For each configuration, design concepts and cost information were developed for the major features of the magnet system including the conductor, electrical insulation, and structure. These studies showed that for mid-size systems, the costs of solenoid and toroid magnet configurations are comparable and that the specific configuration to be used for a given application should be based upon customer requirements such as limiting stray fields or minimizing risks in development or construction.
Author
Magnets; Energy Technology; Engine Design; Design to Cost; Construction

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19980201946 Naval Facilities Engineering Command, Atlantic Div., Norfolk, VA USA
Final Environmental Impact Statement. Realignment of F/A-18 Aircraft and Operational Functions from Naval Air Station (NAS) Cecil Field, Florida, to Other East Coast Installations, Appendix 1, Comments and Responses ***Final Report***
Mar. 1998; 819p; In English
Report No.(s): AD-A340391; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

Appendix I contains all of the public comments received on the Draft ElS. Comments received during the public hearings are contained in Part A, and comments received via correspondence are contained in Part B. The public hearings were recorded

by a court reporter, and the verbal comments received are reproduced below in the verbatim transcript of each speaker. Opening remarks and presentation of the Draft ElS by Navy representatives have been omitted from the verbatim transcript. Each comment within a speaker's transcript has been marked and sequentially numbered. Responses are marked with corresponding numbers, using the speaker's initials as a prefix. Responses appear on the right-hand side of the page. If a comment warrants a change to the ElS, the reader is referred to the appropriate section of the report.
DTIC
Noise Pollution; Navy; Environmental Surveys

19980201947 Naval Facilities Engineering Command, Atlantic Div., Norfolk, VA USA
Final Environmental Impact Statement. Realignment of F/A-18 Aircraft and Operational Functions from Naval Air Station (NAS) Cecil Field, Florida, to Other East Coast Installations, Appendix A-H ***Final Report***
Federal Register; Mar. 1998; Volume 60, No. 212; 526p; In English
Report No.(s): AD-A340392; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
This study examines the capability of NAS Oceana and MCAS Cherry Point, including NALF Fentress, MCALF Bogue, and the local airspace and ranges to accommodate the prospective level of operations resulting from the implementation of BRAC 95-related decisions. This analysis is accomplished through the use of a fast-time computer simulation model, NASMOD. Five alternative relocation scenarios (ARS) were identified by the Navy for analysis. A baseline scenario was analyzed with which to compare the alternatives.
Author
Noise Pollution; Computerized Simulation; Environmental Surveys; Alternatives; Airports; Airspace

19980202173 LGL Ecological Research Associates, Inc., Bryan, TX USA
Cumulative Ecological Significance of Oil and Gas Structures in the Gulf of Mexico: A Gulf of Mexico Fisheries Habitat Suitability Model, Phase 2, Model Description
Gallaway, B. J., LGL Ecological Research Associates, Inc., USA; Cole, J. G., LGL Ecological Research Associates, Inc., USA; Apr. 1998; 128p; In English
Report No.(s): PB98-141443; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Habitat suitability indices (HSI) were developed for 560 model cells located west of 87 degrees west longitude in the nearshore Gulf of Mexico for seven species/ages subject to catch in trawls, and six adult reef fish species. Each model cell is then minutes of latitude by ten minutes of longitude (approximately 129 square miles).
NTIS
Gulf of Mexico; Oils; Ecosystems; Habitats; Marine Biology; Fisheries; Environment Effects

19980202323 Illinois State Environmental Protection Agency, Environmental Policy, Springfield, IL USA
ERMS Guidebook
Apr. 1998; 26p; In English
Report No.(s): PB98-141484; IEPA/ENV/98-004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Illinois EPA has prepared this guidebook to help participants in the Emissions Reduction Market System and other interested persons understand how the system is designed and going to be operated. This guidebook serves as a supplement to other important reference materials such as the ERMS regulations (35 Ill. Admin. Code 205) and the Environmental Protection Act (Sec. 98.).
NTIS
Handbooks; Environment Protection; Air Pollution; Illinois; Pollution Control

19980203053 Army Construction Engineering Research Lab., Champaign, IL USA
The Environmental Assessment and Management Guide, Georgia Supplement ***Final Report***
ORourke, Carolyn, Army Construction Engineering Research Lab., USA; Sep. 1997; 462p; In English
Contract(s)/Grant(s): MIPR-2257
Report No.(s): AD-A341775; CERL-SR-96/110-REV; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
Environmental assessments help determine compliance with current environmental regulations. The U.S. Air Force, U.S. Army, Defense Logistics Agency (DLA), and Corps of Engineers (Civil Works) have adopted environmental compliance programs that identify compliance problems before they are cited as violations by the U.S. Environmental Protection Agency (USEPA). Since 1984, the U.S. Army Construction Engineering Research Laboratories (USACERL), in cooperation with numerous Department of Defense (DOD) components, has developed environmental compliance assessment checklist manuals. The Envi-

ronmental Assessment and Management (TEAM) Guide was developed for use by all DOD components. Currently there are five participating DOD components: the Air Force, Air National Guard, Army, Civil Works, and DLA. These agencies have agreed to share the development and maintenance of this Guide. The Guide combines Code of Federal Regulations and management practices into a series of checklists that show legal requirements and the specific operations or items to review. The TEAM Guide is supplemented by DOD component-specific manuals detailing DOD component regulations and policies. The Georgia Supplement was developed to be used in conjunction with the TEAM Guide, using existing Georgia state environmental legislation and regulations as well as suggested management practices.
DTIC
Environment Management; Environment Protection

19980203054 Army Construction Engineering Research Lab., Champaign, IL USA
The Environmental Assessment and Management (TEAM) Guide, Louisiana Supplement ***Final Report***
ORourke, Carolyn, Army Construction Engineering Research Lab., USA; Jan. 1998; 532p; In English
Report No.(s): AD-A341772; USACERL-SR-EC-95/10-REV; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
Environmental assessments help determine compliance with current environmental regulations. The U.S. Air Force, U.S Army, Defense Logistics Agency (DLA) and Corps of Engineers (Civil Works) have adopted environmental compliance programs that identify compliance problems before they are cited as violations by the U.S. Environmental Protection Agency. Since 1984, the U.S. Army Construction Engineering Research Laboratories, in cooperation with numerous Department of Defense (DOD) components, has developed environmental compliance assessment checklist manuals. The EnvironmentaL Assessment and Management (TEAM) Guide was developed for use by all DOD components. Currently there are five participating DOD components: the Air Force, Air National Guard, Army, Civil Works, and DLA. These agencies have agreed to share the development and maintenance of this Guide. The Guide combines Code of Federal Regulations and management practices into a series of checklists that show legal requirements and the specific operations or items to review. TEAM Guide is supplemented by DOD component-specific manuals detailing DOD component regulations and policies. The Louisiana Supplement was developed to be used in conjunction with the TEAM Guide, using existing Louisiana state environmental legislation and regulations as well as suggested management practices.
DTIC
Environment Management; Environment Protection

19980203062 Army Construction Engineering Research Lab., Champaign, IL USA
The Environmental Assessment and Management (TEAM) Guide; New York Supplement ***Final Report***
ORourke, Carolyn, Army Construction Engineering Research Lab., USA; Jan. 1998; 642p; In English
Contract(s)/Grant(s): MIPR-953092
Report No.(s): AD-A341728; CERL-SR-96/97; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
Environmental assessments help determine compliance with current environmental regulations. The U.S. Air Force, U.S. Army, Defense Logistics Agency (DLA), and Corps of Engineers (Civil Works) have adopted environmental compliance programs that identify compliance problems before they are cited as violations by the U.S. Environmental Protection Agency. Since 1984, the U.S. Army Construction Engineering Research Laboratories, in cooperation with numerous Department of Defense (DOD) components, has developed environmental compliance assessment checklist manuals. The Environmental Assessment and Management (TEAM) Guide was developed for use by all DOD components. Currently there are five participating DOD components: the Air Force, Air National Guard, Army, Civil Works, and DLA. These agencies have agreed to share the development and maintenance of this Guide. The Guide combines Code of Federal Regulations and management practices into a series of checklists that show legal requirements and the specific operations or items to review. TEAM Guide is supplemented by DOD component specific manuals detailing DOD component regulations and policies. The New York Supplement was developed to be used in conjunction with the TEAM Guide, using existing New York state environmental legislation and regulations as well as suggested management practices.
DTIC
Environment Management; Environment Protection

19980203093 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Review of Selected Army-Funded Research on Fog Oil Smoke Characteristics as Related to Clean Air Act Issues ***Final Report, Oct. 1995 - Oct. 1996***
Chester, Nancy A., Edgewood Research Development and Engineering Center, USA; Mar. 1998; 42p; In English
Report No.(s): AD-A344419; ERDEC-TR-475; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The endurance of fog oil (FO) as a choice training smoke is credited to its advantageous characteristics, which lead to optimum obscuration of troops and mechanized equipment as well as its cost efficiency, safety, and ease of handling. Fog oil's popularity, however, has been impacted by environmental regulation of smoke aerosol emissions under the Clear Air Act (CAA). Potential violation of the CAA by use of FO has lead to a request for further understanding of technical data describing the characteristics and behavior of FO droplets/particles and plumes. Selected sources of Army-funded research have been reviewed and summarized in this report.
DTIC
Air Pollution; Smoke; Fog; Oils; Air Quality; Oil Pollution; Environmental Quality

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GEOPHYSICS

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

19980202293 Aerosol Technology Ltd., Moscow, Russia
Modelling of Aerosol Dispersion by Atmosphere Turbulence ***Interim Report, Dec. 1997 - Feb. 1998***
Belov, N. N., Aerosol Technology Ltd., Russia; Belov, P. N., Aerosol Technology Ltd., Russia; Belova, N. G., Aerosol Technology Ltd., Russia; Feb. 25, 1998; 12p; In English
Contract(s)/Grant(s): N68171-97-M-5712
Report No.(s): AD-A340626; R/D-8925-EN-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Synthetic models of aerosol dispersion in atmosphere are based upon the library of streams and the method of modeling aerosol dispersion along the streamline model is based on the method of probe clouds that come from the nozzle of aerosol generator and move along the streamline. Final differences scheme for 3D Navier Stokes equations was improved to build the library. This method is effectively modelling aerosol transport by complex air flows. Second quarter finished with new modification of 3D computation codes - probe clouds model for non homogeneity aerosol plume. Main results are of research group: Preparing of new modification of synthetical modelling of aerosol dispersion ion atmosphere.
DTIC
Atmospheric Models; Air Flow; Finite Difference Theory; Navier-Stokes Equation; Aerosols; Atmospheric Turbulence

19980202358 Michigan Univ., Space Physics Research Lab., Ann Arbor, MI USA
Multiple Tethered Satellites for Ionospheric Studies (MTSIS)
Gilchrist, B. E., Michigan Univ., USA; Heelis, R. A., Texas Univ. at Dallas, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 191-203; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
Multiple Tethered Satellites for Ionospheric Studies (MTSIS) is a new mission concept study sponsored by NASA Space Physics intended to place a multiple tethered satellite mission on firm footing as a means to significantly advance our understanding of ionosphere-thermosphere-magnetosphere coupling processes. Many scientific questions concerning the distribution of plasma structures and electromagnetic fields in the ionosphere must separate space and time variations with minimal ambiguity. The controlled vertical separation of measurement platforms offered by a tethered configuration makes resolving vertical gradients along nominally horizontal orbit tracks practical. In this report we illustrate scientific questions which could benefit from such vertical gradient measurements including the study of auroral acceleration regions, equatorial spread-F, and ionospheric layers. A conceptual design is described which is being used to expose critical issues required for a feasible scientific mission. These issues include the selection of appropriate tether geometries and materials to address survivability issues from micrometeoroid and atomic oxygen flux while minimizing atmospheric drag, a sensible methodology and design for tether deployment, mechanisms for satellite attitude control, instrument payload accommodations, and a sensible power and communications design.
Author
Satellite Attitude Control; Tethered Satellites; Thermosphere; Coupling; Planetary Ionospheres; Planetary Magnetospheres

19980202359 Texas Univ. at Dallas, Richardson, TX USA
Tethered Satellite Investigations of the Ionosphere and Lower Thermosphere
Heelis, R. A., Texas Univ. at Dallas, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 205-221; In English; Also announced as 19980202346
Contract(s)/Grant(s): NAGw-4492; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The ability to resolve horizontal structures in the state variables of the lower thermosphere would considerably advance our understanding of this critical region of the geospace environment. Such measurements can only be obtained from a tethered satellite, where atmospheric drag on the very long tether is compensated by reboost of the mother vehicle. Such an arrangement could presently be accomplished using the space shuttle. Here we describe the rationale for consideration of such an undertaking and describe the known technologies that are required.
Author
Spaceborne Experiments; Tethered Satellites; Radiation Measurement

19980202361 Technical Univ. of Denmark, Dept. of Automation, Lyngby, Denmark
GRADSAT: A Danish Geomagnetic Gradient Mission
Merayo, Jose M. G., Technical Univ. of Denmark, Denmark; Tether Technology Interchange Meeting; Jan. 1998, pp. 239-252; In English; Also announced as 19980202346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We propose a mission of two identical tethered micro satellites for simultaneous two-point mapping of the Earth's magnetic field and of the first space derivative of the field. Launch in the 2002 time frame into a low altitude near polar and approximately circular orbit, slowly drifting in local time is proposed. An approximately 3 month's lifetime in the tether mode (similar to METS), continuing as free flyer(s) for up to 2 years depending on the actual solar cycle atmospheric swelling. The Danish Orsted Earth's field mapping mission brought Denmark into the international front in space magnetometry. A Danish Magnetic Gradient Mission will bring Denmark far ahead, and will consolidate our position in space magnetometry and advanced space technology. The proposed 600-400 km altitude polar orbit and the 20 km gravity gradient extended tether are optimized for simultaneous observations of the field signatures and for the separation of the field sources below the orbit, from sources traversed by the satellites and from sources above the orbit.
Derived from text
Aerospace Engineering; Tethered Satellites; Magnetic Measurement; Mapping; Geomagnetism

19980202701 Aerospace Corp., Technology Operations, El Segundo, CA USA
Survey of Ring Current Composition During Magnetic Storms
Grande, M., Aerospace Corp., USA; Perry, C. H., Aerospace Corp., USA; Hall, A., Aerospace Corp., USA; Fennell, J., Aerospace Corp., USA; Wilken, B.; Feb. 15, 1998; 12p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A341671; TR-98(8570)-3; SMC-TR-98-08; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During geomagnetic storms, the ring current is substantially modified and intensified. We use data from the MICS instrument on CRRES to investigate composition changes in magnetospheric ions in the energy range 20-400 keV/e. These are related to the Dst signature of the storm. Long term survey plots of MICS data show that during storms there is an initial increase of ionospheric material at around L = 3. The peak in the ratio of ionospheric material rises to higher L-shells during the storm recovery. by contrast, solar wind material remains predominantly at higher L-shells, and a belt of ring current alpha particles forms around L = 4. The L-shell of the peak fraction of ionospheric material is a strong function of Dst. Substorm composition reflects the background composition at that L-shell. These results are emphasized by a superposed epoch analysis of substorm injection composition. It shows that the composition of storm time injections is similar to a set of oxygen-rich injections. We conclude that, during the solar maximum interval that CRRES observed, substorms are not directly responsible for the ring current oxygen population. DTIC
Space Missions; Magnetic Storms; Ring Currents; CRRES (Satellite); Surveys

19980202715 Space Environment Corp., Logan, UT USA
Expanded Capabilities for the Ionospheric Forecast Model ***Final Report, 12 May 1994 - 30 Sep. 1997***
Schunk, R. W., Space Environment Corp., USA; Sojka, J. J., Space Environment Corp., USA; Eccles, J. V., Space Environment Corp., USA; Dec. 20, 1997; 149p; In English
Contract(s)/Grant(s): F19628-94-C-0046; AF Proj. 4026
Report No.(s): AD-A341230; AFRL-VS-HA-TR-98-0001; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Ionospheric Forecast Model (IFM) is a computationally efficient, user friendly, model of the global ionosphere that was developed for operational use at the Space Forecast Center. The model provides 12 hours forecasts for the global distributions of the molecular (NO+, O2+, N2+) and O+ densities, and the electron and ion temperatures, at E and F region altitudes (90-1000 km). The model also contains a simple algorithm for predicting H+ densities in the F region. The IFM is self-contained and is run by specifying a few simple parameters and geophysical indices. With support from this contract, the capabilities of the IFM were expanded in order to improve the reliability of its predictions. This involved the extension of the model to 1600 km, and the devel-

opment of a KP forecast algorithm, which was needed in order to obtain forecasts for the time-dependent convection and precipitation patterns. An extensive validation of the IFM was also conducted, including both climatology and storm simulations. In addition, the IFM was modified so that it could be coupled to the Thermospheric Forecast Model (TFM). As part of this effort, we developed the necessary coupling algorithms. Finally, we initiated the construction of a global dynamo model.
DTIC
Ionospherics; Atmospheric Models; Computer Programs; Thermosphere; Simulation; Forecasting

19980202991 California Univ., Earth Sciences Dept., Santa Cruz, CA USA
Crustal Waveguide Effects on Regional Phases in China and Southeast Asia ***Final Report, 11 Aug. 1995 - 11 Nov. 1997***
Lay, Thorne, California Univ., USA; Fan, Guangwei, California Univ., USA; Rodgers, Arthur, California Univ., USA; Dec. 01, 1997; 149p; In English
Contract(s)/Grant(s): F19628-95-K-0014; AF Proj. DENN
Report No.(s): AD-A341517; PL-TR-97-2163; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research program addressed the issue of reducing scatter in regional phase discriminant measures associated with waveguide irregularity. We empirically reduce discriminant measure variance, using along path measures obtained from data bases for surface topography, crustal thickness, and sedimentary layer thickness. Several path specific measures are found to have significant correlations with regional discriminant measurements, both before and after correction for propagation distance, for events in China and the Middle East. For station WMQ, in western China, variance reductions two to three times as large as those for distance corrections alone can be achieved by simple empirical models obtained by multiple regression analysis. Multiple regression analysis is applied for several path properties to all CDSN stations and broadband station ABKT in the Middle East under this contract. This final report presents four preprints: the first addresses variance reduction of discriminant measures at station WMQ, the second applies the same methodology to all stations in two sub-regions in China. The third applies an azimuthal sector analysis to data for station ABKT, and the fourth applies the multiple regression procedure to ABKT.
DTIC
Waveguides; Phases; Earth Crust; Regression Analysis

19980202996 Purdue Univ., Dept. of Agronomy and Mathematics, West Lafayette, IN USA
Toward a Molecular-Scale Understanding of Chemical Adsorption and Frost Heaving, Phase 2 ***Final Report, 1 Jan. 1995 - 31 Dec. 1997***
Cushman, John H., Purdue Univ., USA; Jan. 30, 1998; 12p; In English
Contract(s)/Grant(s): DAAH04-94-G-0068
Report No.(s): AD-A344269; ARO-31387.10-GS-Phase-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Significant advances were made in three basic areas: (1) Multiscale flow and deformational of swelling porous media, (2) nonlocal transport of contaminants in porous media, and (3) development of a molecular-scale understanding of phase separation in binary fluids in microporous media. Two- and three-scale theories were developed for fluid flow and chemical transport in expansive media such as natural soils and many biopolymers. The balance laws coupled with novel constitutive theories were implemented computationally and then compared (favorably) to experimental results. The first successful simulation of crust formation was presented. Chemical transport theories for porous media with evolving heterogeneity were developed. The theories were nonlocal in space and time. They were numerically implemented and they compared favorably to field experiments. Numerical statistical mechanical Monte Carlo simulations of binary mixtures in corrugated micropores were reported. Novel examples of strain induced liquefaction, chromatography and phase coexistence were presented. One book and 20 referred papers were published based on these efforts.
DTIC
Porous Materials; Adsorption; Fluid Flow; Monte Carlo Method; SOIls; Heaving; Frost

19980203027 Finnish Geodetic Inst., Masala, Finland
Geoid Determination by FFT Techniques in the Western China Test Area
Vermeer, Martin, Finnish Geodetic Inst., Finland; Li, Jian–Cheng, Wuhan Technical Univ. of Surveying and Mapping, China; Guo, Chun–Xi, National Bureau of Surveying and Mapping, China; 1997; ISSN 0355-1962; 21p; In English
Report No.(s): FGI-97-5; ISBN 951-711-212-2; Copyright; Avail: Issuing Activity (Finnish Geodetic Inst., Geodeetinrinne 2, FIN-02430 Masala, Finland); US Sales Only, Hardcopy, Microfiche

The principles of computing the geoid using FFT techniques are described in this report. The geoid of the Western China Test Area, which is located in 30 deg N -36 deg N and 96 deg E- 102 deg E, was computed on a 2.5 min grid starting from 1858 original point gravity values, as well as a 30 sec x 30 sec resolution Digital Terrain Model (DTM) grid. The final results are geoid and

quasi-geoid grids of 2.5 sec x 2.5 sec resolution. The methods of computation involve the strict evaluation of the Stokes integral formula and Molodenskii series solution computed by Faye anomalies together with 1D FFT, as well as the Mass point Geopotential Modelling (MGM) technique using 2D FFT to obtain a quasi-geoid also starting from Faye anomalies. For the Molodenskii solution, the terrain correction which involves two terms of series was also computed by 1D FFT. For all solutions we used the latest geopotential model EGM96 as the reference gravity field. Intercomparisons of the gravimetric geoids and quasi-geoids with GPS/Levelling have been performed. A gravimetric geoid fitted to GPS/Levelling using the least squares method, as well as both a smoothed geoid and a smoothed quasi-geoid, were finally obtained in this research.
Author
Geoids; Geopotential; Least Squares Method; Fast Fourier Transformations; Stokes Theorem (Vector Calculus); Mathematical Models

19980203067 Aerospace Corp., Technology Operations, El Segundo, CA USA
CRRES Observations of Particle Flux Dropout Events
Fennell, J., Aerospace Corp., USA; Roeder, J., Aerospace Corp., USA; Spence, H., Aerospace Corp., USA; Singer, H., National Oceanic and Atmospheric Administration, USA; Korth, A., Max-Planck-Inst. fuer Aeronomie, Germany; Feb. 15, 1998; 19p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A341651; TR-98(8570)-2; SMC-TR-98-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The complete disappearance of energetic electrons was observed by CRRES in the near geosynchronous region in 7.5% of the orbits examined. These total flux dropouts were defined by the fluxes rapidly dropping to levels below the sensitivity of the MBA energetic electron spectrometer on the CRRES satellite. They were separated into those that were only energetic electron dropouts and those that were associated with energetic ion and plasma dropouts. Approximately 20% of the events showed dropouts of all particle fluxes, and these were usually coincident with large increases in the local magnetic intensity and signatures of strong current systems. The energetic particle instruments and magnetometer of CRRES provide a detailed picture of the particle and field responses to these unusual conditions. Both the local morning and dusk events were associated with strong azimuthal (eastward) and radial changes in the magnetic field indicative of a strong current system approaching and sometimes crossing the CRRES position at the time of the flux dropouts. The direction of the field changes and the details of particle observations are consistent with CRRES passing through the plasma sheet boundary layer and entering the tail lobe for a significant number of the events.
DTIC
Space Missions; Dropouts; Energetic Particles; Plasmas (Physics); Plasma Layers; Earth Magnetosphere

19980203124 Massachusetts Inst. of Tech., Earth Resources Lab., Cambridge, MA USA
Research on Seismic Monitoring at Regional Distances ***Final Report, 30 Jun. 1995 - 30 Jun 1997***
Imhof, M., Massachusetts Inst. of Tech., USA; Nolte, B., Massachusetts Inst. of Tech., USA; Rodi, W., Massachusetts Inst. of Tech., USA; Toksoz, M. N., Massachusetts Inst. of Tech., USA; Sep. 10, 1997; 88p; In English
Contract(s)/Grant(s): F19628-95-C-0091; AF Proj. 5101
Report No.(s): AD-A340979; MIT-63575; PL-TR-97-2127; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
We report two studies related to numerical modeling of seismic wave generation and propagation. In the first, we use a 2-D multiple multipole method to model seismic wave radiation from nuclear explosions in and near underground cavities. Our modeling results are used to interpret seismograms recorded during the Non-Proliferation Experiment (NPE), which occurred near a large complex of tunnels and cavities. Synthetic seismograms for a simplified NPE geometry correlate well with the observed S-wave energy generated at or near the source and, by including near receiver tunnels into our models, we obtain the observed coupling between the radial and transverse component. The second study demonstrates the advantages of a newly developed irregular grid modeling technique for seismic wave propagation in laterally varying media. A numerical example demonstrates that the technique is more accurate than a standard regular grid finite difference method for modeling the effects of irregular interfaces. We then show that the method can be applied to models with irregular free surface topography, suggesting that our new variable grid method may be a valuable alternative to existing finite difference free surface algorithms. We demonstrate the effect of irregular surface topography on regional wave propagation with a Middle East example.
DTIC
Nuclear Explosions; Underground Explosions; Seismograms; Wave Propagation; Monitors

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19980201948 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Comparison of Advect Cloud Model and Fifth-Generation Mesoscale Model Total Fractional Cloud Forecasts
Pukall, Brian D., Air Force Inst. of Tech., USA; Mar. 1998; 158p; In English
Report No.(s): AD-A340766; AFIT/GM/ENP/98M-08; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Total fractional cloudiness (FC) forecasts from the advect cloud (ADVCLD) model and total FC forecasts diagnosed from the relative humidity and total cloud condensate (snow, ice, rain water, and cloud water) fields from the fifth generation mesoscale model (MM5) were statistically and subjectively compared to determine which model produced the better total FC forecasts from August through November 1997 for a forecast window centered on Bosnia. The real time nephanalysis (RTNFPH) model was used to represent the true state of the atmosphere. ADVCLD and MM5 forecasts were also compared against a persistence forecast to provide a minimal skill baseline. The Air Force Weather Agency (AFWA) provided all model data. The Kvamsttheta and Sundqvist schemes were used to transform the relative humidity forecasted at individual grid points by MM5 into a total FC forecast. Two other methods, the vertical column and layered methods, based on threshold techniques and devised by the author were used to transform the total cloud condensate forecasted by MM5 into a total FC forecast. The results indicate that ADVCLD produced the better total FC forecasts for the first 33 hours of the 36 hr forecast period despite having a tendency to produce too much cloudiness. Overall, the MM5 displayed a significant negative bias in both the relative humidity and total cloud condensate fields. The MM5 was found to significantly underforecast cloud cover over the Adriatic Sea and slightly overforecast cloudiness over mountainous regions. ADVCLD demonstrated skill against persistence throughout the forecast cycle, however, MM5 demonstrated skill only after the 12 hr forecast point.
DTIC
Cloud Cover; Clouds (Meteorology); Weather Forecasting; Atmospheric Models; Data Acquisition

19980202456 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Azimuth and Range Optimization of the Velocity Azimuth Display (VAD) Algorithm in the WSR-88D ***Final Report***
Craft, David L., Air Force Inst. of Tech., USA; Mar. 1998; 158p; In English
Report No.(s): AD-A342680; AFIT/GM/ENP/98M-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Velocity Azimuth Display (VAD) algorithm occasionally produces inaccurate wind estimates for the VAD Wind Profile (VWP) product of the Weather Surveillance Radar 1988 Doppler (WSR-88D) System. Weather forecasters have observed differences between the radar's wind profiles and wind profiles produced by rawinsondes and vertical wind profilers, when radiation and subsidence inversions in the atmosphere caused the radar beam to super refract. This thesis sought to improve the operational use of the VWP product for the WSR-88D near Denver, CO, by finding the optimal VAD algorithm Azimuth and Range parameter settings to overcome data contamination by hills located at the default range used by the algorithm. The WSR-88D Algorithm Testing and Display System (WATADS) processed 24 weeks of archived (level II) VAD wind data, which was verified by rawinsonde and vertical wind profiler data. Azimuth optimization was unsuccessful. However, reducing the range not only provided an average improvement in the accuracy of winds obtained under super refractive conditions, but also in the accuracy of those winds obtained when the atmosphere was not super refractive. In the overall average, the range which produced the most improvement over default range (30 km) accuracy was 28 km. The 26 km range also performed well.
DTIC
Radar Beams; Azimuth; Velocity; Display Devices; Surveillance Radar; Meteorological Radar

19980202495 National Oceanic and Atmospheric Administration, Office of Research and Applications, Washington, DC USA
A Remote Sensing Precipitable Water Product for use in Heavy Precipitation Forecasting
Scofield, R. A., National Oceanic and Atmospheric Administration, USA; Zaras, D., National Oceanic and Atmospheric Administration, USA; S. Kusselson, National Oceanic and Atmospheric Administration, USA; Rabin, R., National Oceanic and Atmospheric Administration, USA; Eighth conference on satellite meteorology and oceanography; 1996, pp. 74-78; In English; 8th; Satellite Meteorology and Oceanography, 28 Jan. - 2 Feb. 1996, Atlanta, GA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Mesoscale Convective Systems (MCSs) that produce heavy precipitation are a multiscale and concatenating event. This makes flash flood forecasting amenable to the satellite forecasting funnel methodology. The funnel takes into account meteorological scales and processes from the global scale to the synoptic scale, to the mesoscale, and finally to the storm scale. On the global to synoptic scale, water vapor plumes (6.7 microns) are often associated with extremely heavy precipitation if a lifting mechanism

is present. However, water vapor plumes only indicate the presence of middle to upper level moisture. In order to analyze the depth of the moisture total Precipitable Water (PW) must be measured. High values of PW and instability are often collocated and become antecedent conditions prior to the development of heavy rainfall and flash floods. High values of PW frequently appear as plumes, areas or surges of moisture. When PW plumes become aligned with equivalent potential temperature (theta-e) ridge axes and a lifting mechanism is present, heavy precipitation often occurs. On the mesoscale there is a need to locate outflow boundaries and short waves that may initiate, focus, and maintain the convection along or near the theta-e ridge axis. Finally, on the storm scale, the intensity, movement, and propagation of the storm is used to determine how much, when and where the heavy rain is going to move. Helicity is an important parameter for determining storm type-super cell versus multi-cellular structure. This paper will concentrate on discussing the development of a blended PW product for use in locating PW plumes-an antecedent condition for flash floods.
Author
Precipitation (Meteorology); Remote Sensing; Forecasting; Mesoscale Phenomena

19980202591 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Regression Analysis of Radar Measured Optical Turbulence with Synoptic Scale Meteorological Variables
Hajek, Diana L., Air Force Inst. of Tech., USA; Mar. 1998; 85p; In English
Report No.(s): AD-A341202; AFIT/GM/ENP/98M-03; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
A key issue to the USAF's Airborne Laser (ABL) program is the ability to accurately predict the level of optical turbulence that the ABL will encounter at its flight levels. The optical turbulence must be characterized so that the range and range variation of the ABL can be determined. Gravity wave spectra resulting from frontal or jet stream passage are presumed to cause layers of optical turbulence; however, exact relationships between optical turbulence and synoptic scale meteorological phenomena are unclear. This study assesses the statistical relationship between optical turbulence and synoptic scale variables through multiple linear regression. The optical turbulence measurements were observed by the 50 MHz radar at White Sands Missile Range, New Mexico from January 1993 to January 1994. Measurements were averaged temporally and vertically to coincide with weather data. The synoptic scale meteorological data was extracted from the NCEP/NCAR reanalysis database. Results from the regression models showed that a linear relationship exists between optical turbulence and major synoptic scale variables; however, this relationship was a weak one. It was concluded that further research was needed to define the exact relationship between synoptic scale meteorological variables and optical turbulence.
DTIC
Laser Beams; Atmospheric Refraction; Optical Measurement; Regression Analysis; Meteorological Parameters; Statistical Correlation; Refractivity; Turbulence

19980202657 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Improving Cape Canaveral's Day-2 Thunderstorm Forecasting Using Meso-ETA Numerical Model Output
Wohlwend, Christian S., Air Force Inst. of Tech., USA; Mar. 1998; 187p; In English
Report No.(s): AD-A341053; AFIT/GM/ENP/98M-12; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
The 45th Weather Squadron (WS) is responsible for the protection of billions of dollars worth of Air Force and NASA equipment from weather hazards. They produce a seven day planning forecast as one tool to support the space launch community. Improving this forecast can potentially save millions of dollars of government funds. This research focuses on the feasibility of improving the day two thunderstorm forecast by applying Meso Eta numerical forecasts to the Neumann-Pfeffer Thunderstorm Index (NPTI). The NPTI is currently used by the 45th WS for same day thunderstorm probability forecasting utilizing the morning radiosonde as input. The perfect prognosis assumption was used when assessing the value of this technique. NPTI thunderstorm probabilities were calculated using input variables extracted from the day two Meso Eta. The NPTI output was verified against coincident thunderstorm observations taken at Cape Canaveral Air Station. Accuracy and bias statistics were used to calculate a forecasting skill score versus persistence. Statistically significant positive skill scores were produced, indicating that the proposed method is a potentially useful forecasting tool for day two thunderstorm probability forecasting. A test of NPTI over 20 years of climatology revealed a moderately accurate forecasting method.
DTIC
Weather Forecasting; Thunderstorms; Forecasting; Mathematical Models; Weather; Climatology

19980202683 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Theater Analysis Procedures (TAP) ***Final Report, 19 Jul. 1994 - 20 Oct. 1997***
Nehrkorn, Thomas, Atmospheric and Environmental Research, Inc., USA; Hoffman, Rose N., Atmospheric and Environmental Research, Inc., USA; Sparrow, Jeanne, Atmospheric and Environmental Research, Inc., USA; Yin, Min, Atmospheric and Envi-

ronmental Research, Inc., USA; Ryckman, Stan, Atmospheric and Environmental Research, Inc., USA; Nov. 13, 1997; 145p; In English
Contract(s)/Grant(s): F19628-94-C-0027; AF Proj. 2688
Report No.(s): AD-A340975; PL-TR-97-2146; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report describes the results of a 3 year project for development of a regional analysis system based on the method of optimal interpolation. The TAP project primary objective is to develop robust analysis procedures to support the tactical user. The function of TAP is to combine background (i.e. a priori) information with observations of diverse type, quality, and density to produce analyses of meteorological fields, which are either provided directly to the end user or used as input to other algorithms, such as mesoscale forecast models. The prototype system design and its implementation are described, along with the ancillary climatology and error statistics databases. The results of system tests are described in which real data collected over North America were used for the generation of customized analysis products, and for initialization of the MM5 mesoscale forecast model.
DTIC
Weather Forecasting; Climatology; Algorithms; Numerical Analysis

19980202689 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Calibrated Probabilistic Quantitative Precipitation Forecasts Based on the MRF Ensemble
Eckel, Frederick Anthony, Air Force Inst. of Tech., USA; Mar. 1998; 147p; In English
Report No.(s): AD-A340919; AFIT/GM/ENP/98M-02; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Probabilistic quantitative precipitation forecasts (PQPF) based on the medium range forecast (MRF) ensemble are currently in operational use below their full potential quality (i.e., accuracy and reliability). This unfulfilled potential is due to the MRF ensemble being adversely affected by systematic errors which arise from an imperfect model and less than ideal ensemble initial perturbations. This thesis sought to construct a calibration to account for these systematic errors and thus produce higher quality PQPF. Systematic errors were explored with the use of the verification rank histogram, which tracks the performance of the ensemble. The information in these histograms was then used in interpreting MRF ensemble forecasts to produce calibrated PQPF. While the calibration technique did noticeably improve the quality of PQPF, its usefulness was bounded by the natural predictability limits of cumulative precipitation. It was discovered that higher levels of cumulative precipitation cannot be reliably predicted in the medium range. Due to this limit of predictability, for significant levels of precipitation (high threshold), the calibration designed in this thesis was found to be useful only for short range PQPF. For low precipitation thresholds, the calibrated PQPF did prove to be of value in the medium range.
DTIC
Weather Forecasting; Predictions; Probability Theory; Numerical Analysis; Atmospheric Moisture

19980202714 Naval Postgraduate School, Monterey, CA USA
Investigation of Strong Surface Winds Associated with an Upper Front Using COAMPS
Schwingshaki, Ken, Naval Postgraduate School, USA; Sep. 1997; 90p; In English
Report No.(s): AD-A341235; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

On 2 April 1997, strong winds blew through the central coast of California that were accompanied by an intense jet streak and upper front. The event was analyzed with standard synoptic scale DIFAX charts and mesoscale charts for comparison. The mesoscale model used was the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) developed by Naval Research Laboratory (NRL), Monterey, California. COAMPS captured features that were not diagnosed on the synoptic charts. Height, isotach and temperature fields showed more detail, although observations were not sufficient to completely verify the model's level of detail. COAMPS was heavily influenced by the topographic field modeling lee troughs and mountain waves along the Sierra Nevada mountains. A strong mountain wave, initiated by the upper front, occurred in central California during this time period. The wave troughs correlated to wind maxima at the surface, including one near San Francisco Bay where winds as high as 66 mph were reported.
DTIC
Weather Forecasting; Temperature Distribution; Mesometeorology; Ground Wind; Air Water Interactions

19980202915 Naval Postgraduate School, Monterey, CA USA
Extratropical Transition of Western North Pacific Tropical Cyclones
Klein, Peter M., Naval Postgraduate School, USA; Sep. 1997; 101p; In English
Report No.(s): AD-A341420; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Extratropical Transition (ET) of a Tropical Cyclone (TC) often results in a mid-latitude storm that threatens maritime and coastal interests. Cases of ET between 1 July through 31 October during 1994-1996 are reviewed using Navy Operational Global

Atmospheric Prediction System (NOGAPS) analyses and hourly geostationary satellite imagery. Current conceptual models are found to be inadequate to explain the physical processes in ET. ET is redefined to have two stages: transformation, where the TC is transformed from a warm-core vortex into a baroclinic, cold-core extratropical cyclone, and re-intensification, where the transformed TC either deepens or dissipates, depending on the existence of upper-tropospheric support for extratropical cyclogenesis. ET is further defined in terms of two characteristic mid-latitude synoptic patterns: meridional, in which the cyclones have meridional tracks and tend to re-intensify less vigorously than zonal, which have zonal tracks and may deepen explosively. Review of NOGAPS 5OO-mb anomaly correlation scores in 1996 demonstrated that ET may be associated with significant NOGAPS errors. Sea-level pressure forecasts during ET events involving a merger tend to be too deep. In ET cases of rapidly deepening storms, NOGAPS tends to overforecast their intensity during transformation, and then underforecast during re-intensification. Rules of thumb are provided to assist forecasters in improving predictions of the track and intensity of storms undergoing ET.
DTIC
Forecasting; Atmospheric Models; Synchronous Platforms; Troposphere; Cyclones

19980202924 Army Research Lab., Adelphi, MD USA
The Refractive Index Structure Parameter/Atmospheric Optical Turbulence Model: CN2 ***Final Report, Jan - Dec. 1997***
Tunick, Arnold D., Army Research Lab., USA; Apr. 1998; 30p; In English
Contract(s)/Grant(s): Proj. PE61102A
Report No.(s): AD-A341685; ARL-TR-1615; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The CN2 model is a semi-empirical algorithm that makes a quantitative assessment of atmospheric optical turbulence. The algorithm uses surface layer gradient assumptions applied to two levels of discrete vertical profile data to calculate the refractive index structure parameter. Model results can be obtained for unstable, stable, and near-neutral atmospheric conditions. The CN2 model has been benchmarked on data from the REBAL'92 field study. The model will shortly be added to the Electro-Optics Atmospheric Effects Library (EOSAEL). This report gives technical and user's guide information on the CN2 model.
DTIC
Micrometeorology; Turbulence Models; Refractivity; Atmospheric Turbulence; Similarity Theorem

19980202976 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
A Simple Method for Classification of Sky Conditions
Nakamura, Hiroshi, Kyushu Univ., Japan; Li, Nong, Kyushu Univ., Japan; Koga, Yasuko, Kyushu Univ., Japan; Igawa, Norio, Kyushu Univ., Japan; Technology Reports of Kyushu University; Mar. 1997; ISSN 0023-2718; Volume 70, No. 2, pp. 175-180; In Japanese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

About fifty IDMP (International Daylight Measurement Programme) measurement stations have been established in the world. The enormous number of data on various aspects of daylight and solar radiation are being obtained every minute of every day at those stations. Usually those data should be arranged be the sky conditions when the data are taken for the application to various fields. The sky conditions are divided into three categories, that is the clear sky condition the intermediate sky condition and the overcast sky condition. The sky conditions are classified by subjective judgements even now because the border lines of the three sky conditions are not defined clearly. A simple automatic method of the classification of sky conditions for computer processing of the data gained at general class IDMP stations spread all over the world is introduced in this paper. The diffuse horizontal illuminance and the vertical illuminance on four cardinal directions are used as parameters. As a trial, the frequency of occurrence of each of three sky conditions through-out two years in Fukuoka was estimated by this method. Furthermore, the results are shown here being compared with those of other research work by the authors.
Author
Illuminance; Cloud Cover; Classifications

19980203013 Federal Aviation Administration, Atlantic City, NJ USA
Weather Systems Processor (WSP) Demonstration Validation (DEMVAL) Plan, Phases 1 and 2
Martinez, Radame, Federal Aviation Administration, USA; Lee, Tai, Federal Aviation Administration, USA; Adamskyj, Cindy, Federal Aviation Administration, USA; Stretcher, Baxter, Federal Aviation Administration, USA; Nov. 1997; 39p; In English
Report No.(s): AD-A341121; DOT/FAA/CT-TN97/22-Phase-1-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research and development of the Weather Systems Processor (WSP) is being accomplished in an effort to satisfy one of the Federal Aviation Administration's (FAA) performance goals in the area of System Efficiency, which is to develop and demonstrate the capability of new systems to decrease the rate of delays due to weather by 10 percent by the year 2002. This plan addresses the Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL) Demonstration Validation (DEMVAL) of the test bed WSP at their Terminal Radar Development Facility (TRDF) in Albuquerque, New Mexico. This DEMVAL began in November

1995, and will continue through 1997. The purpose of this plan is to provide an overview of the MIT/LL DEMVAL to assist the FAA with its DEMVAL monitoring responsibilities, and with future WSP Test and Evaluation (T&E) activities, including Development Test and Evaluation (DT&E) and Production Acceptance Test and Evaluation (PAT&E) monitoring and System Test conduct.
DTIC
Weather; Air Traffic; Systems Engineering; System Effectiveness; Meteorological Parameters

19980203015 Woods Hole Oceanographic Inst., MA USA
Development of an Autonomous Aerosol Sampler for Ocean Buoys and Land Sites
Scholkovitz, Edward, Woods Hole Oceanographic Inst., USA; Allsup, Geoffrey, Woods Hole Oceanographic Inst., USA; Arthur, Richard, Woods Hole Oceanographic Inst., USA; Hosom, David, Woods Hole Oceanographic Inst., USA; McKenney, Kevin, Massachusetts Inst. of Tech., USA; Jan. 1998; 99p; In English
Contract(s)/Grant(s): NSF OCE-94-13212
Report No.(s): AD-A341132; WHOI-98-01; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The authors have successfully designed, built and tested an aerosol sampler which is capable of collecting, in an unattended manner, a time-series set of aerosol samples (aerosol embedded filters) from moored ocean buoys and remote areas on land. Research on aerosols, in particular, and atmospheric chemistry, in general, has not been previously attempted from buoys. Aerosols entering and leaving the ocean play an important role in climate change, ocean productivity, pollutant transport and atmospheric optics. This report discusses: (1) the scientific applications of a buoy mounted aerosol sampler, (2) the advantages of using buoys as research platforms, and (3) the authors' new instrument. Also discussed are the results of a four month test of the aerosol sampler on the AEROCE (Atmosphere and Ocean Chemistry Experiment) tower in Bermuda and the results of a three month test on a buoy moored in Vineyard Sound off Woods Hole, MA, USA. The direct comparison between WHOI filters and AEROCE filters from the Bermuda tower is very encouraging as the Fe concentrations of aerosols compare to within 10-15% over a wide range of values. Aerosol sampling from a buoy moored in coastal waters was successfully tested under a variety of atmospheric and oceanic conditions.
DTIC
Aerosols; Air Sampling; Atmospheric Chemistry; Buoys; Oceans; Marine Meteorology; Samplers; Marine Environments; Remote Sensing

19980203056 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Nowcasting Thunderstorms at Cape Canaveral, Florida, Using an Improved Neumann-Pfeffer Thunderstorm Index
Howell, Cindy L., Air Force Inst. of Tech., USA; Mar. 1998; 109p; In English
Report No.(s): AD-A341763; AFIT/GM/ENP/98M-05; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Neumann-Pfeffer Thunderstorm Index (NPTI) is used daily by the 45th Weather Squadron during the convective season to estimate the probability of afternoon thunderstorms. The current I , developed by Charles J. Neumann in the 1960s, i based on only 13 years of data taken over 30 years ago. The index was in desperate need of an upgrade. Following the multiple regression techniques outlined by Neumann, this thesis examines whether or not including additional data would improve the performance of the NPTI. After performing the multiple regressions and retuning the regression coefficients, both NPTs were validated using a 2-year independent data set. Then, several measures of accuracy were computed to compare the current NPTI, the upgraded NOPTI, and 24-hour persistence. At lower cutoff percentages, the current NPTI and the upgraded version performed quite similarly; persistence was the worst of the three methods. However, at higher cutoff percentages, persistence out-performed both versions of the NPTI. Both NPTs still performed equally well. It is recommended that the current NPTI should continue to be used operationally since the upgraded NPTI did not offer any significant improvement. Furthermore, because persistence out-performed either NPTI at highter cutoff levels, a new forecast method must be developed and implemented immediately.
DTIC
Probability Theory; Regression Coefficients

19980203119 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Forecasting Wet Microbursts Associated with Summertime Airmass Thunderstorms Over the Southeastern USA
Mackey, James B., Air Force Inst. of Tech., USA; Mar. 1998; 142p; In English
Report No.(s): AD-A340856; AFIT/GM/ENP/98M-06; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Microbursts are intense downbursts from thunderstorms that affect an area less than 4 km and have a lifespan less than 10 minutes. Wet microbursts are associated with heavy precipitation and are common in the eastern and southeastern part of the country. The greatest threat from microbursts is to low flying aircraft, where the rapid fluctuations in horizontal and vertical airflow

create tremendous shear zones. Microbursts have been determined to be the causal factor behind at least three major aircraft accidents resulting in numerous fatalities. Due to the short lifespan of microbursts, they often strike without warning and pose a serious challenge to operational forecasters trying to protect Air Force assets. This thesis seeks to develop a technique to forecast wet microbursts using currently operational technology, including upper air soundings and WSR-88D products. The technique developed is comprised of three distinct phases. First, recognize the potential threat for given environmental conditions. Second, predict the maximum outflow velocities from microbursts using predictive equations. Third, highlight key NEXRAD radar products that demonstrate a strong potential to serve as precursors to microburst formation. Using the technique developed, warning leadtimes on the order of 10 to 20 minutes appear to be reasonable in operational applications.
DTIC
Meteorological Radar; Aircraft Accidents

19980203151 Colorado State Univ., Dept. of Atmospheric Science, Fort Collins, CO USA
Development and Testing of Physical Algorithms for Cloud Forecasting on the Mesoscale ***Final Report, 15 Jan. 1995 - 14 Jan 1998***
Cotton, William R., Colorado State Univ., USA; Mar. 18, 1998; 23p; In English
Contract(s)/Grant(s): F49620-95-1-0132
Report No.(s): AD-A341354; AFRL-SR-BL-TR-98-0284; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This research has focused on the development of a comprehensive mesoscale numerical weather prediction (NWP) system for forecasting clouds anywhere in the world. The host model for performing this research, RAMS, has been extended to a global, interactive nested grid forecast model that is capable of running on both shared-memory and distributive memory computers. This unique NWP model is capable of being initialized globally and then being able to telescopically nest anywhere on earth and provide high resolution 24 to 48h forecasts of clouds and precipitation. Some of the physical modules developed under support of this project include: a cumulus parameterization scheme designed specifically for use in an interactive nested grid model, a mesoscale convective system parameterization scheme that interfaces with the cumulus parameterization scheme, a new, computationally fast, two moment, stochastic microphysics parameterization scheme, and a new two-stream cloud-radiation model that interfaces directly with the hydrometeor distributions in the microphysics model. The new cloud forecasting scheme has been tested in applications to Arctic stratus clouds, and mid-latitude and tropical cirrus. The model has been shown to perform very well and moreover, provide new insights into the physics and dynamics of those cloud systems.
DTIC
Atmospheric Models; Clouds (Meteorology); Hydrometeors

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OCEANOGRAPHY

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

19980202922 Naval Postgraduate School, Dept. of Oceanography, Monterey, CA USA
A Large-Scale Modeling Study of the California Current System
Monroe, James T., Naval Postgraduate School, USA; Dec. 1997; 148p; In English
Report No.(s): AD-A341680; NPS-OC-97-007; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
A high resolution, multi-level, primitive equation ocean model is used to investigate the combined role of wind forcing, thermohaline gradients, and coastline irregularities on the formation of currents, meanders, eddies, and filaments in the California Current System (CCS) from 22.5 deg N to 47.5 deg N. An additional objective is to further characterize the formation of the Davidson Current, seasonal variability off Baja California, and the meandering jet south of Cape Blanco. The model includes a realistic coastline and is forced from rest using climatological winds, temperatures, and salinities. The migration pattern of the North Pacific Subtropical High plays a significant role in the generation and evolution of CCS structures. In particular, variations in wind stress induce flow instabilities which are enhanced by coastline perturbations. An inshore train of cyclonic eddies, combined with a poleward undercurrent of varying seasonal depths, forms a discontinuous countercurrent called the Davidson Current north of Point Conception. Off Baja, the equator-ward surface jet strengthens (weakens) during spring and summer (fall and winter). Model results also substantiate Point Eugenia as a persistent cyclonic eddy generation area. The model equator-ward jet south of Cape

Blanco is a relatively continuous feature, meandering offshore and onshore, and divides coastally influenced water from water of offshore origin.
DTIC
Mathematical Models; Climatology; Ocean Models; California; Coasts; Annual Variations

19980203105 Naval Research Lab., Coastal and Semi-Enclosed Seas Section, Stennis Space Center, MS USA
Insights into Unstructured Mesh Generation for Coastal Ocean Applications ***Final Report***
Blain, Cheryl A., Naval Research Lab., USA; McManus, Ashley P., Naval Research Lab., USA; Mar. 06, 1998; 64p; In English
Report No.(s): AD-A341529; NRL/FR/7322--97-9671; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The finite element method for discreitizing differential equations is introduced and briefly compared to finite difference approaches. Advantages of finite element approximations include ease of localized mesh refinement and maximization of computational resources through unstructured, graded meshes and element-based computations. The use of triangular elements lead to realistic representations of shoreline and bathymetric complexity; boundary conditions are naturally incorporated. Presentation of a theoretical framework and state-of-the-art research for determining required mesh resolution in relation to the modeled physics is followed by practical concerns of mesh generation itself. Known tools for mesh generation and promising develop. mental software are discussed. Detailed descriptions of mesh creation, editing, and model diagnostics using the ACE/gredit software, the most versatile and advanced mesh creation and modification tool available, comprises the remainder of this report. Step-by-step instructions for the semi-automatic generation of a finite element mesh are included, which has the potential to advance the rapid relocatability of finite element models.
DTIC
Oceans; Coasts; Finite Element Method; Tides; Finite Difference Theory

19980203189 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA
Controlled Source Electromagnetic Sounding off the Coast of Eureka California
Avera, Will, Naval Research Lab., USA; Mozley, Edward C., Naval Research Lab., USA; Reynaud, Juan, Naval Research Lab., USA; Jun. 1997; 6p; In English; Prepared in collaboration with Mississippi State Univ., Science and Tech Research Center
Report No.(s): AD-A341650; NRL/PP/7442--97-0015; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Controlled electromagnetic (EM) measurements were conducted with a ship towed electric bipole source and fixed electric and magnetic field sensor units that were deployed on the seafloor in 62 meters of water near Eureka, California. The objective was to determine the electrical properties of the marine sediments to depths greater than 20 meters. The survey site was positioned in a region that had been investigated by numerous shallow geologic and geophysical studies. Data was interpreted for a one-dimensional conductivity structure with an iterative least square scheme. The electrical properties interpreted from the EM measurements have been compared with the available bottom towed EM soundings in the area.
DTIC
Electrical Properties; Electromagnetic Measurement

51
LIFE SCIENCES (GENERAL)

19980202298 Interstate Commission on the Potomac River Basin, Rockville, MD USA
Comprehensive List of Chesapeake Bay Basin Species, 1998
Jun. 1998; 112p; In English
Report No.(s): PB98-141476; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The report provides a list of aquatic and aquatic-associated organisms found in recent decades in the Chesapeake Bay Basin. The list is NOT exhaustive because (1) it is based primarily on taxa identified in monitor programs and not all aquatic taxonomic groups are monitored in the basin, and (2) the focus has been on taxa found in tidal waters. The list is updated annually with new species identified in the ongoing Chesapeake Bay Program biological monitoring programs.
NTIS
Chesapeake Bay (US); Organisms; Biological Diversity; Marine Biology; Marine Environments

19980202342 Ludwig-Maximilians-Univ., Inst. of Zoology, Munich, Germany
Amino Acid Racemization and the Preservation of Ancient DNA
Poinar, Hendrik N., Ludwig-Maximilians-Univ., Germany; Hoss, Matthias, Ludwig-Maximilians-Univ., Germany; Science; May

10, 1996; Volume 272, pp. 864-866; In English
Contract(s)/Grant(s): NAGw-2881
Report No.(s): NASA/CR-96-207584; NAS 1.26:207584; Copyright Waived (NASA); Avail: CASI; A01, Hardcopy; A01, Microfiche

The extent of racemization of aspartic acid, alanine, and leucine provides criteria for assessing whether ancient tissue samples contain endogenous DNA. In samples in which the D/L ratio of aspartic acid exceeds 0.08, ancient DNA sequences could not be retrieved. Paleontological finds from which DNA sequences purportedly millions of years old have been reported show extensive racemization, and the amino acids present are mainly contaminates. An exception is the amino acids in some insects preserved in amber.
Author
Amino Acids; Deoxyribonucleic Acid; Aspartic Acid

19980202396 Scripps Research Inst., La Jolla, CA USA
Template-Directed Ligation of Peptides to Oligonucleotides
Bruick, Richard K., Scripps Research Inst., USA; Dawson, Philip E., Scripps Research Inst., USA; Kent, Stephen BH, Scripps Research Inst., USA; Usman, Nassim, Ribozyme Pharmaceuticals, Inc., USA; Joyce, Gerald F., Scripps Research Inst., USA; Chemistry and Biology; 1996; Volume 3, No. 1, pp. 49-54; In English
Contract(s)/Grant(s): GM-48870
Report No.(s): NASA/CR-96-207596; NAS 1.26:207596; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

Synthetic oligonucleotides and peptides have enjoyed a wide range of applications in both biology and chemistry. As a consequence, oligonucleotide-peptide conjugates have received considerable attention, most notably in the development of antisense constructs with improved pharmacological properties. In addition, oligonucleotide-peptide conjugates have been used as molecular tags, in the assembly of supramolecular arrays and in the construction of encoded combinatorial libraries. to make these chimeric molecules more accessible for a broad range of investigations, we sought to develop a facile method for joining fully deprotected oligonucleotides and peptides through a stable amide bond linkage. Furthermore, we wished to make this ligation reaction addressable, enabling one to direct the ligation of specific oligonucleotide and peptide components.To confer specificity and accelerate the rate of the reaction, the ligation process was designed to be dependent on the presence of a complementary oligonucleotide template.
Author
Combinatorial Analysis; Conjugates; Pharmacology; Reaction Kinetics; Peptides

19980202705 Cold Spring Harbor Lab., New York, NY USA
Microbial Pathogenesis and Host Defense ***Final Report, 27 Aug. - 31 Dec. 1997***
Grodzicker, Terri, I, Cold Spring Harbor Lab., USA; Mar. 1998; 282p; In English
Contract(s)/Grant(s): DAMD17-97-1-7352
Report No.(s): AD-A341274; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Understanding microbial pathogenesis demands a detailed knowledge of the host response as well as the pathogen itself, and requires an interdisciplinary approach, integrating the fields of microbiology, eukaryotic cell biology, and immunology. The first Cold Spring Harbor meeting on Microbial Pathogenesis and Host Response was planned to facilitate such interactions, and the meeting attracted over 300 international scientists who approach the study of bacterial and fungal pathogens from a broad range of perspectives.
DTIC
Microbiology; Pathogenesis

19980203205 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Lignin Formation and the Effects of Gravity: A New Approach ***Progress Report, Jun. 1995 - Mar. 1997***
Lewis, Norman G., Virginia Polytechnic Inst. and State Univ., USA; 1997; 23p; In English
Contract(s)/Grant(s): NAG1-00164
Report No.(s): NASA/CR-97-207817; NAS 1.26:207817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two aspects of considerable importance in the enigmatic processes associated with lignification have made excellent progress. The first is that, even in a microgravity environment, compression wood formation, and hence altered lignin deposition, can be induced upon mechanically bending the stems of woody gymnosperms. It now needs to be established if an organism reorientating its woody stem tissue will generate this tissue in microgravity, in the absence of externally applied pressure. If it does not, then

gravity has no effect on its formation, and instead it results from alterations in the stress gradient experienced by the organism impacted. The second area of progress involves establishing how the biochemical pathway to lignin is regulated, particularly with respect to selective monolignol biosynthesis. This is an important question since individual monomer deposition occurs in a temporally and spatially specific manner. In this regard, the elusive metabolic switch between E-p-coumaryl alcohol and E-coniferyl alcohol synthesis has been detected, the significance of which now needs to be defined at the enzyme and gene level. Switching between monolignol synthesis is important, since it is viewed to be a consequence of different perceptions by plants in the gravitational load experienced, and thus in the control of the type of lignification response. Additional experiments also revealed the rate-limiting processes involved in monolignol synthesis, and suggest that a biological system (involving metabolite concentrations, as well as enzymatic and gene (in)activation processes) is involved, rather than a single rate-limiting step.
Author
Gravitational Effects; Lignin; Biochemistry; Microgravity; Plants (Botany); Vegetation Growth; Biosynthesis; Gravitropism

52
AEROSPACE MEDICINE

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

19980202544 Air Force Medical Center, Lackland AFB, TX USA
Effect of the Menstrual Cycle on Maximum Oxygen Consumption and Endothelium-Dependent Vasodilation ***Final Report, 15 Dec. 1995 - 31 Dec. 1997***
Andrews, Thomas C., Air Force Medical Center, USA; Dec. 1997; 14p; In English
Contract(s)/Grant(s): 96MM6641
Report No.(s): AD-A338769; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Endogenous estradiol and progesterone may have important effects on endothelial function in pre-menopausal women and may thereby influence the time course of atherogenesis. This effect may also correlate with changes in exercise and could influence how women perform during times 6f stress. We studied endothelium-dependent vasodilation of the brachial artery during three phases of the menstrual cycle in 20 eumenorrheic subjects to determine the effect of endogenous estradiol and progesterone. The degree of endothelium-dependent, flow-mediated vasodilation was assessed using high resolution brachial artery ultrasound comparing baseline diameter to that obtained during reactive hyperemia. Endothelium-independent vasodilation was similarly assessed by measuring brachial artery diameter after administration of sublingual nitroglycerin. Exercise performance was measured by determining the maximum oxygen consumption and the endurance time on an anaerobic speed test (AST). Serum lipids were measured along with the estradiol and progesterone levels was also determined. Each subject was studied at three phases of the menstrual cycle: early follicular phase when estradiol and progesterone levels are low, at mid-cycle when estradiol levels are elevated and progesterone levels remain low, and during the luteal phase when levels of both hormones are elevated. Compared to the early follicular and luteal phases, flow-mediated vasodilation was greatest at mid-cycle (follicular 8.0+1- 1.1%; mid-cycle 10.9+1- 1.4%, luteal 7.6+1- 1.1%. p 0.059). The serum progesterone level was a significant negative correlated of flow-mediated vasodilation (R-- -0.261, p=0.027). Lipid levels, maximum oxygen consumption and AST times did not change significantly during the three phases of the menstrual cycle.
DTIC
Oxygen Consumption; Endothelium; Menstruation; Hormones

19980202548 Institute for Human Factors TNO, Soesterberg, Netherlands
Telemedicine: Online Teleconsultancy and Telesurgery ***Interim Report Telemedicine: Directe Teleconsultatie en Telechirurgie***
Hin, A. J. S., Institute for Human Factors TNO, Netherlands; Daanen, H. A. M., Institute for Human Factors TNO, Netherlands; Lotens, W. A., Institute for Human Factors TNO, Netherlands; Dec. 22, 1997; 46p; In Dutch
Contract(s)/Grant(s): A96/M/355
Report No.(s): TNO-TM-97-A084; TD-97-0484; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

The Royal Netherlands Army has requested to make a study on the recent developments in the area of telemedicine and to give recommendations on the introduction of on-line teleconsulting and telesurgery systems in the military medical organization. In remote areas (by distance or by inaccessibility) on-line teleconsulting can be a convenient solution to bring the appropriate knowledge and experience an the site of accident or operation. Two situations are distinguished in the military forces to introduce a teleconsulting system. A first application is a system carried by medical personnel for triage of victims on the battlefield. A sec-

ond application is a system for an operating room which allows to consult a remote specialist. The proper characteristics of the video/audio-system, and the implementation of communication procedures between medical man and specialist based on existing military medical protocols need to be investigated further.
Author
Telemedicine; On-Line Systems; Protocol (Computers); Telecommunication

19980202913 Army Construction Engineering Research Lab., Champaign, IL USA
A Comparative Study of Indoor Human Response to Blast Noise and Sonic Booms ***Final Report***
Schomer, Paul D., Army Construction Engineering Research Lab., USA; Sias, John W., Army Construction Engineering Research Lab., USA; Maglieri, Domenic, Army Construction Engineering Research Lab., USA; Mar. 1998; 79p; In English
Report No.(s): AD-A341404; CERL-TR-98/25; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

For the past two decades in the USA, blast sounds and sonic booms both have been assessed using C weighted day and night average sound level. Based almost exclusively on blast sound research, a new method which replaces the C weighted day and night average sound level recently has been recommended, reviewed, and incorporated into a new American National Standard. As in the previous method, the new method includes and assesses sonic boom sounds in a like manner to blast sounds. However, while available evidence suggested that in an indoor setting sonic boom could be treated in a similar fashion to blast sounds, experimental evidence was lacking. to provide the lacking comparison data, this study tested the responses of subjects to sonic booms to determine if they were consistent with the previous blast response data presented by Schomer in 1994, since these data formed the basis for the new method. A key factor in the design of this study was the presentation of real blasts and booms to subjects situated in real structures in the field. The new data resulting from this study show good general agreement with the previous data.
DTIC
Noise; Noise Tolerance; Sonic Booms; Blasts; Human Tolerances

19980203088 NASA Langley Research Center, Hampton, VA USA
Method of and Apparatus for Histological Human Tissue Characterization Using Ultrasound
Yost, William T., Inventor, NASA Langley Research Center, USA; Cantrell, John H., Inventor, NASA Langley Research Center, USA; Taler, George A., Inventor, NASA Langley Research Center, USA; May 05, 1998; 10p; In English
Patent Info.: Filed 26 Jan. 1996; NASA-Case-LAR-15040-1; US-Patent-5,746,209; US-Patent-Appl-SN-592833; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A method and apparatus for determining important histological characteristics of tissue, including a determination of the tissue's health is discussed. Electrical pulses are converted into meaningful numerical representations through the use of Fourier Transforms. These numerical representations are then used to determine important histological characteristics of tissue. This novel invention does not require rectification and thus provides for detailed information from the ultrasonic scan.
Official Gazette of the U.S. Patent and Trademark
Tissues (Biology); Fourier Transformation; Histology; Ultrasonics; Histochemical Analysis; Electric Pulses; Health

19980203141 Army Aeromedical Research Lab., Fort Rucker, AL USA
Heat Stress Effects of a Navy/USMC vs. Army Aviator Ensemble in a UH-6O Helicopter Simulator ***Final Report***
Reardon, Matthew J., Army Aeromedical Research Lab., USA; Fraser, E. B., Army Aeromedical Research Lab., USA; Katz, Lawrence, Army Aeromedical Research Lab., USA; LeDuc, Patricia, Army Aeromedical Research Lab., USA; Morovati, Pooria, Army Aeromedical Research Lab., USA; Feb. 1998; 73p; In English
Contract(s)/Grant(s): Proj-3M162787A879
Report No.(s): AD-A341281; USAARL-98-21; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This aviator heat stress study used a between test subjects design with one environmental condition (hot) and two current (U.S. Navy/U.S. Marine Corps vs. U.S. Army) rotary wing MOPP4 ensembles encumbered with additional ballistic protective and overwater survival components. Four U.S. Marine Corps (USMC) aviators (2 UH-60 crews) were tested in the hot condition and their physiological, subjective, and flight performance responses compared to those of 14 Army aviators (9 crews) who tested in the same condition in a previous related study. The environmental condition consisted of 100 F (dry bulb) and 20 percent relative humidity (RH) in an environmental chamber where test subjects walked on a treadmill for 20 minutes to simulate preflight outdoor activities, and 100 F and 50 percent RH (90 F wet bulb globe temperature WBGT) in the UH-60 simulator. Every 30 minutes the right seat pilot encountered instrument meteorological conditions and ascended to 2000 feet to perform a 10 minute set of standard maneuvers. These maneuvers included straight and level (SL), right standard rate turn (RSRT), left climbing turn (LCT), and left descending turn (LDT). After each iteration of the set of standard maneuvers, the pilot returned to nap of the earth (NOE) and

contour flight between control points. The right seat pilot also performed up to four 1 minute hovers (HOVs) and hover turns (HOVTs) in the 2 hour sortie and three in the second 2 hour sortie.
DTIC
Aircraft Pilots; Heat Tolerance; Flight Simulators; Physiological Effects; UH-60A Helicopter

19980203165 NASA Langley Research Center, Hampton, VA USA
Differential Measurement Periodontal Structures Mapping System
Companion, John A., Inventor, NASA Langley Research Center, USA; May 26, 1998; 15p; In English
Patent Info.: Filed 9 Sep. 1996; NASA-Case-LAR-15282-1; US-Patent-5,755,571; US-Patent-Appl-SN-712984; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

This invention relates to a periodontal structure mapping system employing a dental handpiece containing first and second acoustic sensors for locating the Cemento-Enamel Junction (CEJ) and measuring the differential depth between the CEJ and the bottom of the periodontal pocket. Measurements are taken at multiple locations on each tooth of a patient, observed, analyzed by an optical analysis subsystem, and archived by a data storage system for subsequent study and comparison with previous and subsequent measurements. Ultrasonic transducers for the first and second acoustic sensors are contained within the handpiece and in connection with a control computer. Pressurized water is provided for the depth measurement sensor and a linearly movable probe sensor serves as the sensor for the CEJ finder. The linear movement of the CEJ sensor is obtained by a control computer actuated by the prober. In an alternate embodiment, the CEJ probe is an optical fiber sensor with appropriate analysis structure provided therefor.
Official Gazette of the U.S. Patent and Trademark
Ultrasonic Wave Transducers; Depth Measurement; Dentistry; Acoustics; Surface Acoustic Wave Devices; Signal Detectors

19980203190 Georgetown Univ., Washington, DC USA
Akamai Network for Diagnosis, Treatment and Management to Support Telepresence ***Annual Report, 31 Aug. 1996 - 30 Aug 1997***
Mun, Seong K., Georgetown Univ., USA; Oct. 1997; 335p; In English
Contract(s)/Grant(s): DAMD17-94-V-4015
Report No.(s): AD-A341638; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Akamai Project corresponds with the Joint Science and Technology Plan (JSTP) for Telemedicine, published by the Director, Defense Research and Engineering. A telemedicine needs assessment protocol has been developed to support future programs. Telemedicine capabilities are applied to urgent care, hemodialysis, pathology, radiology, surgery and nuclear medicine. A telemedicine evaluation protocol has been fully implemented. Telemedicine is more than patient care and technology; the potential social impact and questions of data security and patient confidentiality have been assessed. The latter have been studied extensively and a new testing environment is underway. Technologies under development include a multimedia database and a virtual reality application for spine surgery, biopsy and breast palpation. These advanced concepts will play significant roles in telemedicine corresponding to the JSTP statement. As an educational program, teens from DC were trained to develop a home page to educate other teens about the risk of sexually transmitted diseases. Significant progress has been made in segmentation, particularly in developing better edge detection capability, which is fundamental to the success of various imaging projects. * Advances in chest imaging, especially in image processing, will further improve the quality of images in the telemedicine environment. We are working on telemedicine support for chronically ill patients with diabetes, hypertension and/or kidney disease. Much of this work will be done in collaboration with the USAMRMC and Walter Reed Army Medical Center.
DTIC
Medical Services; Telemedicine; Image Processing; Clinical Medicine; Television Systems; Diagnosis; Imaging Techniques; Teleoperators; Networks

53
BEHAVIORAL SCIENCES

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

19980202316 Naval Health Research Center, Health Sciences and epidemiology Dept., San Diego, CA USA
The Mental Status of Women in the Navy and Marine Corps: Preliminary Findings from the 1995 Perceptions of Wellness and Readiness Assessment ***Final Report, 1995-1996***
Hourani, L. L., Naval Health Research Center, USA; Yuan, H., Naval Health Research Center, USA; Graham, W., Naval Health

Research Center, USA; Powers, L., Naval Health Research Center, USA; Simon–Arndt, C., Naval Health Research Center, USA; Appleton, B., Naval Health Research Center, USA; Dec. 1997; 48p; In English
Contract(s)/Grant(s): MIPR-94-KSSM5527
Report No.(s): AD-A339334; NHRC-97-40; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Patterned after the large national health surveys, the 1995 Perceptions of Wellness and Readiness Assessment was designed to provide baseline health and risk factor information on the health and mental health status of women in the US Navy and Marine Corps. A population-based, two-stage, cluster sample of nearly 10,000 active-duty Navy and Marine Corps women and men were screened for above-normal levels of psychosocial distress and depressive symptomatology using standard cut-points on two psychiatric screening instruments. A clinically based, structured computerized telephone interview was administered to sub samples of both positive-and negative-screening volunteers to make Diagnostic Statistical Manual-III-R psychiatric diagnoses.
DTIC
Females; Navy; Mental Health; Psychological Factors

19980202654 Smith-Kettlewell Inst. of Visual Sciences, Eye Research, San Francisco, CA USA
Visual Processing of Object Velocity and Acceleration ***Final Report, 1 Apr. 1995 - 31 Dec. 1997***
McKee, Suzanne P., Smith-Kettlewell Inst. of Visual Sciences, USA; Mar. 27, 1998; 13p; In English
Contract(s)/Grant(s): F49620-95-1-0265; AF Proj. 2313
Report No.(s): AD-A341070; AFRL-SR-BL-TR-98-0299; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research analyzed human detection of object motion in random motion noise. Results from experiments demonstrated that: (1) a flexible neural network enhances detection of a feature moving in a constant direction or changing direction slowly; (2) the network uses a highly non-linear facilitation, rather than the linear sum of contrast or luminance signals; (3) a stimulus pattern that moves along the motion path is more detectable than one oriented orthogonal to it; (4) stereopsis does not provide much benefit for detecting motion signals in noise; (5) motion along the z-axis (motion in depth) can be masked by static disparity noise; and (6) the motion system can simultaneously encode both the local directions of small features and the global direction of the flow field. A Bayesian model of object motion and surface segmentation is being developed to explain these observations. Future work will explore whether this model of human motion processing can be implemented computationally in VLSI hardware for detecting moving projectiles in the midst of noise.
DTIC
Visual Perception; Visual Signals; Velocity; Acceleration; Detection; Random Noise; Trajectories

19980202744 Institute for Human Factors TNO, Soesterberg, Netherlands
The Influence of Expectation on the Perception of Linear Horizontal Motion ***Interim Report De Invloed van Verwachting op de Waarneming van Lineaire Horizontale Beweging***
Mesland, B. S., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Groen, E. L., Institute for Human Factors TNO, Netherlands; Mar. 23, 1998; 23p; In English
Contract(s)/Grant(s): A92/KLu/331; Proj. 789.3
Report No.(s): TD98-0016; TM-98-A010; Copyright; Avail: Issuing Activity (TNO Human Factors Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

In normal situations the judgment of linear horizontal self-motion largely depends on visual information. In the absence of adequate visual feedback, however, the information provided the otolith organs and non-vestibular proprioceptors (together called linear proprioceptiva sensors) becomes more important. The peculiar thing about these sensors is that they respond to linear accelerations, which may arise from transiatory motion as well as from the gravitational acceleration. As a consequence it is difficult for these sensors to differentiate between linear translations and tilt with respect to gravity. This ambiguity may lead to the false perception of tilt during pure linear accelerations along a horizontal path. Still, it was our experience that these illusory perceptions only seldomly occur when we oscillate subjects to and fro on a linear track (the ESA-sled). It was hypothesized that prior knowledge of subjects, who had seen the linear motion device before the experiment, may have biased the perception towards a veridical sensation of linear self-motion as opposed to an illusory sensation of self-tilt. In other words, their expectation may have influenced their perception of the stimulus. Therefore, two experiments were carried out in which this cognitive factor was controlled as an independent variable. In the first experiment, blindfolded subjects who were completely naive regarding the characteristics of the motion device were exposed to oscillatory linear motion at frequencies of 0.159 and 0.252 Hz. In the second experiment similar linear motion was applied, but this time in combination with various angles of actual tilt of the subject's seat. The subjects in this experiment were informed beforehand that they would be exposed to various combinations of linear motion and tilt, so that they-although not completely naive-could not have any expectation about whether to perceive tilt or translation.

In both experiments the dependent variable was the report about experienced self-motion or self-tilt. The results of both experiments unambiguously confirm that illusory self-tilt is sensed much more frequently when the subject has no precise expectation about the linear motion. Expressed in another way, the expectation of subjects who have seen the sled beforehand seems to enhance the threshold for perceiving self-tilt. It is concluded that expectation from prior knowledge and previous experience should be taken into account when modelling the perception of self-motion. The experiments described in this report clearly demonstrate that the expectation, or mental state, of a subject has significant bearing on the judgment of linear horizontal self-motion. Clearly, the interpretation of sensory information about self-motion depends on more than the transfer characteristics of the peripheral senses alone. As a consequence, one has to take cognitive factors, such as prior knowledge or previous experience, into account when investigating or modelling the perception of self-motion. From this point of view it will be difficult to exactly predict or reconstruct the sensations of an aviator on the basis of the physical characteristics of a flight path. Seen from the positive side, the expectation of an experienced pilot is likely to be advantageous for the appreciation of simulated motion in a flight simulator.
Author
Motion Simulators; Horizontal Orientation; Cognition; Expectation; Flight Simulators; Visual Perception

19980202907 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Effect of Stereoscopic and Wide Field of View Conditions on Teleoperator Performance ***Final Report***
Scribner, David R., Army Research Lab., USA; Gombash, James W., Army Research Lab., USA; Mar. 1998; 40p; In English
Contract(s)/Grant(s): Proj-1L162716AH70
Report No.(s): AD-A341218; ARL-TR-1598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study was performed to examine the effects of stereovision and wide Field of View (FOV) and their possible interaction with teleoperator performance. The study used a 2 x 2 (narrow versus wide FOV and mono versus stereo vision) randomized between-subjects design. There were 24 subjects in all, 6 per cell, in conditions of monoscopic-narrow FOV, monoscopic-wide FOV, stereoscopic- narrow FOV, and stereoscopic-wide FOV. No significant interaction effects were found for time or error rate measures. However, ANalyses Of VAriance (ANOVAs) yielded significant differences between mono and stereo vision for error rate (number of obstacles contacted) as well as reported motion sickness symptoms on the FOV dimension. Self-reported stress levels from pre- to post-run also yielded significant differences on the mono-stereo dimension. Chi-square analyses were performed on questionnaire data for condition preferences. A first chi-square analysis revealed significant findings of first choice of viewing condition, which was stereoscopic-wide FOV. Additionally, a second chi-square analysis of unique viewing conditions showed a significant effect of stereovision; it was the single most preferred viewing condition of all four.
DTIC
Teleoperators; Field of View; Stereoscopic Vision; Display Devices

19980203133 Metrica, Inc., San Antonio, TX USA
Evaluating the Decision Making Skills of General Aviation Pilots
Driskill, Walter E., Metrica, Inc., USA; Weissmuller, Johnny J., Metrica, Inc., USA; Quebe, John C., Metrica, Inc., USA; Hand, Darryl K., Metrica, Inc., USA; Feb. 1998; 43p; In English
Report No.(s): AD-A341118; DOT/FAA/AM-98/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An instrument consisting of 51 items was developed to assess pilot decision-making skill. Each item consisted of a stem, a short description of an aviation scenario requiring a decision on the part of the pilot. Four alternatives were provided, and subjects were instructed to rank order the alternatives from best to worst solution to the scenario presented. Rank-ordered judgments of a sample of 246 general aviation (GA) pilots (with an average of about 500 hours of total flying experience) were compared with the recommended solutions provided by an expert panel. Results indicated that, overall, GA pilots and an expert panel of pilots agreed in their judgments of the appropriate course of action in situations critical to flight safety. However, the degree of agreement of individual general aviation pilots with the recommended solutions varied widely. An index of agreement (Safety Deviation Index) was calculated that expressed the degree of agreement of individual GA pilots with the recommended solutions. Initial evaluation of this index indicates that it demonstrates adequate psychometric properties and that, as other research would suggest, it has little relationship with common demographic or flight experience measures.
DTIC
Decision Making; Aircraft Pilots; Pilot Performance

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.

19980202599 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Human Factors Evaluation of Vocoders for Air Traffic Control Environments, Phase 2, ATC Simulation
Sollenberger, Randy L., Federal Aviation Administration, USA; LaDue, James, Federal Aviation Administration, USA; Carver, Brian, Federal Aviation Administration, USA; Heinze, Annmarie, Federal Aviation Administration, USA; Dec. 1997; 48p; In English
Contract(s)/Grant(s): DTFA03-94-C-00042
Report No.(s): AD-A341106; DOT/FAA/CT-TN97/25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vocoders offer a potential solution to radio congestion by digitizing human speech and compressing the signal to achieve low bandwidth voice transmissions. A reduction in bandwidth will allow the addition of more communication channels to the system and reduce radio congestion. This air traffic control simulation study is the second phase of a research effort to compare the effectiveness of two 4.8 kbps vocoders (designated as A and B for test purposes) with the current analog radio communication system. Sixteen air traffic controllers from Level 5 Terminal Radar Approach Controls participated in the study and performed 12 one hour traffic scenarios over 3 days of testing. Scenarios consisted of medium and high traffic volumes designed to produce different levels of controller tasidoad. The communications configuration allowed each simulation pilot to transmit with jet, propeller, or helicopter background noises. The results indicated that the vocoders did not affect controller workload or performance. In general, intelligibility and acceptability ratings were highest for analog radio, slightly lower for vocoder B, and lowest for vocoder A. In addition, intelligibility and acceptability ratings were highest for jet background noise, slightly lower for propeller background noise, and lowest for helicopter background noise. Controller taskload had no effect on intelligibility and acceptability. This human factors evaluation indicated that both vocoders were highly intelligible and acceptable for air traffic control environments. Even the least preferred vocoder did not substantially interfere with controller performance. This study suggests that vocoder technology could replace the current analog radio system in the future.
DTIC
Environments; Human Factors Engineering; Vocoders; Air Traffic Control; Air Traffic Controllers (Personnel); Control Simulation; Radio Communication; Jet Aircraft Noise; Voice Communication

19980202667 Institute for Human Factors TNO, Soesterberg, Netherlands
Effects of Head-Slaved and Peripheral Displays on Lane-Keeping Performance and Spatial Orientation ***Interim Report Effecten van hoofd-gestuurde en perifere displays op stuurprestatie en ruimte-liijke orientatie***
Kappe, B., Institute for Human Factors TNO, Netherlands; Korteling, J. E., Institute for Human Factors TNO, Netherlands; van-Erp, J. B. F., Institute for Human Factors TNO, Netherlands; Nov. 24, 1997; 29p; In English
Contract(s)/Grant(s): A95/KL/306
Report No.(s): TNO-TM-97-A-72; TD-97-057; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

The images presented in low-cost vehicle simulators and in operator interfaces of Remotely Piloted Vehicles (RPVS) often do not provide enough information for optimal vehicle control and do not elicit sufficient spatial orientation. to improve the effectiveness of these images, the virtual viewing direction can be 'head-slaved', or the display can be surrounded with a less detailed peripheral image. Three simulator experiments were used to evaluate the effect of these techniques on steering performance and spatial orientation. In Experiment 1, vehicle references or a head-slaved display provided feedback on the virtual viewing direction. Vehicle references brought about some improvement in lane-keeping performance when a standard 500 x 500 (h x v) display was used. A head-slaved display (501 x 501) allowed better steering performance, but not up to the levels obtained with a traditional three-channel display (1501 x 501). Experiments 2 and 3 addressed the effects of surrounding the head-slaved display with a less detailed peripheral image, and of moving the head-slaved display discretely or continuously. With the peripheral image (surrounding a head-slaved display), lane-keeping performance (Experiment 2) and spatial orientation (Experiment 3) were just as good as they were with a traditional three-channel display. Performance with the discretely moving head-slaved display was superior to the performance with the more sophisticated continuously moving display. The results show that low-cost simulators and RPV operator interfaces can be equipped with an efficient low-cost display that is just as effective as a normal multi-channel display.
Author
Remotely Piloted Vehicles; Optimal Control; Low Cost; Display Devices; Attitude (Inclination)

19980202892 Defence and Civil Inst. of Environmental Medicine, North York, Ontario Canada

Layered Protocol Analysis of a Control Display Unit

Farrell, Philip S. E., Defence and Civil Inst. of Environmental Medicine, Canada; Semprie, Marc A. H., Defence and Civil Inst. of Environmental Medicine, Canada; Dec. 1997; 79p; In English

Report No.(s): AD-A341702; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Layered Protocol Theory (LPT) has been described as a special case of Perceptual Control Theory (PCT) where its core tenet is, All communication is the control of belief. It was recognized that LPT could be used to analyse the interaction between communicating partners in the context of human-machine systems. System interface problems were identified for the Control Display Unit (CDU) in the CH-146 Griffon helicopter. This application presented a good opportunity to conduct a Layered Protocol analysis on the pilot CDU system. Aspects of LPT were discussed in detail including the LPTool, its Network View, GPG View, and Nine Element View. A pilot CDU interaction was modeled with the aid of the LPTool program. The analysis yielded a list of interaction deficiencies between pilot and CDU which supported previous observations. The deficiencies were addressed in a new interface design that would provide the necessary controls and displays so that the required messages could be successfully transmitted and interpreted.

DTIC

Man Machine Systems; Control Equipment; Control Theory; Protocol (Computers); Control Units (Computers); Display Devices; Human Factors Engineering

19980203086 NASA Ames Research Center, Moffett Field, CA USA

Suitlock Docking Mechanism

Culbertson, Philip, Jr., Inventor, NASA Ames Research Center, USA; Dec. 16, 1997; 21p; In English

Patent Info.: Filed 30 Sep. 1996; NASA-Case-ARC-14102-1-LE; US-Patent-5,697,108; US-Patent-Appl-SN-730917; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An environmental protective suit used for hazardous clean-up or space applications includes a suitlock docking mechanism that allows for easy egress and ingress of a crew member between a sealed vessel and a possibly contaminated environment. The suitlock docking mechanism comprises a single actuator that controls latches which, in turn, respectfully control rack and pinion assemblies that allow for easy removal and attachment of a life support equipment enclosure shell to the environmental protective suit or to the vehicle from which the operator performs his/her duties.

Official Gazette of the U.S. Patent and Trademark

Protective Clothing; Mechanical Devices; Locking; Egress; Air Locks

19980203092 Auburn Univ., AL USA

Prospector IX: Human Powered Systems Technologies ***Final Report, 1 Jul. 1997- 30 Jun. 1998***

Rose, Millard F., Auburn Univ., USA; Apr. 1998; 440p; In English; 9th, 2-5 Nov. 1997, Durham, NC, USA

Contract(s)/Grant(s): DAAG55-97-1-0336

Report No.(s): AD-A344414; ARO-37537.1-LS-CF; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

Recent advances in the technologies relevant to harvesting human power, as presented at the workshop, suggest that unobtrusive systems might be built in the range from microwatts to a few watts. As the Army becomes more mobile, a premium is to be paid for capability, reliability, autonomy and minimal mass systems. The frontline soldier, more often than not, does not have access to energy for recharging his power sources and therefore, must carry all his required power sources to complete his mission. The ability to harvest human energy, if favorable in terms of reliability, size, weight, and energy efficiency might translate immediately into increased autonomy time, increased capability, reduce or eliminate certain logistics items, and, perhaps, reduced cost. Fieldable technology rarely equals laboratory prototype or theoretical capability. Obstacles sometimes are fundamental and perhaps can be finessed through appropriate R&D, innovative techniques, and skillful engineering. This workshop attempted to explore some of the possibilities. As confirmed by the plenary speakers and the working groups, there are a number of potential applications where harvesting of human energy could be applied. Typical are: (1) Personal battery chargers, (2) Medical sensors, (3) Display power sources, (4) Gun sight power, and (5) Rangefinder.

DTIC

Energy Conversion; Human Body; Man Machine Systems; Electric Power; Production

60
COMPUTER OPERATIONS AND HARDWARE

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

19980203154 Templex Technology, Inc., Eugene, OR USA
Optical Random Access Memory ***Final Report, 1 Jul - 31 Dec. 1997***
Johnson, Alan E., Templex Technology, Inc., USA; Maniloff, Eric S., Templex Technology, Inc., USA; Mossberg, Thomas W., Templex Technology, Inc., USA; Dec. 1997; 14p; In English
Contract(s)/Grant(s): F49620-97-C-0036; AF Proj. 1660
Report No.(s): AD-A341423; AFRL-SR-BL-TR-98-0303; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The advantage of ODRAM relative to existing memory technologies is speed and capacity for a competitive price. The unit cost in early production will be in the range of $20,OOO-25,OOO for 100 Gigabytes of capacity. The nonmechancial access of ODRAM will enable much higher data throughput rates and much faster access to small records in large databases. ODRAM offers three orders of magnitude improvement in data access rates relative to mechanically-accessed memory technologies.
DTIC
Optical Memory (Data Storage); Random Access Memory; Costs

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19980201925 Arizona Univ., Dept. of Electrical and Computer Engineering, Tucson, AZ USA
High Performance Optimization and Abstraction of Large Simulation Models ***Final Report, Sep. 1995 - Dec. 1996***
Zeigler, Bernard P., Arizona Univ., USA; Moon, Yoonkeon, Arizona Univ., USA; Oct. 1997; 127p; In English
Contract(s)/Grant(s): F30602-95-C-0250; AF Proj. 4594
Report No.(s): AD-A339058; RL-TR-97-146; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Modeling large scale systems with natural and artificial components requires storage of voluminous amounts of knowledge/information as well as computing speed for simulations to provide reliable answers in reasonable time. Computing technology is becoming powerful enough to support such high performance modeling and simulation. This report proposes a high performance simulation based optimization environment to support the design and modeling of large scale systems with high levels of resolution, and represents the results of contract F3O602-95-C-O25O, ”Methodology for Simulation Model Abstraction.”
DTIC
Computerized Simulation; Optimization; Models; Memory (Computers)

19980202032 Space Telescope Science Inst., Baltimore, MD USA
The STIS calibration pipeline
Hulbert, S. J., Space Telescope Science Inst., USA; Hodge, P. E., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 47-51; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Space Telescope Imaging Spectrograph (STIS) calibration pipeline is a complex collection of software tasks and processes managed by many groups at STScI. The current pipeline for STIS differs in several significant ways from previous pipelines at STScI including data structures and software implementation. CALSTIS can be run both under the IRAF environment and completely outside of Interactive Data Reduction and Analysis Facility (IRAF) as the user chooses. The STIS pipeline is up and running with all of the basic capabilities for processing STIS data.
Author
Pipelines; Calibrating; Applications Programs (Computers); Data Processing; Hubble Space Telescope

19980202034 NASA Goddard Space Flight Center, Greenbelt, MD USA
STIS capabilities: Current and future implementation
Woodgate, Bruce E., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 60-64; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Capabilities of STIS currently supported and those going beyond the subset available at the start of Cycle 7 are described. The latter are candidates for later implementation.
Author
Hubble Space Telescope; Calibrating; Faint Objects; Compact Galaxies; Photons; Cycles; Stellar Spectrophotometry

19980202035 Advanced Computer Concepts, Inc., Potomac, MD USA
STIS CCD hot pixel annealing
Beck, T., Advanced Computer Concepts, Inc., USA; Landsman, W., Hughes STX, Inc., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 65-69; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

In an effort to reduce the number of ”hot” pixels in the CCD array, an annealing process was used that allowed the CCD to warm up to about O C for approximately 12 hours. The effectiveness of the procedure was tested by measuring the dark current behavior before and after annealing.
Author
Hubble Space Telescope; Charge Coupled Devices; Pixels; Arrays; Annealing; Heating; Ratios

19980202061 Space Telescope Science Inst., Baltimore, MD USA
NICMOS data processing software in STSDAS
Busko, Ivo C., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 245-249; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Until now the standard form of accessing observational data from the Hubble Space Telescope was through Generic Environmental Impact Statement (GEIS) or Servicing Test Facility (STF) files. The GEIS format was designed to allow storage of multiple ”images” in a single file. The files, however, must store the same kind of information, e.g. science pixels, data quality flags, etc. If a given instrument generates, e.g., both science and data quality arrays, they must be stored in separate files. The new HST instruments Space Telescope Imaging Spectrograph (STIS) and Near Infrared Camera and Multi-Object Spectrometer (NICMOS) generate several ”pixel” arrays from each exposure. Besides the usual science and data quality arrays, there is an error array, and NICMOS includes additional exposure time and number of samples arrays. It would be impractical to store all this associated information in separate files. In order to keep all information pertaining to a single exposure packed together in a single file, the standard data format adopted for STIS and NICMOS data files is FITS with multiple extensions. Each associated ”chunk” of information is named an IMSET, and a single file can store multiple IMSETs, each one identified by a number stored in the EXTVER keyword in each FITS extension header. The existing Interactive Data Reduction and Analysis Facility (IRAF) and STSDAS tasks can operate upon individual FITS extensions as individual images with no problems, but in this way it becomes extremely cumbersome to properly propagate the error, data quality and other information from the input IMSETs into the result. Thus the need for brand-new tasks that could perform basic image processing and at the same time automatically propagate the associated information. This paper describes the mstools package, the NICMOS package, Basic image processing, and image statistics.
Author
Cameras; Near Infrared Radiation; Data Processing; Hubble Space Telescope; Image Processing; Imaging Techniques; Applications Programs (Computers)

19980202071 Arizona Univ., Steward Observatory, Tucson, AZ USA
Software tools for NICMOS
Stobie, E., Arizona Univ., USA; Lytle, D., Arizona Univ., USA; Ferro, A., Arizona Univ., USA; Barg, I., Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 297-302; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) Software Group (NSG) at the University of Arizona has built a number of software tools in IDL for processing NICMOS data.
Author
Data Processing; Computer Systems Programs; Image Processing; Applications Programs (Computers); Editing Routines (Computers)

19980202100 Space Telescope Science Inst., Baltimore, MD USA
New calibration systems projects at STScI
Lubow, Stephen, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 513-517; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Space Telescope Science Institute (STScI) has continued the development of systems for Hubble Space Telescope (HST) data calibration. The calibration database system (CDBS) tracks information about all HST calibration files. CDBS has been rebuilt to be more automated and provide some additional capabilities for users. We have also begun investigating the requirements for an on-the-fly calibration system. This system would allow users to retrieve data that are automatically calibrated at STScI with the most recently recommended calibration files and software.
Author
Calibrating; Hubble Space Telescope; Data Bases; Data Management; Data Base Management Systems; Data Processing

19980202101 Space Telescope Science Inst., Baltimore, MD USA
A package for the reduction of dithered undersampled images
Fruchter, A. S., Space Telescope Science Inst., USA; Hook, R. N., European Southern Observatory, Germany; Busko, I. C., Space Telescope Science Inst., USA; Mutchler, M., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 518-528; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present a set of tasks developed to process dithered undersampled images. These procedures allow one to easily determine the offsets between images and then combine the images using Variable-Pixel Linear Reconstruction, otherwise know as ”drizzle”. This algorithm, originally developed for the combination of the images in the Hubble Deep Field preserves photometry and resolution, can weight input images according to the statistical significance of each pixel, and removes the effects of geometric distortion both on image shape and photometry. In this paper, the method and its implementation are described, and measurements of the photometric accuracy and image fidelity are presented. In addition, we describe ancillary tasks developed for determining offsets between images, and discuss the use of drizzling to combine dithered images in the presence of cosmic rays.
Author
Accuracy; Distortion; Data Reduction; Photometry; Image Processing; Pixels; Image Reconstruction; Cross Correlation

19980202235 Advisory Group for Aerospace Research and Development, Structures and Materials Panel, Neuilly-Sur-Seine, France
Virtual Manufacturing *La Fabrication Virtuelle*
Virtual Manufacturing; May 1998; 154p; In English; In French; 85th; AGARD Structures and Materials Panel, 13-14 Oct. 1997, Aalborg, Denmark; Also announced as 19980202236 through 19980202248; Original contains color illustrations
Report No.(s): AGARD-R-821; ISBN-92-836-0053-3; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

Virtual Manufacturing (VM)is an integrated, synthetic manufacturing environment exercised to enhance all levels of decision and control. This process uses product, process and resource models to evaluate the producibility and affordability of new product concepts prior to commitment to the final product design. Design processes are captured in a single geometric database and integrated with the planned manufacturing processes resulting in a simulation of the manufacturing environment. The critical questions of manufacturing cycle time, people resource requirements and physical resource requirements for various scenarios are quantified by simulation. Thus, Virtual Manufacturing is a tool to achieve more affordable aircraft designs, reduced cycle times and improved quality.
Author
Virtual Reality; Manufacturing; Computer Aided Manufacturing; Computer Aided Design; Production Planning; Concurrent Engineering

19980202236 Short Bros. Public Ltd. Co., Engineering Centre, Belfast, UK
Use of Virtual Prototyping in Design and Manufacturing
Kingsbury, Alan, Short Bros. Public Ltd. Co., UK; Virtual Manufacturing; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

In 1989, Shorts first looked at the potential of replacing physical wooden mock-ups with electronic solid model assemblies. They took existing drawings of the F100 wing and translated these into a solid mock-up. Although these early solid modellers were not user friendly, the resulting demonstrator was impressive and proved that large assemblies could be produced. This gave Shorts the confidence to embark on a small production contract - Trent Nacelle. This had 10 designers working concurrently generating structures, hydraulic and electrical systems all as solid models. Initially there was concern because the project planners who traditionally measure drawing output were getting very little drawings released during the first half of the program as the solid models and assemblies were being created. However, the drawing output increased dramatically near the end because of the fast production of assembly drawings giving a resulting overall reduction in leadtime of 20%. This result set the scene for the technolo-

gy strategy on the Lear 45 when the decision was made to solid model the complete aircraft including all structures, hydraulic and electrical systems.
Author
Manufacturing; Design Analysis; Prototypes; Concurrent Engineering; Systems Integration; Lear Jet Aircraft; Aircraft Models

19980202237 Dassault Aviation, Saint-Cloud, France
A Virtual Rafale: Completely Digital Approach for Product and Process
Rouchon, C., Dassault Aviation, France; May 1998; 6p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

To survive in strong present competition, Dassault Aviation has to ensure a constant update of its organization, management methods and information system. This permanent research has to produce a right compromise between cost, cycle and performances, both for civil and military aircraft. The Digital Mock-Up (DMU) provides support for Concurrent Engineering (CE) methodologies and contributes directly to customer satisfaction. In the first part, we will introduce the Dassault's use of CE methodologies as a systematic approach to integrated development of a product with the manufacturing processes and customer support. We will emphasize the importance of Teamwork-based decisions, co-specifications, cross-discipline cooperation, efficient communication, change management, simulations, etc. The second part will be dedicated to CAD/CAM techniques and their extension: Virtual Reality (VR). We will not mention all the activities related to flight simulators.
Author
Management Methods; Costs; Information Systems; Concurrent Engineering; Computer Aided Manufacturing; Computer Aided Design; Virtual Reality

19980202238 Daimler-Benz Aerospace A.G., Optical Measurement Methodologies, Ulm, Germany
Virtual Manufacturing: From Optical Measurement to Rapid Prototyping
Juenemann, G., Daimler-Benz Aerospace A.G., Germany; May 1998; 10p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

While a CAD model provides the starting point in conventional "engineering", the process is turned upside down in "reverse engineering", for an existing physical part is the starting point. We have developed an innovative reverse engineering tool providing an efficient link between the real world and the virtual world. Surface-like measuring technology provides "express access" to the world of computer data. Innovative triangulation procedures enable complicated CAD modelling to be circumvented, thus providing a direct transition to production.
Author
Manufacturing; Optical Measurement; Prototypes; Reverse Engineering; Virtual Reality

19980202239 Aerospatiale, Dept. DCR/IK, Suresnes, France
Aerospace Approach for Virtual Manufacturing *Approche Aerospatiale pour la Fabrication Virtuelle*
Dureigne, M., Aerospatiale, France; May 1998; 6p; In French; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The paper analyzes, in the first step, virtual manufacturing deployment within Aerospatiale with the development of information technology tools. It points out the importance of man and the diversity of solutions. This deployment is clearly linked to the main characteristics of Aerospatiale: high technology, human potential stable, skilled and open to innovation, all products developed in a multi-language and cultural partnership. In the second step, the deployment is analyzed through a system methodology to derive the main drivers of the deployment. In the last step, the paper presents the research work preparing the next state of deployment. This state will put emphasis on refined product models, distributed virtual manufacturing and semantic based language to improve both people and machine data processing. But as usual, the next state will heavily rely on the ability of research work to lead to easy appropriation of new technologies by people and organizations.
Author
Manufacturing; Information Systems; Data Processing; Technologies; Virtual Reality; Architecture (Computers); Deployment; Computer Aided Design

19980202240 Wright Lab., Simulation Assessment Validation Environment Program, Wright-Patterson AFB, OH USA
Simulation Assessment Validation Environment (SAVE) Reducing Cost and Risk Through Virtual Manufacturing
Poindexter, James W., Wright Lab., USA; Cole, Paul E., Lockheed Aeronautical Systems Co., USA; May 1998; 10p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The 1994 Lean Aircraft Initiative industry forum, identified the application of Virtual Manufacturing (VM), in the form of integrated simulation technologies, as a key technology in reducing cost and increasing quality. The Joint Strike Fighter Program initiated the Simulation Assessment Validation Environment (SAVE) Program to integrate a set of VM tools and to validate the potential savings through a series of demonstrations. This paper describes the SAVE program and its potential for a $3 Billion (US) savings on the Joint Strike Fighter program.
Author
Virtual Reality; Manufacturing; Cost Reduction; Aircraft Industry; Systems Integration; Functional Design Specifications

19980202241 British Aerospace Airbus Ltd., Electronic Product Definition Project, Bristol, UK
Implementation of Airbus Concurrent Engineering
Landeg, Bob, British Aerospace Airbus Ltd., UK; Ash, Steve, British Aerospace Airbus Ltd., UK; May 1998; 10p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

In the 27 years since it was founded, Airbus Industrie has developed a portfolio of aircraft in the above 100 seat range which has captured over 35% of the global market. This has been achieved despite the the fact that, up to 1995, the Airbus partners used a variety of software systems. However, at the end of 1995, the four Airbus partners signed an historic contract, committing the partnership to buying at least 1500 seats of common CAD/CAM/CAE and enterprise data management software from a common supplier - Computervision. Airbus realized that its aggressive competitive goals could only be reached if all partners adopt common ways of working across Europe. to drive this change, it launched an Airbus Concurrent Engineering (ACE) project in 1996 to enable it to revolutionize the way it designs, builds and supports aircraft . This paper will describe the work in British Aerospace to produce a radical vision of world class people, processes, systems, teamworking and performance. It will illustrate how this vision was developed and shared by the Airbus partnership, resulting in a strategic plan to provide a revolutionary change in performance, enabling Airbus Industrie to proceed towards its goal of being a leading aircraft manufacturer in the world. It will show that ACE is ”not just another IT programme” but a change programme delivering hardware, software, networks, processes, tools, methodologies, organization, training and support in a contract with Airbus aircraft programmes called a ”version”. The pivotal role that the ACE project plays was reinforced by the Airbus partners signing a memorandum of understanding with the intention to establish a single Airbus company by 1999.
Author
Concurrent Engineering; European Airbus; Computer Aided Design; Computer Aided Manufacturing; Project Management; Project Planning

19980202242 Boeing Co., Information, Space and Defense Systems, Seattle, WA USA
Virtual Manufacturing Technology Implementation at Boeing
Renton, W. J., Boeing Co., USA; Rudnick, F. C., Boeing Co., USA; Brown, R. G., Deneb Robotics, Inc., USA; May 1998; 8p; In English; Also announced as 19980202235; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Virtual Manufacturing is an integrated set of tools and technologies which provide a highly accurate near real time 3D simulation environment to evaluate: new or exiting methods and processes; tool and fixture design/assembly sequences; facility layouts and material flow; ergonomic/human factors; and alternate production scenarios involving one or more products. Boeing is expanding its usage of these tools and technologies, as utilization in selected applications has demonstrated dramatic improvements in reducing cycle time and cost, while improving productivity and product quality. This paper will discuss our application of and experience with Virtual Manufacturing for an ever expanding breadth of applications. These include; simulating kinematic devices for Space Station; robotic painting; visualization of airplane assembly processes; and simulation of man/machine interactions, numerically controlled (N.C.) machining cells and composite fabrication processes. With the successes experienced to date, the authors will look into the next millennium, projecting further advancements in technology and its’ projected usage in the aerospace industry.
Author
Virtual Reality; Manufacturing; Computerized Simulation; Human Factors Engineering; Fabrication; Cost Reduction; Technology Utilization

19980202243 Daimler-Benz Aerospace A.G., Munich, Germany
Virtual Manufacturing for Composites
Berchtold, G., Daimler-Benz Aerospace A.G., Germany; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The geometry based aircraft design to manufacturing process is described, highlighting the extensive use of simulation activities along its phases to verify the geometry. It is shown that the manufacturing simulation has an exceptional role in minimizing or even avoiding global iteration loops. In addition, some wording is defined in the world of virtual manufacturing to be able to position the different software developments. Based on this information two examples are shown - the composite stiffener technology and the composite skin technology - both based on prepreg tape targeting for high performance aircraft structures. Due to the full usage of all necessary material-, manufacturing-, and machine data right from the beginning of the design it is demonstrated that a fully automatic NC-code generation can be achieved at the end of the engineer's design process producing verified manufacturable data without any additional human interaction based on the designed geometry. By means of this, time consuming iteration loops coming back from the manufacturing phases and creating local iteration loops to the structural analysis are avoided. Real examples of this "virtual manufacturing" process are indicating 10 to 50 times faster processes compared to existing methods. Finally, for both manufacturing technologies the integration with the corresponding optimization code is explained, outlining the important issues in this field.
Author
Structural Analysis; Aircraft Design; Aircraft Structures; Prepregs; Manufacturing; Virtual Reality; Computerized Simulation; Composite Materials; Optimization

19980202244 Katholieke Univ. te Leuven, Dept. of Mechanical Engineering, Belgium
An Object-Oriented Taxonomy for Part and Process Design
VanZeir, G., Katholieke Univ. te Leuven, Belgium; Kruth, J.–P., Katholieke Univ. te Leuven, Belgium; May 1998; 12p; In English; Also announced as 19980202235; Sponsored in part by GOA and IUAP
Contract(s)/Grant(s): ESPRIT Proj. 6805; GOA Proj. 95-2; IUAP Proj. 50; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper describes an object-oriented data/knowledge model for interactive part and process design. This model is employed in a Computer Aided Process Planning (CAPP) kernel. Objects are used to represent the process planning information. Each data-object has attributes, a set of methods, a constructor, etc. The information contained in such objects can be supplied either by a software expert module or by the human expert, through an interface that is provided for each type of object. Consulted expert modules will take into account the information that was added by the human expert (or by earlier consulted expert modules). Moreover, the interface to human expert allows him/her to verify, accept or alter the information generated by an expert module, at any time. Objects with partial information (empty attributes, attributes that describe intervals or constraints or multiple discrete values, etc.) will be called virtual objects, while objects that are unambiguously determined by the information contained in their attributes will be called physical objects. The paper elaborates on the distinct knowledge sources and their relation with the data model. It explains, for each knowledge source, its representation and its instantiation. Further, the aspect virtual versus physical object is handled; i.e. how virtual objects evolve towards physical objects by providing them with necessary information.
Author
Object-Oriented Programming; Taxonomy; Design Analysis; Prototypes; Computer Aided Design; Virtual Reality; Production Planning

19980202245 Wright Lab., Manufacturing Directorate, Wright-Patterson AFB, OH USA
Joint Strike Fighter Manufacturing Demonstration (JMD): Integrating Design and Cost for an Affordable Weapon System
Herner, Alan E., Wright Lab., USA; Rowland, Jerold K., Hughes Aircraft Co., USA; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

In 1995, the Joint Strike Fighter (JSF) program office, through the USAF Wright Laboratory's Manufacturing Directorate, contracted with Hughes Aircraft Company to define and demonstrate a development methodology that incorporates lean practices and tools and integrates design and cost information. This methodology will be refined, demonstrated and shared with the JSF contractor community. The JMD program is a 40-month effort in two phases. The first phase developed the initial JMD lean methodology and demonstrated its application to a Transmit/ Receive microwave electronic modules used in active array radars. The second phase will refine the methodology and demonstrate it on a more complex subarray assembly. This paper describes the JMD program and presents its progress to date.
Author
Manufacturing; Design to Cost; Technology Transfer; Product Development; Weapon Systems; Electronic Modules

19980202246 Greenwich Univ., Centre for Numerical Modelling and Process Analysis, London, UK

Multi-Physics Modelling: A Vital Component of Virtual Manufacturing

Cross, M., Greenwich Univ., UK; Bailey, C., Greenwich Univ., UK; Pericleous, K., Greenwich Univ., UK; McManus, K., Greenwich Univ., UK; Bounds, S., Greenwich Univ., UK; Moran, G., Greenwich Univ., UK; Taylor, G., Greenwich Univ., UK; Wheeler, D., Greenwich Univ., UK; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

One of the core tasks of the virtual-manufacturing environment is to characterize the transformation of the state of material during each of the unit processes. This transformation in shape, material properties, etc. can only be reliably achieved through the use of models in a simulation context. Unfortunately, many manufacturing processes involve the material being treated in both the liquid and solid state, the transformation of which may be achieved by heat transfer and/or electromagnetic fields. The computational modeling of such processes, involving the interactions amongst various interacting phenomena, is a considerable challenge. However, it must be addressed effectively if Virtual Manufacturing Environments are to become a reality. This contribution focuses upon one attempt to develop such a multi-physics computational toolkit. The approach uses a single discretization procedure and provides for direct interaction amongst the component phenomena. The need to exploit parallel high performance hardware is addressed so that simulation elapsed times can be brought within the realism of practicality. Examples of multiphysics modelling in relation to shape casting, and solder joint formation reinforce the motivation for this work.

Author

Manufacturing; Heat Transfer; Computerized Simulation; Mechanical Properties; Virtual Reality; Parallel Processing (Computers)

19980202248 Prosolvia Clarus A.B., Gothenburg, Sweden

A Radical New Way of Product Development: Exploring the Benefits with Virtual Reality in Virtual Concept

Nordlander, Sverker, Prosolvia Clarus A.B., Sweden; May 1998; 8p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

With the introduction of powerful Virtual Reality (VR) tools, changes to the product development process have started. However, the potential of these tools are today not fully explored since the changes to the process still is very limited. The technique behind VR and the possibilities that it offers is very promising. Due to increasing performance of computers, at a reasonable low price, it is now possible to implement and use VR for several new tasks that earlier were restricted due to the complexity of the system and cost of the solution. Using it in new areas also put additional requirements on the solutions such as the need for simpler user interfaces. In this paper, a new way of using VR technology in product development is described together with some of the benefits it gives. Some of the requirements on the environment is also discussed and a new phrase ”Virtual Concept” is introduced as well as a short description on the thoughts behind the model.

Author

Product Development; Virtual Reality; Computer Aided Manufacturing; Computer Aided Design; Models

19980202460 Missouri Univ., Dept. of Statistics, Columbia, MO USA

Inference and Modeling for Repairable Systems and Software ***Progress Report, 15 Jun. 1995 - 14 Sep. 1997***

Basu, Asit P., Missouri Univ., USA; Apr. 22, 1998; 5p; In English

Contract(s)/Grant(s): F49620-94-1-0355

Report No.(s): AD-A342765; TR-3; AFRL-SR-BL-TR-98-0383; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Three graduate students have been supported by the grant and Tricia Jones is currently working with the Principal Investigator, Asit Basu, for her Ph.D. degree in statistics. The other two students, Mary Richardson and Larry Ries have completed their dissertations in December, 1995 and 1997. Interesting results on software reliability theory have been obtained. Comparative studies of existing methods are made. Also criteria are being developed as to when a software can be released to the users. Both Bayesian and frequentist approaches are considered.

DTIC

Software Engineering; Bayes Theorem; Computer Systems Programs; Software Reliability

19980202475 Colorado Univ., Dept. of Aerospace Engineering and Sciences, Boulder, CO USA

Fast staggered algorithms for the solution of three-dimensional nonlinear aeroelastic problems

Farhat, Charbel, Colorado Univ., USA; Lesoinne, Michel, Colorado Univ., USA; Mar. 1998; 12p; In English; Also announced as 19980202469

Contract(s)/Grant(s): F49620-97-1-0059; NAG2-827; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

We overview two sequential and parallel partitioned procedures that are popular in computational nonlinear aeroelasticity, and address their limitation in terms of accuracy and numerical stability. We propose two alternative serial and parallel staggered algorithms for the solution of coupled transient aeroelastic problems, and demonstrate their superior accuracy and computational efficiency with the flutter analysis of the AGARD Wing 445.6. We contrast our results with those computed by other investigators and validate them with experimental data.
Author
Flutter Analysis; Aeroelasticity; Numerical Stability; Parallel Processing (Computers); Staggering; Parsing Algorithms; Three Dimensional Models; Mathematical Models; Conservation Laws; Nonlinearity

19980202550 National Lab. for High Energy Physics, Radiation Safety Control Center, Tsukuba, Japan
Proceedings of the Sixth EGS4 Users' Meeting in Japan
Hirayama, Hideo, Editor, National Lab. for High Energy Physics, Japan; Namito, Yoshihito, Editor, National Lab. for High Energy Physics, Japan; Ban, Syuichi, Editor, National Lab. for High Energy Physics, Japan; Nov. 1996; 131p; In English; 6th; EGS4 Users Meeting, 29-31 Jul. 1996, Tsukuba, Japan; Also announced as 19980202551 through 19980202565
Report No.(s): KEK-Proceedings-96-10; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Topics considered in the proceedings include: (1) Implementation of the Electron Impact Ionization into the EGS4 Code; (2) Implementation of an L-shell Photoelectron and an L X-ray for Elements into the EGS4 Code; (3) Calculation using MCNP Code for Bremsstrahlung Photons Emitted from Radioisotope Battery; (4) On the Behaviour of Secondary Electrons from Materials of Various Atomic Numbers; (5) Characterization of N-13 and O-15 Induced in Air of a High Energy Electron Accelerator Room; (6) Analysis of 4(pi)(gamma) Ionization Chamber Response using EGS4 Monte Carlo Code; (7) Response Function of a Ge Detector to Compton Backscattered Photons Calculated by EGS4/PRESTA Code; (8) Application of EGS4 Monte Carlo Code to Design of Compton Suppression System; (9) Calculation of CdTe Semiconductor Detector Response; (10) Calculations of Wall Effect in Proportional Counter for Absolute Radioactivity Measurements of Gaseous Radioisotopes; (11) Estimation of S/N Ratios for Double Beta Decay Experiments with DCBA; (12) Simulation Study of X-ray Polarity using the Photo Effect in the Micro-Strip Gas Chamber; (13) Design Study of the Collimator System for the Neutral Beam Line; (14) Calculation of Dose for Skyshine Radiation from a 45 MeV Electron Linac; and (15) Conceptual Design of Beam Dump for High Power Electron Beam.
CASI
Conferences; Atomic Structure; Electron Accelerators; High Energy Electrons; Ionization; Linear Accelerators; Monte Carlo Method

19980202551 National Lab. for High Energy Physics, Tsukuba, Japan
The Implementation of the Electron Impact Ionization into the EGS4 Code
Namito, Y., National Lab. for High Energy Physics, Japan; Hirayama, H., National Lab. for High Energy Physics, Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 1-9; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

A modification to the general-purpose Monte-Carlo electron-photon transport code EGS4 was made in order to include K-shell electron-impact ionization. Gryzifiski's formula of electron-impact ionization is employed for the calculation along with a relativistic correction for the formula. The ratio of electron impact ionization cross section to the Moller scattering cross section is prepared by the PEGS4 program, and is used in the EGS4 calculation. A simulation of the photon emission from a Sn target for an incident 100 keV electron was performed using the improved EGS4 code; the calculated K-X ray and bremsstrahlung photon spectra agreed well with the measurements.
Author
Electron Impact; Ionization; Ionization Cross Sections; Computer Programs

19980202556 Seikei Univ., Faculty of Engineering, Tokyo, Japan
Analysis of 4 Pi Gamma Ionization Chamber Response Using EGS4 Monte Carlo Code
Suzuki, H., Seikei Univ., Japan; Sibaike, K., Seikei Univ., Japan; Hashimoto, H., Seikei Univ., Japan; Kawada, Y., Seikei Univ., Japan; Hino, Y., Electrotechnical Lab., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 40-46; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Pressurized 4 pi gamma ionization chambers are often used as secondary standard instruments for radioactivity measurements of gamma-ray emitting nuclides. When a detector of this kind is calibrated for the incident gamma-ray energy of more than 200 keV, the shape of the response curve as a function of the gamma-ray energy is monotonous, and it is easy to determine the response

curve by fitting experimental data obtained with only limited number of standard sources of different nuclides. However, in the lower energy region below 200 keV, the shape of the response curve is not simple and very dependent of the materials and size of the chamber wall and the filling gas. In this lower energy region, moreover, it is rather difficult to find suitable standard sources emitting only single photons per decay. Theoretical calculations based upon analytical means or Monte Carlo simulations are therefore very helpful to determine the response curve in this lower energy region. In this study, the energy response curves of three different types of pressurized 4 pi gamma ionization chambers were studied by adopting EGS4 Monte Carlo simulation code, and were compared with the experimental results. The effects of the axial and radial displacements of source position from center were also demonstrated.
Derived from text
Ionization Chambers; Monte Carlo Method; Computerized Simulation; Radioactivity; Radiation Measurement; Gamma Rays

19980202557 Electrotechnical Lab., Quantum Radiation Div., Tsukuba, Japan
Response Functions of a Ge Detector to Compton Backscattered Photons Calculated by EGS4/PRESTA Code
Kudo, K., Electrotechnical Lab., Japan; Takeda, N., Electrotechnical Lab., Japan; Fukuda, A., Electrotechnical Lab., Japan; Noguchi, T., Electrotechnical Lab., Japan; Ohgaki, H., Electrotechnical Lab., Japan; Yamazaki, T., Electrotechnical Lab., Japan; Sugita, T., Science System Lab., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 47-54; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The EGS4/PRESTA Monte Carlo code has been used to calculate response functions of a pure Ge detector to quasi-monoenergetic photons up to 10 MeV, which are produced by Compton backscattering of laser light with high energy electrons circulating in a storage ring of TERAS at the Electrotechnical Laboratory (ETL). For the precise calculation, we took into account a detailed configuration of the whole system in the EGS4 code, that is, a volume source of photons produced in a laser collision region with relativistic electrons, three lead collimators to define the energy spread of photons and a coaxial Ge detector with all physical processes necessary for accurate calculations at the electron energies from 350 MeV to 530 MeV. The calculated response functions showed relatively good agreement in shape with experimental response functions at some photon energies, however some difference tendencies were seen in energy resolution at other energies. Both the integrated responses above 1.5 MeV showed fairly good agreement with the maximum difference of 4% at all energies of photons from 3.4 MeV to 10 MeV, after fitting the calculated result to the experimental pulse height distribution.
Author
Backscattering; Compton Effect; Computation; Relativistic Particles; Photons; Electron Energy; Pulse Amplitude

19980202602 Kestrel Inst., Palo Alto, CA USA
Synthesis Approach to Parallel Software Engineering ***Final Report, Sep. 1994 - Apr. 1997***
Smith, Douglas R., Kestrel Inst., USA; Emerson, Thomas, Kestrel Inst., USA; Gilham, LiMei, Kestrel Inst., USA; Westfold, Stephen J., Kestrel Inst., USA; Feb. 1998; 50p; In English
Contract(s)/Grant(s): AF Proj-5581
Report No.(s): AD-A341071; RL-TR-97-232; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes our research on a synthesis approach to parallel Software Engineering. The main goal of this project was to develop concepts and generic tools to support the synthesis of parallel algorithms from formal specifications, and to carry out a representative sample of derivations for a variety of applications. Our technical approach is based on program transformation technology which allows the systematic machine-supported development of software from requirement specifications. The development process can produce highly efficient parallel code alone with a proof of the code's correctness. We focused on three application domains to test our concepts.
DTIC
Software Engineering; Transformations; Computer Programming; Synthesis; Algorithms; Parallel Processing (Computers)

19980202655 Naval Postgraduate School, Monterey, CA USA
Web-Centric Systems in Support of Argumentation, Negotiation, and Organizational Memory
Vickers, Randal R., Naval Postgraduate School, USA; Wright, Carl M., Naval Postgraduate School, USA; Dec. 1997; 81p; In English
Report No.(s): AD-A341066; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this thesis is to propose and demonstrate a new negotiation and argumentation medium. This medium will take advantage of the latest in web technologies while conducting a detailed analysis and design of a prototype web based decision support system to support on-line argumentation, claims, and team decisions. The information obtained from the application will be stored in an ODBC database, to be used as part of the organizational memory. Organization memory will significantly enhance

an organizations ability to utilize historical data in conjunction with current decision making requirements. The findings in this study strongly support the strengths of the action-resource based argumentation system (ARBAS) model and indicate that future research and application development would significantly advance the fields of web-based negotiation and argumentation. A web-centric prototype developed during this research can be viewed at HTTP://WWW.CIMNET.NPS.NAVY.MIL/THESIS.
DTIC
World Wide Web; On-Line Systems; Organizations; Support Systems; Memory (Computers)

19980202656 Naval Postgraduate School, Monterey, CA USA
Protocols for Secure Client-Server Applications in the Joint Maritime Command Information System
Weldon, Steven G., Naval Postgraduate School, USA; Sep. 1997; 71p; In English
Report No.(s): AD-A341065; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The new architecture for the Joint Maritime Command Information System, referred to as JMCIS'98, seeks to provide uniform access to tactical and non-tactical information. The goal is to allow access to such information using Wide Area Network technology and Personal Computers running Windows NT in a web environment. This architecture relies on web servers to deliver executable content, such as Java applets, to clients and gateway servers to route requests to the appropriate servers and/or databases. This architecture raises new security risks which must be addressed. Two of these risks are addressed in this thesis: executing downloaded code from a web server and transmitting sensitive information, such as passwords, to gateway servers. We investigate three cryptographic protocols to address these risks. The first protocol treats the risk of executing downloaded code from a web server by using digital signatures. The second protocol addresses the transmission of sensitive information to a gateway server by using certificates and symmetric key cryptography. Finally, we explore an alternative approach, that of the Secure Sockets Layer, which provides mutual authentication. We discuss how the first two protocols can be implemented in Java using the Java Developer's Kit (JDK) 1.1 and the Java Cryptography Extension (JCE) 1.1.
DTIC
Data Bases; Wide Area Networks; Protocol (Computers); Computer Information Security; Information Systems; Data Transmission; Personal Computers; Command Guidance

19980202710 Naval Postgraduate School, Monterey, CA USA
Automatic Layout Techniques for the Graphical Editor in the Computer Aided Prototyping System (CAPS)
Ray, William J., Naval Postgraduate School, USA; Sep. 1997; 323p; In English
Report No.(s): AD-A341244; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Computer Aided Prototyping System (CAPS) is a systems engineering tool intended to make the iterative process of software development more efficient. The simplest way to input and modify a CAPS design is through the graphical editor. When a design is modified over and over, the resultant graphical representation can become difficult to comprehend. Trying to change the graphical representation by hand can be very tedious. by adding automatic layout techniques to the graphical editor, this task is made easier for the user of the system. Automatic layout techniques for general graphs that maximize all of the aesthetic characteristics of a graph are not possible. One characteristic may conflict with another. by giving the user multiple layout algorithms that emphasis different characteristics over others, the user may choose between different layouts for the graphical representation. Since CAPS was in the middle of a restructure and no graphical editor was available, automatic layout techniques were investigated using other graphical editors. Graphs with characteristics similar to a CAPS graph were input into the graphical editors and then the layout algorithms applied. The results of this assessment proved that the addition of automatic layout techniques to CAPS would improve performance. The library of layout algorithms will be incorporated into the new graphical editor in CAPS.
DTIC
Software Engineering; Computer Aided Design; Computer Graphics; Computer Techniques; Layouts

19980202717 Arizona State Univ., Dept. of Computer Science, Tempe, AZ USA
Automated Object-Oriented Software Development for Parallel Processing Systems ***Final Report, Jul. 1995 - Dec. 1996***
Yau, Stephen S., Arizona State Univ., USA; Gao, Changju, Arizona State Univ., USA; Jia, Debin, Arizona State Univ., USA; Wang, Jun, Arizona State Univ., USA; Wu, Jiazheng, Arizona State Univ., USA; Feb. 1998; 117p; In English
Contract(s)/Grant(s): F30602-95-C-0202; AF Proj. 5581
Report No.(s): AD-A341223; RL-TR-97-231; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A set of computer aided software engineering (CASE) tools for the software development framework for parallel processing systems based on the Parallel Object Oriented Functional computation model (PROOF) toward the automation of object oriented software development for parallel processing systems is presented. An object oriented analysis tool has been developed to identify and express parallelism in the problem statement. We have developed a communication estimation tool to estimate the commu-

nication among objects, and a clustering tool to partition the objects in groups so that the intergroup communication is reduced and concurrency with specified user requirements is realized. The parallelism analysis tool further explores potential parallelism by analyzing the invocation relations and data flow among objects. The PROOF/L back end translator is extended to support clustering and dynamic allocation features in order to achieve better performance on a workstation cluster. The software effort using our approach can be greatly reduced due to implicit synchronization and communication, the user friendly graphical interfaces of the CASE tools, the automated object oriented analysis and parallelism analysis. The performance of software developed using our approach can be improved due to the integration of the object clustering algorithm, the parallelism analysis tool and the extended back end translator.
DTIC
Software Engineering; Software Development Tools; Parallel Processing (Computers); Computer Programming; Object-Oriented Programming

19980202894 Army Construction Engineering Research Lab., Champaign, IL USA
Applying Collaborative Engineering to the Facility Delivery Process: A Testbed Demonstration ***Final Report***
Brucker, Beth A., Army Construction Engineering Research Lab., USA; Stumpf, Annette L., Army Construction Engineering Research Lab., USA; Jan. 1998; 77p; In English
Contract(s)/Grant(s): Proj. 4A162784AT41
Report No.(s): AD-A341709; CERL-TR-98/32; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Researchers at the US Army Corps of Engineers Construction Engineering Research Laboratories (USACERL) have been developing a collaborative engineering (CE) software environment to enable sharing of design information as it is created and refined during the facility design and construction process. Improved information sharing capabilities and conflict management during collaborative design enables a team to resolve design issues and conflicts earlier in design development, resulting in an improved facility design, fewer errors and omissions, and better interdisciplinary coordination of design goals and building systems. An integrated information model to bridge the gap between product and process information for a construction project not only encourages those involved in construction to use and add to design information, but also provides richer information representation, better efficiency and data consistency, and the flexibility to support life-cycle information management. An important part of the CE research program at USACERL is the development of an integrated information model that allows agents to communicate/collaborate over the life cycle of the project. This report presents a CE environment that was developed to support collaboration among design and construction agents. Lessons learned during this case study will be used to reengineer the facility delivery process using a CE approach.
DTIC
Software Engineering; Computer Aided Design; Project Management; Engineers; Information Management; Automation; Facilities

19980202896 Naval Postgraduate School, Monterey, CA USA
Improving Syntactic Matching for Multi-Level Filtering
Herman, Jeffrey S., Naval Postgraduate School, USA; Sep. 1997; 146p; In English
Report No.(s): AD-A341744; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
At the center of software reuse is the search and retrieval of software components from large software libraries. Recent research has illuminated a promising approach called multi-level filtering that breaks the problem up into a series of increasingly stringent filters that move along a continuum of high recall, low-precision syntactic techniques towards the more computationally expensive, high-precision semantic techniques. In multi-level filtering, syntactic matching is decomposed into two phases: profile filtering and signature matching. This thesis presents improvements to the resolution of syntactic profiles where the intent is to increase precision without a loss in recall during profile filtering. Large integer representation of profiles and profile lookup tables lead to an optimal time and space solution to profile representation. Finally, a new approach to signature matching is proposed that provides early pruning of the search space in an effort to cut down the time it takes to find valid signature maps. The resulting software is mature enough for future integration with the other elements of multi-level filtering as well as inclusion in a CASE tool such as CAPS.
DTIC
Software Engineering; Computer Programs; Procedures; Time Functions

19980202898 Naval Postgraduate School, Monterey, CA USA
Project Scheduling Tool
Evans, John, Naval Postgraduate School, USA; Sep. 1997; 266p; In English

Report No.(s): AD-A341531; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Optimally scheduling a team of developers on a large software project is an NP- complete problem. The scheduling algorithm employed by the Evolutionary Control System (ECS) portion of the Computer-Aided Prototyping System (CAPS) does near-optimal scheduling using an algorithm that runs in Order N2 space and time. The problem addressed by this thesis is to improve the performance of the algorithm and make it more useful for scheduling software developers. The thesis accomplished three things: (1) Modified the algorithm to run in order N time and space, preserving its near-optimal behavior; (2) implemented a calendaring package that computes federal holidays for any year after 1970 and schedules tasks only on non-holiday workdays; and (3) incorporated a more realistic capability model to better match programming tasks with each developer's abilities.

DTIC

Algorithms; Scheduling; Computer Programs; Time; Prototypes; Computer Techniques

19980202908 Army Research Lab., White Sands Missile Range, NM USA

STATBIC: A Method for Inclusion of Fractal Statistics in Obscurant Transport Models ***Final Report, Oct - Nov. 1996***

OBrien, Sean G., New Mexico State Univ., USA; Hoock, Donald W., Army Research Lab., USA; Apr. 1998; 34p; In English

Report No.(s): AD-A341219; ARL-TR-1375; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A generic texture routine was developed for upgrading smooth obscurant cloud models by introduction of time and space dependent fluctuations in line of sight (LOS) propagation and image generation. The routine runs separately from or in conjunction with other obscuration models that predict electro-optical (EO) propagation for mean or average aerosol concentration contributions in the obscurant cloud. Atmospheric turbulence and eddy structures are the underlying sources of concentration fluctuations. Eddy structures can possess certain well defined and statistically predictable correlations between larger and smaller eddies that are linked to the steady breakup of larger eddies and the cascade of energy to smaller eddy scales. The resulting effects of these correlations in concentration are simulated by prototype algorithms that provide either two-dimensional propagation overlays for image modification or three-dimensional volume fluctuations. Path integrated concentration, LOS propagation fluctuations, and realistic cloud imaging are then simulated by multiplication of pseudorandom fluctuation outputs with smooth, ensemble averaged outputs from more traditional, simple obscuration models. Two platform-specific implementations of the generic texture routine were developed for IBM PC and Silicon Graphics, Inc. (SGI), display hardware. Examples of graphical output for both the two and three-dimensional algorithms are shown.

DTIC

Computerized Simulation; Plumes; Time Dependence; Line of Sight; Imaging Techniques; Two Dimensional Models; Occultation; Atmospheric Turbulence

19980202989 Kestrel Inst., Palo Alto, CA USA

Real-Time Software Visualization ***Final Report, Sep. 1993 - Mar. 1996***

Green, Cordell, Kestrel Inst., USA; Furst, Rafael, Kestrel Inst., USA; McDonald, Jim, Kestrel Inst., USA; Westfold, Stephen, Kestrel Inst., USA; Mar. 1998; 75p; In English

Contract(s)/Grant(s): F30602-93-C-0236; AF Proj. 5581

Report No.(s): AD-A341504; RL-TR-97-240; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes a formal approach to visualizing software specifications. The approach taken was to begin with a formal description of the entity to be visualized and repeatedly apply automated inference steps to transform the description into a form which could be rendered using standard techniques. The Specware specification construction environment was used to build specifications defining these visualizations. Several examples are included. In addition to visual representation, the role of sound in understanding and visualizing complex structures was also investigated.

DTIC

Knowledge Based Systems; Real Time Operation; Specifications

19980203017 Bagrodia and Chandy Associates, Los Angeles, CA USA

Concept of Operations for a Virtual Machine for C3I Applications ***Final Report***

Bagrodia, Rajive, Bagrodia and Chandy Associates, USA; Chandy, Mani, Bagrodia and Chandy Associates, USA; Oct. 1997; 132p; In English

Contract(s)/Grant(s): F30602-95-C-0045; AF Proj. 5581

Report No.(s): AD-A341142; RL-TR-97-205; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This final technical report summarizes research accomplished by Bagrodia and Chandy Associates. This 12-month research endeavor, entitled "Concept of Operations for a Virtual Machine for C3I Applications," examined issues in using a concurrent virtual machine for the design of C3I applications, where a concurrent virtual machine is an abstraction of a parallel machine.

These issues were evaluated and defined for the purposes of handling concurrency in the design of parallel programs and to facilitate porting a parallel program to multiple architectures. This report provides a description of requirements analysis, state-of-the-art review, technology trends, concurrent virtual machine, cost benefit analysis and case study undertaken. One of the recommendations proposed demonstrates the applicability of the proposed concurrent virtual machine for the design of a terrain masking program.
DTIC
Software Engineering; Software Development Tools; Parallel Computers; Target Masking; Terrain

19980203059 Naval Postgraduate School, Monterey, CA USA
ARIES: An Architectural Implementation of a Multi-Criterion Spatial Decision Support System (SDSS)
Falk, Peter R., Naval Postgraduate School, USA; Sep. 1997; 293p; In English
Report No.(s): AD-A341746; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This thesis describes a component-based methodology for developing a new class of systems called spatial decision support systems (SDSS). The methodology is presented within the context of the development of the ARIES (Army Reserve Installation Evaluation System) software application, an SDSS designed to evaluate and compare site desirability for Army Reserve unit locations. The ARIES SDSS consists of a flexible component-based architecture that seamlessly integrates a user interface, GIS, multi-criteria decision model with associated DSS, and data warehouse. to build the SDSS, the ARIES developers introduced a new architectural paradigm, undertaking a collaborative approach with U.S. Army Reserve Command (USARC) decision-makers to rapidly prototype ARIES using component-based technologies. The developers implemented several domain specific architectures using a formalized proof of concept heuristic, Concept to Code (C2C), which conceptualizes user requirements in architectural terms, and migrating legacy data sources into a spatial data warehouse. C2C allowed the resultant ARIES application to be conceptualized initially in general terms, and then specialized architecturally around existing off the shelf components, as design requirements were collaboratively prototyped and implemented within the existing USARC information system infrastructure. C2C facilitated the complete development of a complex, map-based system and accompanying data warehouse in the span of a few months with a technical team of three analysts and programmers. Significant system performance gains resulted from instituting a Migration Architecture System (MARS) engine to extract and spatially enable relevant data sources for geographic querying. Additional performance enhancements were also obtained through the use of rapid, component-based development techniques.
DTIC
Architecture (Computers); Procedures; Information Systems; Decision Support Systems; Complex Systems

19980203060 Ohio State Univ., Research Foundation, Columbus, OH USA
Functional Representation of Software Systems and Component-Based Software Technology ***Final Report, Oct. 1993 - Mar. 1997***
Chandrasekaran, B., Ohio State Univ., USA; Weide, Bruce, Ohio State Univ., USA; Feb. 1998; 213p; In English
Contract(s)/Grant(s): ARPA ORDER-A714; Proj-A714
Report No.(s): AD-A341742; RL-TR-97-220; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The overall objectives of this project were to develop approaches to program comprehension that would provide significant added benefits in many aspects of software engineering. As one part of that effort, the RESOLVE/ACTI framework for a software component composition technology was developed. The technology focuses on development of software components that can be reused and a composition discipline that helps in creating programs whose properties can be efficiently reasoned about. As another part of the effort, a device comprehension framework called Functional Representation was applied, and its utility shown for software architecture comprehension, legacy software reengineering and representation of system requirements.
DTIC
Software Engineering; Computer Systems Programs

19980203064 Armstrong Lab., Crew Systems Directorate, Wright-Patterson AFB, OH USA
Subjective Assessment of SAR Imagery Enhancement Algorithms ***Interim Report, Jan - Sep. 1997***
Kuperman, Gilbert G., Armstrong Lab., USA; Shaya, Dorit, Armstrong Lab., USA; Sep. 1997; 25p; In English; Prepared in collaboration with Israel Air Force, Human Factors Engineering Branch.
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A341722; AL/CF-TR-1997-0133; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Image display enhancement algorithms employing Statistical processing and Fuzzy Logic processing were applied to 14 synthetic aperture radar (SAR) images. Three groups of subject matter experts, provided by the Israel Ministry of Defense (Air Force imagery analysts, Ground Corps Command imagery analysts, and Air Force weapon system officers) employed a subjective image

interpretability rating scale in assessing the affect of the enhancement processing. No statistically significant effect was found for either the algorithms or the groups of subjects.
DTIC
Fuzzy Systems; Image Enhancement

19980203100 Naval Postgraduate School, Monterey, CA USA
Evolution of a Graphical User Interface for the Rapid Prototyping of Real-Time Embedded Systems
Moeller, Kenneth B., Naval Postgraduate School, USA; Sep. 1997; 452p; In English
Report No.(s): AD-A341448; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The Computer-Aided Prototyping System (CAPS) is an integrated collection of software tools that support the development of software systems utilizing the prototype paradigm. Central to CAPS is the Prototype System Description Language (PSDL). The PSDL Editor supplied in CAPS Release 1 provided a unique combination of a graphical interface for editing PSDL data flow diagrams and an attribute-grammar based text editor to enforce syntactically correct PSDL prototypes. Feedback from CAPS users highlighted on productivity impacts due to the dual user interface as well as the steep learning curve required to become proficient with the attribute-grammar based text editor. This research initiates the development of the next generation of the CAPS PSDL Editor, focusing on the graph editor. Our approach provides a single graphical user interface with pull-down menus for editing both graphical and text information. Automatic syntax generation and validation as well as limited semantic validation is provided by a background syntax/semantics checker. The result of this research is a working graph editor meeting all the new requirements. When integrated with a the new syntax/semantics checker, CAPS Release 2 will have a PSDL Editor with enhanced capabilities and expected productivity improvements.
DTIC
Graphical User Interface; Prototypes; Real Time Operation; Computer Programs; Computer Aided Design; Software Engineering

19980203120 General Accounting Office, General Government Div., Washington, DC USA
Sec Year 2000 Report: Future Reports Could Provide More Detailed Information
Burnett, Michael, General Accounting Office, USA; Goebel, Cody, General Accounting Office, USA; Reveyoso, Jean–Paul, General Accounting Office, USA; Stephenson, John, General Accounting Office, USA; Mountjoy, Gary, General Accounting Office, USA; Mar. 1998; 22p; In English
Report No.(s): AD-A340883; GAO/GGD/AIMD-98-51; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On July 21,1997, you asked us to review the Securities and Exchange Commission's (SEC) report on the status of its efforts to ensure that the computer systems it uses, as well as those used by participants in the securities industry, are ready for the date changeover in the year 2000. SEC issued its report in response to your request that it report annually on the progress made in addressing this issue. Your letter specifically requested that we review (1) SEC'S June 1997 report on the status of Year 2000 compliance by SEC, the securities industry, and public companies to identify any ways that future reports might be improved; (2) the adequacy of SEC'S oversight of the Year 2000 remediation efforts directed at its internal systems, self-regulatory organizations (SRO), broker-dealers, and other regulated entities; and (3) the guidance SEC has provided to public companies for disclosing Year 2000 remediation efforts. We agreed with your office that this report would focus only on ways to improve the content and format of future SEC Year 2000 reports to Congress, to provide SEC as much time as possible to incorporate any changes into its next report. We intend to address the remaining issues discussed in your letter separately in a subsequent review.
DTIC
Automatic Control; Computers

19980203134 Synectics Corp., Rome, NY USA
Molecular Dynamics Simulation Upgrade ***Final Report, Jan - Jun. 1997***
Kolek, Lisa, Synectics Corp., USA; Rogers, Geraldine W., Synectics Corp., USA; Oct. 1997; 53p; In English
Contract(s)/Grant(s): F30602-95-D-0028; AF Proj. 2982
Report No.(s): AD-A341123; WH-94-RY-09; RL-TR-97-202-VOL-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of the MDEM simulation upgrade was to improve performance, enhance the ""user-friendly"" features and generally clean up the source code for the MDEM simulation software tool. Performance improvement was primarily focused on the attainment of MDEM processing speedup. This was achieved at a low level by examining the existing code structure, as well as at a high level by modifying the simulation algorithm. Enhancement of user-friendly features included the implementation of a prototype graphical user interface (GUI) and the creation of the user S guide for both the command-line and GH versions of

MDEM. Code cleanup involved deletion of unnecessary code and comments, and reorganization of variables. In addition to this, miscellaneous software engineering and development support was provided to Rome Laboratory on an ”as required” basis.
DTIC
Computerized Simulation; Software Engineering; Graphical User Interface

19980203204 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Practical Parallel Divide-and-Conquer Algorithms
Hardwick, Jonathan C., Carnegie-Mellon Univ., USA; Dec. 1997; 172p; In English
Contract(s)/Grant(s): DABT63-96-C-0071
Report No.(s): AD-A341564; CMU-CS-97-197; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Nested data parallelism has been shown to be an important feature of parallel languages, allowing the concise expression of algorithms that operate on irregular data structures such as graphs and sparse matrices. However, previous nested data-parallel languages have relied on a vector PRAM implementation layer that cannot be efficiently mapped to MPPs with high inter-processor latency. This thesis shows that by restricting the problem set to that of data-parallel divide and conquer algorithms I can maintain the expressibility of full nested data-parallel languages while achieving good efficiency on current distributed memory machines. Specifically, I define the team parallel model, which has four main features: data-parallel operations within teams of processors, the subdivision of these teams to match the recursion of a divide and conquer algorithm, efficient single processor code to exploit existing serial compiler technology, and an active load balancing system to cope with irregular algorithms. I also describe Machiavelli, a toolkit for parallel divide and conquer algorithms that implements the team parallel model. Machiavelli consists of simple parallel extensions to C, and is based around a distributed vector datatype. A preprocessor generates both serial and parallel versions of the code, using MPI as its parallel communication mechanism to assure portability across machines. Load balancing is performed by shipping function calls between processors. Using a range of algorithm kernels (including sorting, finding the convex hull of a set of points, computing a graph separator, and matrix multiplication), I demonstrate optimization techniques for the implementation of divide and conquer algorithms. An important feature of team parallelism is its ability to use efficient serial algorithms supplied by the user as the base case of recursion.
DTIC
Algorithms; Matrices (Mathematics); Data Processing; Compilers; Parallel Processing (Computers)

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19980202506 Iowa State Univ. of Science and Technology, Dept. of Chemistry, Ames, IA USA
Parallel Quantum Chemistry In an SMP Environment ***Final Report, 1 Apr. - 31 Dec. 1997***
Gordon, Mark S., Iowa State Univ. of Science and Technology, USA; Apr. 08, 1998; 3p; In English
Contract(s)/Grant(s): F49620-97-1-0173(DURIP)
Report No.(s): AD-A342698; AFRL-SR-BL-TR-98-O359; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The funds awarded were used to purchase an eight node IBM J50 computer, and the associated software. Each node is configured with 256MB of memory and 4 GB of disk. The system is currently being run as eight separate nodes. In addition to the DoD funds, IBM provided $40,000 in matching funds for this project. The IBM funds were used to purchase two dual processor 233 MHz IBM 43P computers. These are PCI-based systems, each of which is configured with 512 MB of memory and 9 GB of disk. As for the J50, we are using these systems as two independent nodes, until the parallel environment is released. Finally, Apple Computer has given us a high end Macintosh computer as part of their match. This computer has already played a central role in the development of MacMolPlt, a graphical interface for our electronic structure code GAMESS.
DTIC
Computer Programs; Quantum Chemistry; Macintosh Personal Computers

19980202592 Hughes Research Labs., Malibu, CA USA
Electro-Optic Computing Architectures ***Final Report, Jul. 1993 - Jul 1997***
Efron, U., Hughes Research Labs., USA; Esener, S., Hughes Research Labs., USA; Wu, C. S., Hughes Research Labs., USA; Marchand, P. J., Hughes Research Labs., USA; Sayyah, K., Hughes Research Labs., USA; Feb. 1998; 164p; In English
Contract(s)/Grant(s): F30602-93-C-0173; AF Proj. A275
Report No.(s): AD-A341200; RL-TR-97-229; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The objective of the Electro-Optic Computing Architecture (EOCA) program was to develop multi-function electro-optic interfaces and optical interconnect units to enhance the performance of parallel processor systems and form the building blocks for future electro-optic computing architectures. Specifically, three multi-function interface modules were targeted for development - an Electro-Optic Interface (EOI), an Optical Interconnection Unit (OW), and a Space-Time Compander (STC). Electro-optic 3-D interconnection module stacks were assembled, allowing for system global communication and fast efficient data routing and sorting. The achieved goal of the system study, to identify and analyze all the architectural implications due to the addition of optical based free-space interconnects in locally connected processor arrays, is leading to new highly optimized 3-D electro-optic computer processing networks.
DTIC
Optical Equipment; Optical Switching; Computer Networks; Parallel Processing (Computers); Electro-Optics; Architecture (Computers); Optical Computers

19980202596 Physics and Electronics Lab. TNO, The Hague, Netherlands
Software Specifications BIAS
Bennis, H. G. M., Physics and Electronics Lab. TNO, Netherlands; Onderwater, A. P. T. M., Physics and Electronics Lab. TNO, Netherlands; Sep. 1997; 78p; In English
Report No.(s): AD-A341131; TNO-FEL-97-A253; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This document describes the Software Requirement Specifications (SRS) and the Recommendations Software Specifications (RSS) for a Bit Analysis System (BIAS) for the Royal Dutch Army. This BIAS is a system to analyse intercepted long haul digital communications links. The SRS is developed according to MlL-STD-498. The resulting SRS shall be used to define and implement a BIAS or redefine an existing analysis program.
DTIC
Communication Networks; Specifications; Bias; Computer Programs; Pulse Communication

19980202634 Naval Postgraduate School, Monterey, CA USA
Exit Strategy in the Implementation of Information Technology Systems
Pugh, Todd W., Naval Postgraduate School, USA; Sep. 1997; 69p; In English
Report No.(s): AD-A341257; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This thesis proposes that planning for the implementation of information technology projects include an exit strategy. The military origins of exit strategy are reviewed along with corporate formulations of exit strategies in plans for non-technology investments. Cultural, political and organizational barriers to exit strategy are considered.
DTIC
Systems Analysis; Information Management; Project Management; Technology Assessment; Information Systems; Strategy; Military Operations

19980202685 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Methodology for the Analysis and Design of Internet Software Components Providing Relational Database Access Through the World Wide Web
DiPiro, Daniel L., Air Force Inst. of Tech., USA; Mar. 1998; 124p; In English
Report No.(s): AD-A340958; AFIT/GCS/ENG/98M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This work examines the application of Internet software technologies to provide access to remote relational databases via the World Wide Web. The research applies these software technologies to assist the Air Force Institute of Technology Civilian Institute Program in improving operations and student to staff communication. An analysis of the existing Internet software technologies revealed several competing technologies capable of performing the same database access functions. The analysis further revealed weaknesses and inconsistencies in the existing AFIT/CI database. A methodology is proposed to assist in analyzing an existing development environment and in selecting among the competing technologies to provide the web based database access. The methodology is applied to the AFIT/CI test case to demonstrate a technique of analyzing and designing web software components that will create new and improved uses for the existing CI database. Additional recommendations are also offered to improve the existing database operations. The results of applying the methodology demonstrated that it effectively focuses the developer on the key areas of the development environment necessary to choose among competing software technologies. Additionally, the methodology was proven to be flexible in response to changes in implementation technologies.
DTIC
Data Bases; Design Analysis; Internets; Computer Programs; Object-Oriented Programming

19980202703 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

A Nitpick Analysis of Mobile IPv6

Jackson, Daniel, Carnegie-Mellon Univ., USA; Ng, Yuchung, Carnegie-Mellon Univ., USA; Wing, Jeanette M., Carnegie-Mellon Univ., USA; Mar. 1998; 26p; In English; Prepared in cooperation with Cornell Univ., Computer Science Dept., Ithaca, NY and MIT Lab. for Computer Science, Cambridge, MA.

Contract(s)/Grant(s): F33615-93-1-1330; F30602-97-2-0031

Report No.(s): AD-A341559; CMU-CS-98-113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A lightweight formal method enables partial specification and automatic analysis by sacrificing breadth of coverage and expressive power. by design, NP is a specification language that is a subset of Z and Nitpick is a tool that quickly and automatically checks properties of finite models of systems specified in NP. We used NP to state two critical acyclicity properties of Mobile IPv6, a new internetworking protocol that allows mobile hosts to communicate with each other. In our Nitpick analysis of Mobile IPv6 we discovered a flaw in a 1996 version of the design: one of the acyclicity properties does not hold. It takes only two hosts to exhibit this flaw. This paper gives self-contained overviews of Mobile IPv6 and of NP and Nitpick to understand the details of our specification and analysis.

DTIC

Computer Networks; Computer Conferencing; Program Verification (Computers)

19980202709 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA

Building Information Servers ***Final Report, 30 Sep. 1993 - 29 Sep 1997***

Knoblock, Craig A., University of Southern California, USA; Swartout, William, University of Southern California, USA; Tejada, Sheila, University of Southern California, USA; Nov. 24, 1997; 3p; In English

Contract(s)/Grant(s): F49620-93-1-0594

Report No.(s): AD-A341247; AFRL-SR-BL-TR-98-0302; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research addressed the problem of determining the relationships among multiple, diverse information sources in order to support the integration of data from these sources. In general, to integrate data from multiple sources requires a model of the precise relationships between the sources. Constructing such a model by hand is a difficult and time consuming process. The relationships captured in a model describe the type of overlap between data instances in different sources. In this work data mining techniques were used to determine these relationships by comparing the data instances between sources. A related problem is that data instances can exist in different formats across several sources, e.g. IBM may be abbreviated as IBM in one source and appear as International Business Machines in another source. This work addressed this problem by developing techniques for automatically determining the mapping between names used in different sources. These integration techniques were use in conjunction with the SIMS information mediator. allowing SIMS to correctly and efficiently integrate data across several sources that contained data instances appearing in multiple formats.

DTIC

Data Management; Information Retrieval; Models; Measure and Integration; Information Systems; Internets; Data Processing

19980202897 Naval Postgraduate School, Monterey, CA USA

A Management System for Heterogeneous Networks (MSHN) Security Analysis

English, John P., Naval Postgraduate School, USA; Sep. 1997; 107p; In English

Report No.(s): AD-A341530; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A team of interdisciplinary experts funded by DARPA is in the process of developing a Resource Management System termed MSHN (a Management System for Heterogeneous Networks). MSHN's primary function is to accept a sequence of jobs, and intelligently determine what jobs should be executed on which machines and when. It is designed to take both machine affinity and loads into account, thus providing superior performance and Quality of Service (QoS). The current prototype of MSHN does not provide protection against the threats of inadvertent disclosure and corruption of sensitive information and resources. A rigorous security analysis of MSHN is the first step required to successfully incorporate security into the MSHN project. The approach taken was to analyze MSHN's architecture, information flow diagrams and user interfaces and explain how fundamental security concepts may be applied to MSHN. by exercising the MSHN simulator, this work was able to expose many security weaknesses and outline conceivable methods of exploitation. As a result of this effort, a security policy tailored to MSHN is proposed, a functional breakout process based on the principle of least privilege between common user interface capabilities and administration capabilities is provided, and finally design recommendations for the incorporation of security into MSHN are presented.

DTIC

Management Information Systems; Security; Computer Networks; Information Management; Information Flow; Resources Management; Management Systems; Data Processing

19980202926 University of North Texas, Dept. of Computer Sciences, Denton, TX USA
Scalability in Neural Network Learning and Computation ***Final Report, 1 Jan. 1993 - 31 Dec. 1996***
Parberry, Ian, University of North Texas, USA; Feb. 26, 1997; 11p; In English
Contract(s)/Grant(s): F49620-93-1-0100
Report No.(s): AD-A341808; AFRL-SR-BL-TR-98-0321; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Progress has been made in six topics in the area of computational complexity of neural networks. The loading problem for analog neural networks with only 6 nodes is NP-complete. Some foundational results on linear threshold functions with Boolean inputs have been extended to real- valued inputs; Hastad's lower bound on the dynamic range of weights for linear threshold functions has been improved slightly; Theoretical and experimental results have shown that Hopfield nets are inferior to classical sequential and parallel algorithms for the knight's tour problem, a special case of the Travelling Salesperson Problem; The problem of finding stable states is PCS-complete even for some very simple and restrictive classes of Hopfield nets; and we have constructed n-node planar Hopfield networks that take time 2 coverage sequentially, and to coverage in parallel.
DTIC
Neural Nets; Computer Networks; Learning; Computation; Threshold Logic

19980203061 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Active Disks: Remote Execution for Network-Attached Storage
Riedel, Erik, Carnegie-Mellon Univ., USA; Gibson, Garth, Carnegie-Mellon Univ., USA; Dec. 1997; 14p; In English
Contract(s)/Grant(s): ARPA ORDER-D306
Report No.(s): AD-A341735; CMU-CS-97-198; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The principal trend in the design of computer systems is the expectation of much greater computational power in future generations of microprocessors. This trend applies to embedded systems as well as host processors. As a result, devices such as storage controllers have excess capacity and growing computational capabilities. Storage system designers are exploiting this trend with higher level interfaces to storage and increased intelligence inside storage devices. One development in this direction is Network Attached Secure Disks (NASD) which attaches storage devices directly to the network and raises the storage interface above the simple (fixed size block) memory abstraction of SCSI. This allows devices more freedom to provide efficient operations; promises more scalable subsystems by offloading file system and storage management functionality from dedicated servers; and reduces latency by executing common case requests directly at storage devices. In this paper, we push this increasing computation trend one step further. We argue that application specific code can be executed at storage devices to make more effective use of device, host and interconnect resources and significantly improve application I/O performance. Remote execution of code directly at storage devices allows filter operations to be performed close to the data; enables support of timing sensitive transfers and application-aware scheduling of access and transfer; allows management functions to be customized without requiring firmware changes; and makes possible more complex or specialized operations than a general purpose storage interface would normally support.
DTIC
Computer Systems Performance; Computer Techniques

19980203063 Arizona State Univ., Tempe, AZ USA
Adaptable Locally Interconnected Architectures ***Final Report, 1 Nov. 1995 - 1 Apr. 1998***
Akers, Lex A., Arizona State Univ., USA; Feb. 24, 1998; 24p; In English
Contract(s)/Grant(s): N00014-98-1-0107
Report No.(s): AD-A341725; DWA0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Photodetection circuits form the first stage of the artificial image acquisition process. The image acquisition circuits discussed in this final report pertain to circuits fabricated in a standard CMOS process. Such circuits offer advantages such as random access to a pixel, faster readout, integration of processing circuitry on the same die, low voltage and low power dissipation, and lower cost over the conventional Charge Coupled Device (CCD) process. We describe a new locally adaptive multimode photodetector circuit. The advantages of the circuit are local adaptation, wide dynamic range excellent sensitivity, and large output voltage swing. The circuit was fabricated in the 2 CMOS process through MOSIS. Simulation and experimental results of the circuit are given. The research contract generated 12 papers and supported 7 graduate students.
DTIC
Architecture (Computers); Image Processing; Circuits; Photometers; Adaptive Control

19980203101 Naval Postgraduate School, Monterey, CA USA
Windows NT Threats and Vulnerabilities
Moore, Febbie P., Naval Postgraduate School, USA; Sep. 1997; 73p; In English

Report No.(s): AD-A341457; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this research is to examine the threats and vulnerabilities of a Windows NT network. One aspect of this research is to add to the Department of Defense's understanding of the disadvantages of the system. This research demonstrates five vulnerabilities of Windows NT with respect to the military network operating system security environment. First, there is the NetBIOS-over-TCP/IP vulnerability. Windows NT by default allows networking over this protocol. This protocol could allow an attacker to remotely connect to a drive and edit the registry. Second, the server message block (SMB) vulnerability allows remote access to shared directories. An unauthorized user could use this hole to access everything on the shared resources. Third, the remote registry access vulnerability could allow an attacker to view and change the contents of another computer's Registry. Fourth, improperly set permissions could allow unauthorized access to sensitive and classified data. Fifth, the built-in file transfer protocol (FTP) service allows users to change directories. Users could use this hole to sec the root directory. Before DOD becomes too committed to Windows NT, these issues need to be addressed.

DTIC

Computers; Computer Networks; Computer Information Security; Vulnerability; Windows (Computer Programs)

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.

19980201944 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Air Force Workshop on Optimal Design and Control ***Final Report, 1 Apr. - 31 Dec. 1997***

Burns, John A., Virginia Polytechnic Inst. and State Univ., USA; Cliff, Eugene M., Virginia Polytechnic Inst. and State Univ., USA; Mar. 06, 1998; 31p; In English

Contract(s)/Grant(s): F49620-97-1-0264

Report No.(s): AD-A340384; ICAM-98-03-01; AFRL-SR-BL-TR-98-0277; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains a summary and highlights of the work funded by the Air Force under AFOSR Grant F49620-97-1-0264, titled 'Air Force Workshop on Optimal Design and Control'. This effort was conducted by the Air Force Center for Optimal Design and Control (CODAC), during the period 1 April 1997 - 31 December 1997. The Center planned, organized and ran a workshop in Washington, DC from 30 September through 3 October 1997. The workshop was attended by sixty-six participants with thirty-six technical presentations. The objectives of the workshop included an assessment of current research efforts in optimal design, an evaluation of Air Force needs and identification of future directions in optimal design. The speakers, including twenty invited leading researchers, covered a variety of topics including: (1) Sensitivity Equation Methods, (2) Adjoint Methods, (3) Automatic Differentiation, and (4) Optimization Theory and Algorithms and Engineering Design Applications. Twenty-two of the technical papers have been assembled into a Proceeding volume, to be published by Birkhanser-Boston. A second volume assessing the state-of-the-art and future directions will also be published by Birkhanser-Boston.

DTIC

Algorithms; Optimal Control; Sensitivity; Design Analysis; Conferences

19980202403 Illinois Univ., Urbana, IL USA

Reduced-Encoding Dynamic Imaging ***Final Report***

Hanson, Jill M., Illinois Univ., USA; Apr. 1997; 94p; In English

Report No.(s): AD-A342779; AFRL-SR-BL-TR-98-0369; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This research addresses the problem of acquiring a time series of magnetic resonance images with both high spatial and temporal resolutions. Specifically, we systematically investigate the advantages and limitations of reduced-encoding imaging using a priori constraints. This study reveals that if the available a priori information is a reference image, direct use of this information to 'optimize' data acquisition using the existing wavelet transform or singular value decomposition schemes can undermine the capability to detect new image features. However, proper incorporation of the a priori information in the image reconstruction step can significantly reduce the resolution loss associated with reduced-encoding. For Fourier encoded data, we have shown that the Generalized-Series (GS) model is an effective mathematical framework for carrying out the constrained reconstruction step. Several techniques are proposed in this dissertation to improve the basis functions of the GS model by introducing dynamic information. The two reference reduced-encoding imaging by generalized-series reconstruction (TRIGR) method suppresses background information through the use of a second high resolution reference image. A second technique injects information from

the dynamic data into the GS basis functions, as opposed to deriving them solely from the reference information. These techniques allow the GS basis functions to more accurately represent the areas of dynamic change. Finally, motion that occurs between the acquisition of the reference and dynamic data sets can render the reference information useless as a constraint for image reconstruction. A motion compensation method is proposed which uses a similarity norm to accurately detect the motion in spite of contrast changes and the low resolution nature of the dynamic data.
DTIC
Data Acquisition; Image Processing; Imaging Techniques; Wavelet Analysis; Time Series Analysis; Magnetic Resonance

19980202507 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Parallel Implementation of an Artificial Neural Network Integrated Feature and Architecture Selection Algorithm
Rizzo, Craig W., Air Force Inst. of Tech., USA; Mar. 13, 1998; 77p; In English
Report No.(s): AD-A342706; AFIT/GOR/ENS/98M-20; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The selection of salient features and an appropriate hidden layer architecture contributes significantly to the performance of a neural network. A number of metrics and methodologies exist for estimating these parameters. This research builds on recent efforts to integrate feature and architecture selection for the multilayer perceptron. In the first stage of work a current algorithm is developed in a parallel environment, significantly improving its efficiency and utility. In the second stage, improvements to the algorithm are proposed. With regards to feature selection, a common random number (CRN) addition is proposed. Two new methods of architecture selection are examined, to include an information criterion and a signal to noise based procedure. These methodologies are shown to improve algorithm performance.
DTIC
Algorithms; Architecture (Computers); Parallel Computers; Random Numbers; Neural Nets

19980202590 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Neural Network Modeling of the Head-Related Transfer Function
Reinhardt, Damion, Air Force Inst. of Tech., USA; Mar. 1998; 121p; In English
Report No.(s): AD-A341209; AFIT/GAM/ENC/98M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Battlefield synthesis of 3-D audio may require the interpolation and compression of head-related transfer function (HRTF) data. This thesis is an implementation of a functional model of the HRTF using artificial neural networks (ANNs), the model provides both compression and interpolation.
DTIC
Neural Nets; Auditory Signals; Auditory Perception; Transfer Functions

19980202906 George Mason Univ., Fairfax, VA USA
Computer Vision through Learning *Final Report*
Michalski, R. S., George Mason Univ., USA; Rosenfeld, A., George Mason Univ., USA; Aloimonos, Y., George Mason Univ., USA; Duric, Z., George Mason Univ., USA; Maloof, M., George Mason Univ., USA; Sep. 1997; 53p; In English
Contract(s)/Grant(s): F49620-95-1-0462
Report No.(s): AD-A341212; GMU-5-25709; AFRL-SR-BL-TR-98-0307; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The underlying motivation for this research is that vision systems need learning capabilities for handling problems for which algorithmic solutions are unknown or difficult to obtain. In this context, we have conducted research on a wide range of vision problems that can benefit from machine learning. We have developed a general methodology for this purpose, called MIST, that supports multilevel image sampling, transformation, learning and interpretation. MIST is based on the application of symbolic or multistrategy learning methods (the latter one integrates symbolic and neural net learning) for creating visual concept descriptions. MIST was applied and demonstrated to be useful for such problems as conceptual interpretation of natural scences, nonstructural and structural texture description and identification, detection of blasting caps in X-ray images of airport luggage, and target detection in SAR images. We have also obtained important results in the areas of action recognition in video image sequences, visual memories, estimation of environment properties from sampling, and bisight head control. The obtained results have demonstrated a significant promise and usefulness of the efforts to apply modern machine learning methods to problems of computer vision.
DTIC
Image Processing; Artificial Intelligence; Computer Vision; Procedures; Detection

19980203019 Physical Optics Corp., Torrance, CA USA

A Highly Functional Decision Paradigm Based on Nonlinear Adaptive Genetic Algorithm ***Final Report, 7 Aug. 1996 - 10 Jul. 1997***

Kostrzewski, Andrew, Physical Optics Corp., USA; Kim, Jeongdal, Physical Optics Corp., USA; Oct. 07, 1997; 69p; In English
Contract(s)/Grant(s): DAAH04-96-C-0063
Report No.(s): AD-A344278; ARO-36350.1-EL-SB2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this phase, Phase 2, the genetic algorithm (GA) developed in Phase 1 was refined and integrated with a neural network for network topology optimization. In addition, a Mathlink GA was developed as a Mathematica module. POC wrote the Mathematica plug-in module as a function optimizer using Mathlink. The GA route optimizer was written, tested, and demonstrated. On the hardware side, a TMS320C80 based parallel DSP board was used as a testbed for parallel GA. The GA programs running on the parallel computing hardware exhibited a significant speedup.
DTIC
Genetic Algorithms; Neural Nets; Computer Networks; Software Engineering

19980203065 Naval Postgraduate School, Monterey, CA USA

Multiple Autonomous Vehicles for Mine Field Reconnaissance and Mapping

Starr, Jack A., Naval Postgraduate School, USA; Dec. 1997; 132p; In English
Report No.(s): AD-A341713; NPS-ME-97-008; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The development of numerical search modeling for Autonomous Search Vehicles (ASV's) is an essential tool for development of ASV strategy using groups of small, crawling vehicles. Reconnaissance of surf-zone bottoms for mines and obstacles, as well as providing an environmental mapping capability, is the objective. These models allow numerical simulations to be conducted that determine the relationships between search times, target and obstacle sensing radius, vehicle speed and numbers of vehicles using simple, preprogrammed search strategies. The results from these simulations on intial models can then be used to determine the overall system performance. More complex models can then be developed using search strategies that include directed search, avoidance behaviors, networking and mapping with sufficient navigational accuracy. With sufficient information on their behavior of these vehicles, the ultimate goal of providing an autonomous reconnaissance and neutralization capability in very shallow water and surf zones can be realized.
DTIC
Autonomy; Surface Vehicles; Robotics; Detection; Reconnaissance

19980203106 Institute of Electrical and Electronics Engineers, Piscataway, NJ USA

1997 IEEE Workshop on Neural Networks for Signal Processing 7 ***Final Report***

Principe, Jose, Editor, Institute of Electrical and Electronics Engineers, USA; Gile, Lee, Editor, Institute of Electrical and Electronics Engineers, USA; Morgan, Nelson, Editor, Institute of Electrical and Electronics Engineers, USA; Wilson, Elizabeth, Editor, Institute of Electrical and Electronics Engineers, USA; Mar. 16, 1998; 671p; In English; 7th, 1997, USA
Contract(s)/Grant(s): F49620-97-1-0311
Report No.(s): AD-A341539; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

NNSP'07 was held In Amelia Island Plantation, Amelia Island Florida, September 24-26, 1997. NNSP'97 was sponsored by the Neural Networks Technical Committee of the IEEE Signal Processing Society, in cooperation with the IEEE Neural Network Council and with co-sponsorship from the Air Force Office of Scientific Research. This year two topics were announced in the calls for papers. The goal was to create a critical mass of submissions and dedicate a full session to discuss a topic of current interest. This year topics were blind signal processing and pattern recognition applications. We had an exciting technical program with first rated papers and speakers. We invited as plenary speakers Drs. Simon Haykin, from McMaster University, David Brown from F.D.A., S.Y. Kung, from Princeton, J. F. Cardoso from Paris V, and Yann LeCun from ATT Bell Labs. Eighty high quality papers were presented with contributions from 16 countries. The proceedings were distributed at the conference, and were published by the IEEE Press. The organization sponsored ten students to present their work. The highlights of the conference were the following: the advances made on blind source separation, both at the theoretical level and in practical applications; the advances in the implementation of the support vector machines; the interest in recurrent neural networks; the exciting new applications of neural networks to multimedia, and the continuing interest in biomedical applications. All the sessions were very lively, in particular the excellent poster sessions where lengthier discussions among researchers were conducted. Overall this was a high quality conference, which everybody enjoyed greatly.
DTIC
Conferences; Signal Processing; Neural Nets; Pattern Recognition

19980203136 Naval Postgraduate School, Monterey, CA USA

Object Recognition Using 2D Sensors and Autonomous Vehicle Navigation Issues

Gomes, Jader, Naval Postgraduate School, USA; Filbo, Silva, Naval Postgraduate School, USA; Dec. 1997; 293p; In English
Report No.(s): AD-A341146; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This research deals with the problem of extracting features from an image using wavelets and then using these features to recognize objects present in the image. This technique is applied to recognition of Unexploded Ordnance (UXO) objects. However, the concepts described here can be extended to recognition of other objects such as ships, missiles and aircraft. This work is performed as part of an ongoing effort to develop an autonomous vehicle capable of detecting UXOs.
DTIC

Neural Nets; Autonomous Navigation; Target Recognition; Pattern Recognition; Two Dimensional Models

19980203148 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

Multitask Learning

Caruana, Rich, Carnegie-Mellon Univ., USA; Sep. 23, 1997; 253p; In English
Contract(s)/Grant(s): F33615-93-1-1330
Report No.(s): AD-A341329; CMU-CS-97-203; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Multitask Learning is an approach to inductive transfer that improves learning for one task by using the information contained in the training signals of other related tasks. It does this by learning tasks in parallel while using a shared representation; what is learned for each task can help other tasks be learned better. In this thesis we demonstrate multitask learning for a dozen problems. We explain how multitask learning works and show that there are many opportunities for multitask learning in real domains. We show that in some cases features that would normally be used as inputs work better if used as multitask outputs instead. We present suggestions for how to get the most out of multitask learning in artificial neural nets, present an algorithm for multitask learning with case based methods like k nearest neighbor and kernel regression, and sketch an algorithm for multitask learning in decision trees. Multitask learning improves generalization performance, can be applied in many different kinds of domains, and can be used with different learning algorithms. We conjecture there will be many opportunities for its use on real world problems.
DTIC

Machine Learning; Neural Nets; Artificial Intelligence; Decision Theory

19980203152 Massachusetts Inst. of Tech., Lab. for Information and Decision Systems, Cambridge, MA USA

Multiresolution Methods in Systems, Signals and Images ***Final Report, 1 Dec. 1994 - 28 Feb. 1998***

Willsky, Alan S., Massachusetts Inst. of Tech., USA; Mar. 1998; 21p; In English
Contract(s)/Grant(s): F49620-95-1-0083
Report No.(s): AD-A341363; AFRL-SR-BL-TR-98-0306; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this final report we summarize our research accomplishments under this grant: (a) research on our multiresolution estimation methodology to solve a variety of difficult image and large scale data assimilation problems and to extend the theoretical domain of applicability of our methodology considerably to allow for the fusion of multisensor data; (b) the development of several new methods involving synthetic aperture radar (SAR) data including multiresolution segmentation and compression algorithms and an estimation-theoretic approach to moving target SAR image formation; (c) the development of a new nonlinear multiresolution image evolution algorithm that produces extremely robust image segmentations; (d) the development of a new variation on so-called matching pursuit methods with application to robust and stable feature extraction and recognition of objects; and (e) the development of hierarchical and wavelet-based methods for the design of joint detection algorithms for multiple access communication in the presence of highly correlated user signals. In addition a number of significant transitions and interactions resulting from our work are described.
DTIC

Image Resolution; Pattern Recognition

19980203169 NASA Johnson Space Center, Houston, TX USA

Global Qualitative Flow-Path Modeling for Local State Determination in Simulation and Analysis

Malin, Jane T., Inventor, NASA Johnson Space Center, USA; Fleming, Land D., Inventor, NASA Johnson Space Center, USA; Mar. 24, 1998; 63p; In English
Patent Info.: Filed 30 Nov. 1994; NASA-Case-MSC-22618-1; US-Patent-5,732,192; US-Patent-Appl-SN-346793; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

For qualitative modeling and analysis, a general qualitative abstraction of power transmission variables (flow and effort) for elements of flow paths includes information on resistance, net flow, permissible directions of flow, and qualitative potential is

discussed. Each type of component model has flow-related variables and an associated internal flow map, connected into an overall flow network of the system. For storage devices, the implicit power transfer to the environment is represented by ”virtual” circuits that include an environmental junction. A heterogeneous aggregation method simplifies the path structure. A method determines global flow-path changes during dynamic simulation and analysis, and identifies corresponding local flow state changes that are effects of global configuration changes. Flow-path determination is triggered by any change in a flow-related device variable in a simulation or analysis. Components (path elements) that may be affected are identified, and flow-related attributes favoring flow in the two possible directions are collected for each of them. Next, flow-related attributes are determined for each affected path element, based on possibly conflicting indications of flow direction. Spurious qualitative ambiguities are minimized by using relative magnitudes and permissible directions of flow, and by favoring flow sources over effort sources when comparing flow tendencies. The results are output to local flow states of affected components.
Official Gazette of the U.S. Patent and Trademark
Mathematical Models; Computerized Simulation; Qualitative Analysis; Power Transmission; Dynamical Systems; Systems Analysis

19980203192 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Rotation Invariant Neural Network-Based Face Detection
Rowley, Henry A., Carnegie-Mellon Univ., USA; Baluja, Shumeet, Carnegie-Mellon Univ., USA; Kanade, Takeo, Carnegie-Mellon Univ., USA; Dec. 1997; 16p; In English; Prepared in cooperation with Justsystem Pittsburgh Research Center, Pittsburgh, PA.
Contract(s)/Grant(s): N00014-95--I-0591; DAAH04-94-G-0006
Report No.(s): AD-A341629; CMU-CS-97-201; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper, we present a neural network-based face detection system. Unlike similar systems which are limited to detecting upright, frontal faces, this system detects faces at any degree of rotation in the image plane. The system employs multiple networks; the first is a router network which processes each input window to determine its orientation and then uses this information to prepare the window for one or more detector networks. We present the training methods for both types of networks. We also perform sensitivity analysis on the networks, and present empirical results on a large test set. Finally, we present preliminary results for detecting faces which are rotated out of the image plane, such as profiles and semi profiles.
DTIC
Neural Nets; Pattern Recognition; Computer Vision; Sensitivity; Rotation

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19980202413 Texas A&M Univ., Dept. of Mathematics, College Station, TX USA
Surface Fitting via Radial and Related Basis Functions with Applications to Neural Networks ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Narcowich, Francis J., Texas A&M Univ., USA; Ward, Joseph D., Texas A&M Univ., USA; Feb. 25, 1998; 9p; In English
Contract(s)/Grant(s): F49620-95-1-0194
Report No.(s): AD-A342010; AFRL-SR-BL-TR-98-0300; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Progress was made along several fronts during this period. Classes of RBF, periodic, and nonstationary spherical wavelets were constructed, all being capable of synthesizing and analyzing scattered data. Shape preservation problems were investigated. A framework for obtaining rates of approximation in non-traditional settings and data - i.e. compact manifolds and generalized Hermite data, was provided. This framework was used to derive approximation rates for various classes of functions on the circle and the 2-sphere. In particular, for a broad class of functions, rates of approximation were obtained for scattered data on the m-sphere. Stability questions related to these classes of functions were studied. Results from the work above were applied to neural networks.
DTIC
Neural Nets; Algorithms; Pattern Recognition; Architecture (Computers)

19980203161 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
High Order Numerical Methods for Discontinuous or High Gradient Problems ***Final Report, 15 Mar. 1994 - 15 Jan. 1998***
Shu, Chi–Wang, Brown Univ., USA; Mar. 09, 1998; 10p; In English
Contract(s)/Grant(s): DAAH04-94-G-0205

Report No.(s): AD-A344382; ARO-32612.1-MA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project is about the design, analysis and application of high order accurate and nonlinearly stable finite difference (including finite volume), finite element and spectral algorithms for computing solutions of partial differential equations which are either discontinuous or with sharp gradients. Algorithm development, theoretical study about stability and convergence of the algorithms, investigation about efficient implementation including parallel implementations, and applications in compressible and incompressible gas dynamics and in semiconductor device simulations, are performed. The achievement strengthens our objective to obtain powerful and reliable high order numerical algorithms and use them to solve problems containing discontinuous solutions, especially those of army interest.

DTIC

Algorithms; Gradients; Finite Element Method; Finite Volume Method; Design Analysis; Finite Difference Theory

65
STATISTICS AND PROBABILITY

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

19980202333 Army Research Lab., Aberdeen Proving Ground, MD USA

The Generation, Use, and Misuse of "PKs" in Vulnerability/Lethality Analyses ***Final Report, Jan. 1997 - Oct. 1997***

Deitz, Paul H., Army Research Lab., USA; Starks, Michael W., Army Research Lab., USA; Mar. 1998; 43p; In English

Contract(s)/Grant(s): DA Proj. 1L1-62618-AH-80

Report No.(s): AD-A340652; ARL-TR-1640; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Beginning with World War II and its aftermath, the area of ballistic vulnerability/lethality (V/L) was first defined as a specific discipline within the field of ballistics. As the field developed, various practices and metrics emerged. In some cases metrics were developed that were abstractly useful but bore no direct relationship to field observables. In the last decade, as issues concerning Live Fire strategies have gained importance, increased attention has been focused on V/L with the intent of bringing greater rigor and clarity to the discipline. In part this effort has taken the form of defining a V/L Taxonomy, which is a method of decomposing a series of concatenated complex processes into separable, less complex operations, each with certain specifiable properties and relationships. Using the Taxonomy, this report describes the most commonly used V/L metrics are a function of platform aggregate damage, reduced platform capability, and reduced military utility. We show that these three distinct and separable classes of metrics are linked by operators that are multivariate, stochastic, and nonlinear. We also show that it is useful to form probability distributions with respect to initial and boundary conditions in order to characterize damage, capability, and utility. Many defense community studies ignore these distinctions to the detriment of fundamental clarity. Examples are given and potential remedies described.

DTIC

Ballistics; Lethality; Vulnerability; Warfare; Damage; Ordnance; Multivariate Statistical Analysis

19980202345 California Univ., Dept. of Statistics and Applied Probability, Santa Barbara, CA USA

A Practical Guide to Heavy Tails: Statistical Techniques for Analyzing Heavy Tailed Distributions

Adler, Robert J., Editor, California Univ., USA; Feldman, Raisa E., Editor, California Univ., USA; Taqqu, Murad S., Editor, California Univ., USA; Jan. 1997; 5p; In English; Sponsored in part by the Israel Science Foundation

Report No.(s): AD-A336956; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Data with heavy-tailed histograms has traditionally been difficult, if not impossible to analyze statistically. Although heavy-tailed distributions and processes have been studied for decades, major advances in the development of statistical analysis techniques have been made only within the last 10 years or so. Many of these newly developed techniques were summarized in 1994 in a work by Samorodnitsky and Taqqu. Their collection provided a theoretical background for the papers in this collection, which consists of expository papers on techniques for data analysis, applications, and models for the general practitioner. These papers were gathered from many disciplines and are intended as a users' guide for the analysis of heavy-tailed data.

CASI

Statistical Analysis; Manuals; Probability Theory

19980202686 College of William and Mary, Williamsburg, VA USA

Improved Techniques for Modeling and Controlling Nonlinear Systems with Few Degrees of Freedom ***Final Report, 1 Apr - 31 Dec. 1997***

Tracy, E. R., College of William and Mary, USA; Brown, Reggie, College of William and Mary, USA; Mar. 27, 1998; 12p; In

English
Contract(s)/Grant(s): F49620-97-1-0158
Report No.(s): AD-A340951; TR-333261; AFRL-SR-BL-TR-98-0309; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

New nonlinear signal processing and modeling techniques were examined. The key issues which formed the focus of the project were: (1) The design of coupling terms for synchronizing the model with driving signals from the system of interest. This is the first analytical result of its kind, and gives sufficient conditions for guaranteeing that the model will synchronize. (2) The development of symbolic time series methods for estimation of correlation timescales of complex signals and the detection of weak periodicities. (3) A theory of anomalous scaling behavior in not normal systems which are subcritical (i.e. linearly stable but unstable to finite amplitude perturbations). Both noise free and noise driven cases were treated.
DTIC
Time Series Analysis; Nonlinear Systems; Procedures; Models; Degrees of Freedom

19980202711 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Anderson-Darling and Cramer-Von Mises Based Goodness-of-Fit Tests for the Weibull Distribution With Known Shape Using Normalized Spacings
Frisco, Eric W., Air Force Inst. of Tech., USA; Mar. 1998; 189p; In English
Report No.(s): AD-A341241; AFIT/GOR/ENC/98M-01; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Two new goodness-of-fit tests are developed for the three-parameter Weibull distribution with known shape parameter. These procedures eliminate the need for estimating the unknown location and scale parameters prior to initiating the tests and are easily adapted for censored data. This is accomplished by employing the Anderson-Darling and Cramer-von Mises statistics based on the normalized spacings of the sample data. Critical values of the new tests are obtained for common significance levels by large Monte Carlo simulations for shapes 0.5(0.5)4.0 and sample sizes 5(5)40 with up to 40% censoring (Type II) from the left and/or right. An extensive Monte Carlo power study is also conducted to compare the two tests with each other and with their prominent competitors. The competitors include another spacings test, Z*, and the modified Kolmogorov-Smirnov, Cramer-von Mises, and Anderson-Darling EDF tests. Results show the Anderson-Darling spacings test is the preferred test for the three-parameter Weibull distribution with known shape parameter.
DTIC
Weibull Density Functions; Censored Data (Mathematics); Goodness of Fit; Kolmogorov-Smirnov Test; Statistical Tests

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19980202459 Johns Hopkins Univ., Dept. of Electrical and Computer Engineering, Baltimore, MD USA
Research on Gain Scheduling ***Final Report, 1 Mar. 1995 - 28 Feb. 1997***
Rugh, Wilson J., Johns Hopkins Univ., USA; Apr. 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0195; AF Proj. 2304
Report No.(s): AD-A342757; AFRL-SR-BL-TR-98-0390; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final technical report provides a summary and documentation of research accomplishments on methods to improve the performance of gain scheduled controller designs. The main topics involve use of information about scheduling signals, in addition to their current values, to improve performance, the establishment of an optimization framework for the analysis and design of gain scheduled systems, and the development of controller interpolation methods. A list of journal publications is included.
DTIC
Nonlinear Systems; Scheduling; Control Theory; Controllers; Interpolation

19980202895 Synergia, Redwood City, CA USA
Computational Models of Human Organization Dynamics ***Quarterly Report, 16 Feb. - 15 Oct. 1997***
Courand, Gregg, Synergia, USA; Fehling, Michael, Synergia, USA; Oct. 15, 1997; 5p; In English
Contract(s)/Grant(s): MDA972-97-C-0001
Report No.(s): AD-A341743; COD-2; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This is the second quarterly report for the project: Computational Models of Human Organization Dynamics. This report covers the period from 7/16/97 through 10/15/97. Progress During Reporting Period: During this project period we have made signifi-

cant progress on the specification and initial development of a suite of software technologies to enable analysts to define, validate, and explore the implications of models of organization dynamics. We divide these technologies into three tool suites, which we are beginning to implement in the form of interfaces. Taken together, these technologies will allow users to develop an understanding of an organization's dynamics based on the results of monte carlo simulations. Our conception of these three technology suites is as follows.
DTIC
Mathematical Models; Computer Programs; Technology Assessment

19980202905 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
An Advanced Visualization Method for an Operations Research Analysis
Oimoen, Steven C., Air Force Inst. of Tech., USA; Mar. 1998; 223p; In English
Report No.(s): AD-A341211; AFIT/GOR/ENG/98M-01; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
Visualizing multidimensional data using only two dimensions and conventional visualization techniques limits the understanding of the data set. Underlying structures or patterns within the data can easily go unnoticed. In order to gain additional insight into an analysis, incorporation of visualization and multidimensional graphics into the analysis results should be accomplished. The results must ensure that the information portrayed is not misleading or misunderstood. The integrity of the data must be preserved throughout the transformation. The primary objective of this research effort is to identify techniques to visualize multidimensional data and then develop a software tool to display the multidimensional data in order to gain insight into the data and analysis performed.
DTIC
Operations Research; Computer Graphics; Display Devices; Object-Oriented Programming

19980202911 Honeywell Technology Center, Minneapolis, MN USA
Nonlinear Control Theory for Aerospace Vehicles ***Final Report, Mar. 1995 - Mar 1998***
Morton, Blaise, Honeywell Technology Center, USA; Elgersma, Michael, Honeywell Technology Center, USA; Mar. 23, 1998; 77p; In English
Contract(s)/Grant(s): F49620-95-C-0015
Report No.(s): AD-A341388; AFRL-SR-BL-TR-98-0283; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This report contains two related manuscripts on the subject of mechanism geometry. The first paper addresses general theory, the second addresses practical computations. Together, they suggest a general approach for efficient parametrization of spatial mechanism configuration spaces.
DTIC
Control Theory; Nonlinearity; Aerospace Vehicles; Geometry

19980203153 Georgia Inst. of Tech., School of Industrial and Systems Engineering, Atlanta, GA USA
Search Strategies in Large-Scale Discrete Optimization: A Joint AI/OR Approach ***Final Report, 1 Jul. 1996 - 31 Dec. 1997***
Etherington, David W., Oregon Univ., USA; Joslin, David, Oregon Univ., USA; Nemhauser, George L., Georgia Inst. of Tech., USA; Mar. 31, 1998; 29p; In English; Prepared in collaboration with Oregon Univ., Computational Intelligence Research Lab., Eugene, OR.
Contract(s)/Grant(s): F49620-96-1-0335; AF Proj. 2304
Report No.(s): AD-A341379; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The aim of this award was to exploit and enhance the differing strengths of Artificial Intelligence (AI) and Operations Research (OR) in solving hard combinatorial optimization problems, discover synergies, and so develop better solution techniques. by studying the strengths and weaknesses of the various approaches in the context of a large scale manufacturing problem, a new AI solution approach capable of producing better solutions than traditional heuristic methods and handling larger problems than exact techniques was developed. This new approach generalizes a number of seemingly divergent existing techniques and seems to be widely applicable. In addition, it was discovered that OR techniques can be used to augment the new AI solver, resulting in significant improvements in both solution time and quality. This hybridized approach has also led to a new understanding of the OR technique known as 'column generation,' and these insights promise improvements in solution quality and time for a variety of OR problems.
DTIC
Linear Programming; Artificial Intelligence; Operations Research

19980203195 Naval Postgraduate School, Monterey, CA USA

Efficiently Interdicting a Time-Expanded Transshipment Network

Derbes, H. D., Naval Postgraduate School, USA; Sep. 1997; 85p; In English

Report No.(s): AD-A341596; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A 'network interdictor' as a limited supply of resource with which to disrupt a 'network user's' flow of supplies in a capacitated transhipment network. The interdictor's problem of minimizing the maximum flow through the network is a difficult-to-solve integer programming problem but we show that a heuristic based on Lagrangian relaxation is very effective in approximately solving the problem. We implement algorithms in C to approximately solve both the static (without considering time) and dynamic network interdiction problems. Static test networks range in size from 25 nodes and 64 arcs to 400 nodes and 1519 arcs. Using an IBM RS/6000 Model 590 workstation, we find optimal solutions for seven of 12 test networks and solve the largest problem in only 31.0 seconds. We model a dynamic network in time-expanded form in order to assign time weights of 0 to 1 to flow, include repair time of interdicted arcs, and provide a schedule to the network interdictor that identifies arcs and time periods for interdictions. Dynamic networks range in size from 525 nodes and 1.344 arcs to 40,400 nodes and 153.419 arcs (in time-expanded form). We find near-optimal solutions in 13 to 24 test networks and solve the largest network in 1729.5 seconds.

Author

Mathematical Models; Networks; Lagrangian Function; Integers; Heuristic Methods; Algorithms

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PHYSICS (GENERAL)

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

19980202693 Department of the Navy, Washington, DC USA

Bridge Configuration for a Magneto-Resistive Linear-Displacement Sensor

Lubitz, Peter, Inventor, Department of the Navy, USA; Hoines, Lilian, Inventor, Department of the Navy, USA; Jan. 13, 1997; 26p; In English

Patent Info.: Filed 13 Jan. 1997; US-Patent-Appl-SN-806044

Report No.(s): AD-D018767; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A thermal bridge includes a first Giant Magneto Resistance film having a layer with a fixed bias pointing in a first direction, and a second Giant Magneto Resistance film superposed on, and in thermal engagement with, the first Giant Magneto Resistance film. The second Giant 5 Magneto Resistance film has a layer with a fixed bias pointing in a second direction opposite to the first direction.

DTIC

Electric Bridges; Displacement; Magnetoresistivity

19980202708 Brunel Univ., Uxbridge, UK

Robust Adaptive Finite Element Schemes for Nonlinear Viscoelastic Solid Deformation: An Investigative Study ***Interim Report, 11 Dec. 1997 - 11 Mar. 1998***

Whiteman, J. R., Brunel Univ., UK; Shaw, S., Brunel Univ., UK; Mar. 11, 1998; 5p; In English

Contract(s)/Grant(s): N68171-97-M-5763

Report No.(s): AD-A341249; R/D-8336-MS-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During this second three month phase of the seed project we have consolidated the phase 1 work on the Volterra formulation of linear quasistatic viscoelasticity problems, and three papers have now been submitted to research journals. Another paper is expected to be submitted before the summer. The visit of Dr. A.R. Johnson during March 1-8 was highly productive. During this time Drs. Johnson and Shaw implemented an adaptive solution procedure into Dr. Johnson's existing code for numerically simulating viscoelastic beam problems, while Dr. Johnson and Prof. Whiteman made progress on the direction the work should take toward simulating constitutively nonlinear viscoelastic response. During the visit of Dr. J. Illinger to BICOM on March 6 discussion took place concerning the extension of the seed project to a second year, Sept. 1998-Sept. 1999, in view of the undoubted success of the research and the collaboration between BICOM and ARL, NASA Langley.

DTIC

Deformation; Viscoelasticity; Nonlinearity; Robustness (Mathematics); Solid Phases; Finite Element Method

19980202904 Connecticut Univ., Storrs, CT USA
Integrated Optical Transceiver ***Final Report, 16 Sep. 1995 - 31 Mar. 1997***
Taylor, Geoffrey W., Connecticut Univ., USA; Jun. 1997; 111p; In English
Contract(s)/Grant(s): F33615-95-C-1632; AF Proj. 2001
Report No.(s): AD-A341600; WL-TR-97-1181; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In previous work for the Air Force on the Three Terminal Optoelectronic Array program, a technology base was developed for the implementation of monolithic integrated optoelectronic circuits based upon the modulation doped inversion channel interface. In the Integrated Optical Transceiver program, that technology was adapted to the implementation of traveling wave devices that could operate at frequencies up to 100 Gb/s. The concepts of a grating coupled vertical cavity laser and a grating coupled resonant cavity detector are introduced and designs were completed and implemented in photomasks. The performance of the second order grating was evaluated and models developed. The insertion of the grating into the vertical cavity waveguide was characterized and the laser performance was analyzed. A new approach to the implementation of the waveguide was developed. The speed of the detector was analyzed as a function of the velocity mismatch. A complete set of photomasks (14 levels) was developed including traveling wave devices, O/E test circuits and a variety of diagnostic test chips. The devices implemented include FET circuits-CCDs, switch based O/E interface circuits, HFET and DOES lasers as vertical emitters, directional couplers, and heterodyne laser sources.
DTIC
Waveguides; Traveling Waves; Integrated Circuits; Technology Assessment; Field Effect Transistors

19980203020 Queens Coll., Dept. of Physics, Flushing, NY USA
Systematics of Permanent Magnet Film Texturing and the Limits of Film Synthesized 1-12 and 2-17 Iron Based Rare Earth Transition Metal Permanent Systems ***Final Report, 15 Apr. 1994 - 31 Dec. 1997***
Cadieu, Fred J., Queens Coll., USA; Jan. 21, 1998; 21p; In English
Contract(s)/Grant(s): DAAH04-94-G-0079
Report No.(s): AD-A344282; ARO-31518.9-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant was concerned with the optimization of both the magnetic properties of new rare earth transition metal permanent magnet phases, and of the film synthesis methods which have been used to synthesize high energy product film magnets and structures. High energy product permanent magnet sputtered films were synthesized onto polycrystalline substrates that either have the easy direction of magnetization in the film plane or perpendicular to the film plane. In-plane magnetized Sm-Co films were synthesized with 16-18 MGOe energy products. Other perpendicular anisotropy tetragonal Nd(Fe,Co,Mo)12N films were made with a room temperature energy product of 46.3 MGOe. The systematics of sputter process control used to grow textured permanent magnet films were elaborated in several publications. A key aspect of this work was the elucidation of surface atom mobility in controlling film texture. In recent studies that are still in progress pulsed laser deposition, PLD, was used to grow high coercivity SmCo based films. Room temperature coercivities up to 11.3 kOe have been achieved for PLD deposited films.
DTIC
Magnetic Materials; Pulsed Laser Deposition; Magnetic Films; Rare Earth Elements; Polycrystals; Transition Metals

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ACOUSTICS

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

19980202404 Naval Research Lab., Shallow Water Coastal Acoustics Section, Stennis Space Center, MS USA
The Effects of Ambient Shipping Noise on the Performance of Single and Multiple Channel Moment Detectors for Unknown Transient Signals ***Final Report***
Pflug, Lisa a., Naval Research Lab., USA; Ioup, George E., Naval Research Lab., USA; Iopu, Juliette W., Naval Research Lab., USA; Mar. 27, 1998; 53p; In English; Prepared in collaboration with New Orleans Univ.
Report No.(s): AD-A342783; NRL/FR/7173--97-9678; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Second, third, and fourth order moments are used for passive detection of simulated transient signals embedded in both simulated independent Gaussian noise and measured noise. The measured noise was recorded by a vertical array located near the San Diego harbor and is dominated at low frequencies by ship-generated noise. The detectors do not assume noise or signal stationarity, and can use either one, two, or p channels of data for the p-th order moment detector. Detection simulations using six synthetic transient signals embedded in the measured noise reveal that the fourth order moment detector often detects better than the second order moment (or energy) detector in both the Gaussian noise and the measured noise. Although the application of one-dimension-

al passband filters before the moment calculations improves the performance of all three detectors, it induces additional detection gain for the higher order moment detectors.
DTIC
Signal Processing; Acoustic Measurement; Underwater Acoustics; Method of Moments; Noise (Sound); Sound Detecting and Ranging

19980202668 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Inst. of Applied Physics, Delft, Netherlands
Underwater Sound Radiation: further Analysis of Nearfield Acoustic Holography experiments
deJong, C. A. F., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vanderKnaap, F. G. P., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Sep. 15, 1997; 27p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KM/131
Report No.(s): TPD-HAG-RPT-970114; TD-97-0316; Copyright; Avail: Issuing Activity (TNO-Inst. of Applied Physics, Stieltjesweg 1, 2628 CK, Delft, The Netherlands); US Sales Only, Hardcopy, Microfiche

This report describes a part of the long term research program at TNO-TPD that is aimed at the development of tools for the prediction of the underwater acoustic signature of ships in the design stage. The Nearfield Acoustic Holography (NAH) technique is being applied as a tool to study experimentally the sound radiation from the ship hull. NAH can be used as a diagnostic tool and as an experimental method to validate prediction methods. The post-processing of the data has been extended with the concept of ”Supersonic Acoustic Intensity”, which reveals the contributions of sound radiated from different parts of the structure to the farfield, undisturbed by the energy that is circulating in the nearfield. This technique has been applied to further investigate the interpretation of existing data from NAH measurements on a series of ”baffled plate” experiments and on an ANTEASR scale model.
Author
Underwater Acoustics; Acoustic Properties; Acoustical Holography; Prediction Analysis Techniques; Sound Waves

19980202762 Maryland Univ., Dept. of Computer Science, College Park, MD USA
Numerical Methods for Underwater Structural Acoustics Simulations ***Final Report, 1 Mar. 1995 - 1 Dec. 1997***
Elman, Howard, Maryland Univ., USA; OLeary, Dianne P., Maryland Univ., USA; Mar. 31, 1998; 8p; In English
Contract(s)/Grant(s): N00014-95-1-0338
Report No.(s): AD-A341089; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Algorithms were developed for the numerical solution of the Helmholtz problems with Sommerfeld like boundary conditions. Discretization by finite differences or finite elements can be effectively preconditioned using similar operators but separable boundary condition. We empirically demonstrated that the preconditioners are easy to apply and cause iterative methods such as GMRES to converge in a very modest number of iterations. Parallel implementation on the SP-2 computer enabled efficient solution of quite large problems. We then provided the fast analysis of such problems by noticing that the eigenvalues for two and three-dimensional domains can be calculated exactly by solving a set of one-dimensional eigenvalue problems. This observation permits analysis of quite large problems. Preconditioning using Neumann boundary conditions yields eigenvalues that are uniformly bounded, located in the first quadrant, and outside the unit circle. In contrast, Dirichlet boundary conditions yield eigenvalues that approach zero as the product of wave number with the mesh size is deceased. We have extended our algorithm to inhomogeneous media in which the speed of wave propagation is different on an interior domain. The algorithms display efficiency comparable to that for the homogeneous medium, mating them quite useful for the problem of acoustic analysis with a submarine.
DTIC
Underwater Acoustics; Numerical Analysis; Simulation; Acoustic Measurement; Algorithms

19980203167 NASA Langley Research Center, Hampton, VA USA
Method for Fabricating Piezoelectric Polymer Acoustic Sensors
Hall, Thomas E., Jr., Inventor, NASA Langley Research Center, USA; Bryant, Timothy D., Inventor, NASA Langley Research Center, USA; May 12, 1998; 14p; In English; Division of abandoned US-Patent-Appl-SN-319142, filed 4 Oct. 1994
Patent Info.: Filed 28 Feb. 1996; NASA-Case-LAR-14240-2; US-Patent-5,750,002; US-Patent-Appl-SN-622175; US-Patent-Appl-SN-319142; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A method for forming a sensor includes providing a first and a second film and bonding an internal connection tab there between. The internal connection tab is positioned between the inner surfaces of the first and second film. Then, a conductive adhe-

sive is applied to either the tab or to the inner film surfaces such that the inner surfaces of the film and the tab are electrically connected. Finally, the films are pressed together to bond the film together with the internal connection tab in between.
Official Gazette of the U.S. Patent and Trademark
Piezoelectricity; Fabrication; Acoustics; Sound Transducers; Polymeric Films; Adhesive Bonding

19980203170 NASA Kennedy Space Center, Cocoa Beach, FL USA
Self-Calibrating and Remote Programmable Signal Conditioning Amplifier System and Method
Medelius, Pedro J., Inventor, NASA Kennedy Space Center, USA; Hallberg, Carl G., Inventor, NASA Kennedy Space Center, USA; Simpson, Howard J., III, Inventor, NASA Kennedy Space Center, USA; Thayer, Stephen W., Inventor, NASA Kennedy Space Center, USA; Mar. 31, 1998; 10p; In English; Continuation-in-part of US-Patent-Appl-SN-233583, filed 26 Apr. 1994
Patent Info.: Filed 29 Mar. 1996; NASA-Case-KSC-11688; US-Patent-5,734,596; US-Patent-Appl-SN-624152; US-Patent-Appl-SN-233583; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A self-calibrating, remote programmable signal conditioning amplifier system employs information read from a memory attached to a measurement transducer for automatic calibration. The signal conditioning amplifier is self-calibrated on a continuous basis through use of a dual input path arrangement, with each path containing a multiplexer and a programmable amplifier. A digital signal processor controls operation of the system such that a transducer signal is applied to one of the input paths, while one or more calibration signals are applied to the second input path. Once the second path is calibrated, the digital signal processor switches the transducer signal to the second path. and then calibrates the first path. This process is continually repeated so that each path is calibrated on an essentially continuous basis. Dual output paths are also employed which are calibrated in the same manner. The digital signal processor also allows the implementation of a variety of digital filters which are either programmed into the system or downloaded by an operator, and performs up to eighth order linearization.
Official Gazette of the U.S. Patent and Trademark
Amplifiers; Signal Processing; Digital Filters; Amplifier Design; Calibrating

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19980202504 Georgia Univ., Research Foundation, Athens, GA USA
Fundamental Studies of Ions and Ionic Processes ***Final Report, 1 Nov. 1996 - 31 Oct. 1997***
Schaefer, Henry F., Georgia Univ., USA; Apr. 08, 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0059; AF Proj. 2303/FS
Report No.(s): AD-A342686; AFRL-SR-BL-TR-98-0393; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The object of this research is to characterize the energetics, spectroscopic properties, and elementary chemical reactions of molecular ions. The approach used will exploit recent developments in ab initio molecular quantum mechanics. Some of the systems to be studied include the species CF sub n and (n=1-3), SF sub n and (n=1-7), (HNO3)n (H2O)m, (ClNO3), (H2SO4)m (HNO3)n (H2O)o, and + CH4.
DTIC
Ions; Quantum Chemistry; Quantum Theory; Chemical Reactions; Nitric Acid

19980202552 National Lab. for High Energy Physics, Radiation Safety Control Center, Tsukuba, Japan
Implementation of an L-Shell Photoelectron and an L X-Ray for Elements into the EGS4 Code
Hirayama, H., National Lab. for High Energy Physics, Japan; Namito, Y., National Lab. for High Energy Physics, Japan; Ban, S., National Lab. for High Energy Physics, Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 10-16; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The subroutines PHOTO and EDGSET were modified in order to treat photo-electrons from L photoabsorption and L fluorescence photons in elements. The L1, L2 and L3 shells are treated separately. An L fluorescence photon after K fluorescence is also treated. The flag IEDGFL(IR) is used to produce fluorescence photons or to disable them for each region (IR). When IEDGFL is set to the atomic number of the element at each region, fluorescence photons can be produced after K and L photoabsorption. If IEDGFL is negative and its absolute value is the atomic number of the element, although a photoelectron after the L photoab-

sorption is produced, a fluorescence photon is treated as energy absorption. In the case that IEDGFL is equal to zero, a photoelectron produced after K only photoabsorption is treated without a fluorescence photon.
Author
Photoelectrons; X Rays; Photoabsorption

19980202554 Tsukuba Univ., Japan
On the Behaviour of Secondary Electrons From Materials of Various Atomic Numbers
Tada, J., Tsukuba Univ., Japan; Hirayama, H., National Lab. for High Energy Physics, Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 24-31; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Absorbed dose is the most fundamental dosimetric quantity in the current system of radiation dosimetry. As the quantity is defined as spatial density of mean energy imparted to a small volume of the matter, its value is extremely influenced by the distribution of the matter around the point of interest. It is not easy to understand the property of the absorbed dose of X- and gamma rays near the boundary of matter where charged particle equilibrium does not hold, since almost all of the energy imparted are brought by the Coulomb interaction between charged particles in the volume. In this respect, it is important to know the behaviour of the secondary electrons in the vicinity of the interface of materials. In this paper, results of numerical analysis of the behaviour of the forward scattered secondary electron (FSSE) from materials with various atomic numbers are discussed. Concerning this problem, Hine reported experimental results. His experiment is to observe the changes (increase) of the response of an ionization chamber irradiated with gamma rays by putting a thin foil of various materials in front of it. The chamber wall was made of aluminium of 0.0064 mm thick (which is approximately equal to the CSDA range of 25 keV electron), and the thicknesses of the foils were chosen approximately equivalent to the range of secondary electrons (according to his expression) . It is reported that the yield of FSSE are at a minimum on materials of medium atomic number.
Derived from text
Electrons; Secondary Emission; Atomic Structure; Numerical Analysis; Radiation Dosage

19980202560 Nagoya Univ., School of Engineering, Nagoya, Japan
Calculations of Wall Effect in Proportional Counter for Absolute Radioactivity Measurements of Gaseous Radioisotopes
Wu, Y., Nagoya Univ., Japan; Mori, C., Nagoya Univ., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 70-75; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

For absolute radioactivity measurement of gaseous samples, two new methods, known as "diffusion-in a long proportional counter method" and "position-sensitive proportional counter method", were developed to eliminate the end effect of proportional counters and high precision of the measurements were obtained. However, the wall effect also affects the measurement in addition to the end effect. It is because that for the sample gas near the wall of the proportional counter some beta-rays lose little energy in the counting gas and dissipate most of the energy in the wall of the counter, so that their pulse heights become very small. On the other hand, in order to eliminate electronic noise, the pulse discrimination level must be set in this system. Thus, if the pulse height is below the pulse discrimination level, the pulse will not be counted, which is called wall effect. Wall effect can be measured with the pressure extrapolation method, but this measurement needs an energy calibration source which emits very low monoenergetic radiation, for example Ar-37 emitting 22OeV L-Auger electrons. This kind of source is not easy to obtain in general, so that it is important to evaluate wall effect by calculation. Thus, EGS4 code is employed to calculate wall effect in this paper and the calculated results are compared with experimental results. The limits of EGS4 code for the evaluation of wall effect by the calculation are also discussed.
Author
Monte Carlo Method; Proportional Counters; Walls; Instrument Compensation; Extrapolation; Calibrating

19980202561 Tokyo Metropolitan Univ., Coll. of Allied Medical Sciences, Tokyo, Japan
Estimation of S/N Ratios for Double Beta Decay Experiments With DCBA
Kitamura, S., Tokyo Metropolitan Univ., Japan; Ishihara, N., National Lab. for High Energy Physics, Japan; Obama, T., National Lab. for High Energy Physics, Japan; Takeda, S., National Lab. for High Energy Physics, Japan; Yamada, Y., National Lab. for High Energy Physics, Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 76-91; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

A magnetic tracking detector called DCBA (Drift Chamber Beta-ray Analyzer) is proposed for double beta decay experiments. It will be able to measure the half lives of two-neutrino double beta decay (2upsilon(beta)(beta)) and neutrinoless double beta decay (0(upsilon)(beta)(beta)) of Nd-150. The measurable half-life limit of 0(upsilon)(beta)(beta) with DCBA is 4 x 10(exp

24) yr with enriched Nd-150, which lower the effective mass limit of Majorana neutrino down to 0.5 - 0.1 eV, depending on the nuclear matrix element. Possible backgrounds caused by gamma rays hitting source plates are studied using the EGS4 code and other Monte Carlo codes. In the measurement of 0(upsilon)(beta)(beta) decays, it is important to suppress gamma rays of energy between 4-6 MeV in order to reduce backgrounds. The estimation procedure of S/N (signal to background noise) ratios is described.
Author
Computation; Signal to Noise Ratios; Beta Particles; Particle Decay; Experimentation

19980202563 National Lab. for High Energy Physics, Tsukuba, Japan
A Design Study of the Collimator System for the Neutral Beam Line
Sato, T., National Lab. for High Energy Physics, Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 99-112; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

We are now preparing a proposal to search for a rare decay mode K(sub)L yields pi(sup 0)(upsilon)(upsilon) to the KEK 12 GeV Proton Synchrotron. K(sub L)'s are produced by bombarding a metal target with a proton beam. They are collected with a collimator system made with heavy metal. Although the charged particles produced at the target are swept out by the magnetic field around the collimator, the neutral particles such as neutrons and gammas are contaminating the K(sub L) beam. Because the amount of these contaminating particles are estimated to be nearly 1000 times of the K(sub L), we need to study the behavior of these contaminating particles to make the experiment successful. In this note, we describe the results of the simulation for the gammas coming from the decays of the neutral pions produced at the target by using the EGS4 code.
Author
Design Analysis; Collimators; Contamination; Estimating; Neutral Beams; Proton Beams

19980202712 Wisconsin Univ., Dept. of Chemistry, Madison, WI USA
Intramolecular and Intermolecular Energy Transfer in Highly Vibrationally Excited Molecules ***Final Report, 1 Oct. 1994 - 30 Sep. 1997***
Crim, F. F., Wisconsin Univ., USA; Mar. 18, 1998; 8p; In English
Contract(s)/Grant(s): F49620-95-1-0009; AF Proj. 2303/ES
Report No.(s): AD-A341237; AFRL-SR-BL-TR-98-0290; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research described in this Final Report was directed at studying the dynamics of vibrationally excited molecules, which are important in many energetic environments. The first goal was assembly of an ultrafast laser system producing 1 mJ, 100 fs pulses of 800 nm light, and implementing nonlinear processes for converting those pulses to infrared and ultraviolet light. This system permitted the a direct measurement of the time for intramolecular vibrational energy flow in nitric acid (HONO2) initially prepared with two quanta of O-H bond stretching excitation. The measurements showed that energy flowed out of that initially excited vibration in 12 ps, a time consistent with a coupling matrix element of about 0.08 /cm. This result on an isolated molecule sets the stage for the a similar measurement in a liquid.
DTIC
Vibration; Excitation; Energy Transfer; Lasers; Molecular Energy Levels

19980202877 National Inst. for Fusion Science, Nagoya, Japan
The Screening Length of Interatomic Potential in Atomic Collisions
Yamamura, Y., National Inst. for Fusion Science, Japan; Takeuchi, W., National Inst. for Fusion Science, Japan; Kawamura, T., National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-6364; 31p; In English
Report No.(s): NIFS-DATA-45; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In computer studies on the interaction of charged particle with solids, many authors treat the nuclear collision by the Thomas-Fermi screened Coulomb potential. For better agreement with experiment, the screening length is modified sometimes. We investigate the theoretical background for the correction factor of the screening length in the interatomic potential which can be deduced from two steps. The first step is to select the correction factor of an isolated atom so as to match the average radius of the Thomas-Fermi electron distribution with that of the Hartree-Fock electron distribution, where we use the Clementi and Roetti's table. The second step is to determine the correction factor of the screening length of the interatomic potential by using a combination rule. The correction factors obtained for the screening length are in good agreement with those determined by the computer analysis of the Impact Collision Ion Scattering Spectroscopy (ICISS) data.
Author
Atomic Collisions; Interatomic Forces; Computation; Charged Particles; Computer Techniques

19980203066 California Univ., San Diego, Dept. of Chemistry, La Jolla, CA USA
Nd:YLF Laser System for the Study of Termolecular Reactions and Metastable Isomers of Polyatomic Molecules ***Final Report, 1 Apr - 31 Dec. 1997***
Continetti, Robert E., California Univ., San Diego, USA; Dec. 31, 1997; 4p; In English
Contract(s)/Grant(s): F49620-97-1-0255; AF Proj. 2303
Report No.(s): AD-A341660; AFRL-SR-BL-TR-98-0316; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The DURIP grant F49620-97-1-0255 has supported acquisition of a state-of-the-art regeneratively amplified Ti:Sapphire laser system. This laser system is the primary laser for our new multi-particle photoelectron photofragment coincidence spectrometer, and is currently being used to carry out experiments on three-body dissociation dynamics in clusters of oxygen and ozone. These experiments make use of a new particle detector built in our laboratory capable of recording the time and position of arrival of up to eight photofragments in a period of 20-500 ns following a laser pulse. The initial DURIP proposal discussed the purchase of a Nd:YLF psec regenerative amplifier, however, the Ti:Sapphire laser purchased is a much more flexible and powerful laser, producing both psec and fsec pulses with a higher peak power. The initial experiments with this laser will use the fundamental and the 2nd, 3rd amd 4th harmonics. Future applications will include the generation of tunable radiation with an optical parametric amplifier and ultrafast experiments using 100 fs pulses. We took delivery of the laser December 1, 1997, with initial installation December 12, 1997.
DTIC
Polyatomic Molecules; Lasers; Metastable State; YLF Lasers; Isomers

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19980202555 Japan Atomic Energy Research Inst., Dept. of Health Physics, Tokai, Japan
Characterization of N-13 and O-15 Induced in Air of a High Energy Electron Acceleration Room
Endo, A., Japan Atomic Energy Research Inst., Japan; Henshaw, J., AEA Technology, UK; Mignanelli, M. A., AEA Technology, UK; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 32-39; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The amounts of N-13 and O-15, present as aerosol and gas in the air of a 100 MeV electron linear accelerator (linac) facility, were analyzed along with their chemical forms. Measurements showed that most of the N-13 and O-15 are gaseous forms and that their chemical forms are N2, O2, NO(x) and O3. Simulations with EGS4 and a radiation chemistry model were performed to study the chemical reactions of N-13 and O-15 with the radiolytic products of the air molecules. From the comparison between the experiment and simulations, significant factors that control the chemical compositions of N-13 and O-15 were identified.
Author
Oxygen Isotopes; Nitrogen Isotopes; High Energy Electrons; Experimentation; Inference

19980202565 Power Reactor and Nuclear Fuel Development Corp., Oarai, Japan
Conceptual Design of Beam Dump for High Power Electron Beam
Takei, H., Power Reactor and Nuclear Fuel Development Corp., Japan; Takeda, Y., Power Reactor and Nuclear Fuel Development Corp., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 122-128; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

A high power CW (Continuous Wave) electron linac has been developed at PNC and its injector section has been completed in 1996. This paper presents the conceptual design of beam dump for a high power low energy beam (200 kW of 10 MeV electron). It has a Ring and Disk structure. The thermal analysis, stress analysis showed that 200 kW electron beam could be securely stopped in the beam dump. The temperature rise at its highest position was estimated to be 343 degrees.
Author
Design Analysis; Dumping; Thermal Analysis; Stress Analysis; Continuous Radiation

19980202938 National Inst. for Fusion Science, Nagoya, Japan
Effect of Recombination Processes on FeXXIII Line Intensities
Murakami, Izumi, National Inst. for Fusion Science, Japan; Moribayashi, Kengo, National Inst. for Fusion Science, Japan; Kato, Takako, National Inst. for Fusion Science, Japan; May 1998; ISSN 0915-6364; 39p; In English
Report No.(s): NIFS-DATA-47; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

We have constructed a collisional-radiative model for Be-like Fe ion (Fe(22+)) to calculate the intensities of FeXXIII spectral lines in non equilibrium ionization plasma. In the model, we consider levels with n less than or approx. equal to 70 and take into account the ionization and recombination processes to/from Fe(23+) ion. The recombining processes of Fe(22+) ion had not been considered in detail in models for the spectral lines. We calculate the dielectronic recombination rate coefficients into the excited states with use of the Cowan's code. We examine the effect of radiative cascades from levels with n greater than or approx equal to 5 to the population densities and find it is important especially for the recombining plasma. We study the line intensities and the intensity ratios as a function of an electron temperature at an electron density of 10(exp 14)/cc for a plasma in non equilibrium ionization with arbitrary ion abundance ratio of Fe(23+) ion to Fe(22+) ion. The dielectronic satellite lines and the radiative loss by Fe(22+) ion are also discussed.
Author
Electron-Ion Recombination; Iron Isotopes; Standard Model (Particle Physics); Line Spectra; Flux Density

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OPTICS

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

19980201922 Air Force Inst. of Tech., Dept. of Engineering Physics, Wright-Patterson AFB, OH USA
Investigation of the Optical Properties of Ordered Semiconductor Materials
McCrae, Jack E., Air Force Inst. of Tech., USA; Jan. 22, 1997; 158p; In English
Report No.(s): AD-A339037; AFIT/DS/ENP/97-03; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Optical Studies have been conducted upon CdGeAs2 and ZnGeP2, two of the most promising semiconductors being developed for mid-infrared non-linear optics applications. These experiments included PhotoLuminescence (PL) studies of both compounds as well as PhotoReflectance (PR) measurements upon CdGeAs2. In addition, Hall effect measurements were carried out upon CdGeAs2, to aid in interpretation of the optical data. PL was measured as a function of laser power, sample temperature, and crystal orientation for CdGeAs2. One broad weak peak near 0.38 eV, and another somewhat narrower and often far brighter peak near 0.57 eV were found by low temperature (4 K) PL measurements. Strongly polarized PL was observed with the E field of the PL parallel to the material's c-axis. A polarization ratio as high as 6:1 was observed. PL on ZnGeP2 in the mid-IR revealed a pre viously unreported PL peak near 0.35 eV. PR measurements on CdGeAs2 allowed the estimation of the bandgap as a function of temperature. Hall effect measurements on CdGeAs2 reveals the dominant acceptor level lies about 120 meV above the valence band.
DTIC
Optical Properties; Optical Materials; Experimentation; Semiconductors (Materials); Infrared Radiation; Optical Equipment; Product Development

19980202046 NASA Goddard Space Flight Center, Greenbelt, MD USA
Scattered light in the STIS echelle modes
Landsman, W., Hughes STX, Inc., USA; Bowers, C., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 132-137; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Space Telescope Imaging Spectrograph (STIS) echelle spectra obtained during the Early Release Observations have non-zero residuals in the cores of saturated interstellar lines, indicating the need for a scattered light correction. A rough measure of the magnitude of the needed correction shows the ratio of the interorder to the in-order flux in different echelle modes in both pre-launch calibration images of a continuum lamp source and in post-launch images of stellar continuum sources. The interorder and in-order fluxes are computed by averaging the central 200 pixels in the dispersion direction. The amount of scattered light in the interorder region rises toward shorter wavelengths for two reasons: (1) the order separation decreases toward shorter wavelengths; and (2) the amount of echelle scattering is expected to have an inverse dependence on wavelength. At the shortest wavelengths the fraction of light scattered into the interorder region can be 10% for the Near-ultraviolet-Multi-Anode Microchannel Array (NUV-MAMA) and 15% for the Far-ultraviolet-Multi-Anode Microchannel Array (FUV-MAMA).
Author
Light Emission; Hubble Space Telescope; Echelle Gratings; Line Spectra; Stellar Spectra; Imaging Spectrometers; Light Scattering

19980202048 NASA Goddard Space Flight Center, Greenbelt, MD USA

Determination of geometric distortion in STIS images

Malumuth, Eliot M., Hughes STX, Inc., USA; Bowers, Charles W., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 144-149; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This is a report on the characterization of the geometric distortion of the Space Telescope Imaging Spectrograph (STIS) Charge Coupled Devices (CCD) and the STIS Far-Ultraviolet Multi-Anode Microchannel Arrays (FUV-MAMA) detectors when used in imaging mode. We find that the amount of the distortion is fairly small over most of the field. The maximum displacement is 1.66 pixels for the CCD and 2.71 pixels for the FUV-MAMA. This data also allows us to determine the plate scale for both cameras. For the CCD the scale is 0”.05071 +/- 0”.00007 /pixel. For the FUV-MAMA the scale is 0”.02447 +/- 0”.00001 /pixel in x and 0”.02467 +/-0”.00002 /pixel in y.

Author

Multi-Anode Microchannel Arrays; Charge Coupled Devices; Hubble Space Telescope; Geometric Rectification (Imagery); Displacement; Far Ultraviolet Radiation; Geometric Accuracy; Radiation Detectors

19980202049 Advanced Computer Concepts, Inc., Greenbelt, MD USA

Fringe science: Creating a STIS CCD fringe flat field

Plait, Philip, Advanced Computer Concepts, Inc., USA; Bohlin, Ralph, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 150-155; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Internal interference in the Space Telescope Imaging Spectrograph (STIS) Charge Coupled Devices (CCD) in mode G750L causes large amplitude fringing in spectra at wavelengths longer than 7000A. Flat fields taken contemporaneously with a spectral observation will usually reduce the effect of fringing, but there may be occasions when previously observed flat fields will be more useful. We present a method for modifying long slit (52 x O.l arcsec) internal tungsten lamp flat observations for this use. We find that in many cases, the effect of fringing can be reduced by more than a factor of four.

Author

Hubble Space Telescope; Charge Coupled Devices; Diffraction Patterns; Spectrum Analysis; Amplitudes; Imaging Spectrometers; Emission Spectra

19980202050 European Southern Observatory, Spect Telescope European Coordinating Facility, Garching, Germany

Extraction of point source spectra from STIS long slit data

Walsh, J. R., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 156-160; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Space Telescope Imaging Spectrograph (STIS) provides a unique opportunity to obtain spectra of point sources from very crowded fields and complex scenes, such as galactic nuclei, utilizing high spatial resolution. A small suite of programs is described for simple and optimal extraction of point source spectra, targeted specifically at STIS data. A multi-channel (spatial) restoration is also under development using the method employed by Lucy and Hook for imaging data. The algorithms are briefly described and applications to STIS Servicing Mission Observatory Verification (SMOV) data illustrates the potential.

Author

Extraction; Point Sources; Hubble Space Telescope; Algorithms; Emission Spectra; Applications Programs (Computers); Point Spread Functions; Data Processing

19980202053 Space Telescope Science Inst., Baltimore, MD USA

The photometric performance of NICMOS

Colina, L., Space Telescope Science Inst., USA; Rieke, M. J., Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 182-191; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This contribution reviews our current understanding of Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) photometric characteristics paying special attention to the absolute calibration of NICMOS detectors and the sources of systematic uncertainty when performing the calibration. Preliminary results based on Servicing Mission Observatory Verification (SMOV) and Cycle 7 calibration programs are presented.

Author

Calibrating; Cameras; Imaging Spectrometers; Performance Tests; Radiation Detectors; Photometry; Correction

19980202065 Space Telescope Science Inst., Baltimore, MD USA

Persistence in NICMOS: Results from on-orbit data

Daou, Doris, Space Telescope Science Inst., USA; Skinner, C. J., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 263-266; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We present the results of the analysis of Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) persistence data taken as part of the Servicing Mission Observatory Verification (SMOV). This test is a sequel to the System Level Thermal Vacuum (SLTV) persistence tests performed with NICMOS. The goal is to reassess the conclusions previously reached with SLTV data and determine the level of persistence and operational limitations required for programs dealing with previous overexposures to bright objects. The results and analysis of the SMOV test show persistence to be present in data taken after a bright illumination for at least 60-120 seconds followed by a decay. The S/N of the data is not high enough to accurately fit a function to the persistence observations. After analysis, it is discovered that the type of sequence used in obtaining the SMOV data is not the most revealing for persistence study.

Author

Near Infrared Radiation; Cameras; Thermal Vacuum Tests; Dark Current; Brightness; Radiation Detectors; Image Processing

19980202073 Space Telescope Science Inst., Baltimore, MD USA

Long-term and short-term variations of NICMOS Foci

Suchkov, A. A., Space Telescope Science Inst., USA; Bergeron, L., Space Telescope Science Inst., USA; Galas, G. G., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 308-313; In English; Also announced as 19980202026

Contract(s)/Grant(s): NASw-5632; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We present the results of the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) focus monitoring program and discuss long-term focus variations due to ongoing deformation processes within NICMOS, short-term variations due to Hubble Space Telescope (HST) ”breathing” effects, and focus spatial variations across NICMOS fields of view.

Author

Photometry; Image Processing; Field of View; Breathing Vibration; Periodic Variations; Focusing; Cameras

19980202074 Space Telescope Science Inst., Baltimore, MD USA

WFPC2 status and overview

Whitmore, B. C., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 317-326; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The current status of the Wide Field and Planetary Camera 2 is reviewed, with special emphasis on the 2.5 years since the last Hubble Space Telescope (HST) Calibration Workshop. The WFPC2 continues to take excellent images that are making fundamental contributions to astronomy. The calibration and understanding of the WFPC2 continues to improve, as does the available documentation and access to WWW tools. Photometric accuracies of a couple percent are now routinely possible for the common observing modes. There are ongoing efforts to more fully characterize the less commonly used modes such as polarization and linear ramp filter observations. The WFPC2 came through the 1997 servicing mission with essentially no changes to its characteristics. Finally, new observing techniques are allowing observers to push the instrument to the limits of its capabilities.

Author

Cameras; Imaging Techniques; Instrument Approach; Photometry; Wide Angle Lenses; Focusing; Optical Filters

19980202075 Space Telescope Science Inst., Baltimore, MD USA

WFPC2 photometric calibration

Casertano, Stefano, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 327-337; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The updated absolute photometric calibration for Wide Field and Planetary Camera 2 (WFPC2) yields typical uncertainties for bright sources below 2% for the photometric filter set and of about 3% for other filters between 400 and 800 nm. We present a quantitative characterization of some well-known WFPC2 non-linearities, the CTE error and the long vs. short anomaly, which allows a better estimate of their possible impact under a variety of observing conditions.

Author

Cameras; Calibrating; Astronomical Photometry; Instrument Errors; Photographic Equipment

19980202076 European Southern Observatory, Garching, Germany
WFPC2 calibration for emission line images
Dudziak, G., European Southern Observatory, Germany; Walsh, J. R., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 338-342; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Formulae for the flux calibration of Wide Field and Planetary Camera 2 (WFPC2) emission lines are presented. The photometric information given in the header is not adequate, and does not consider the contamination due to neighboring emission lines in the filter pass-band or by the continuum. The formulae were originally calibrated using ground-based images of the Orion Nebula. The photometric accuracy of the flux calibration process is assessed by comparing WFPC2 fluxes with ground-based absolute fluxes and aperture photometry of four bright planetary nebulae. A 5% absolute accuracy for the H Alpha emission line is achievable using this method.
Author
Calibrating; Emission Spectra; Cameras; Line Spectra; Astronomical Photometry; Image Filters; Flux Quantization

19980202079 Space Telescope Science Inst., Baltimore, MD USA
Drizzling dithered WFPC2 images-A demonstration
Mutchler, Max, Space Telescope Science Inst., USA; Fruchter, Andrew, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 355-360; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Interactive Data Reduction and Analysis Facility (IRAF)/STSDAS package dither and its primary task drizzle were created by Andrew Fruchter and Ivo Busko to reconstruct dithered WFPC2 images, and remove cosmic rays from singly-dithered images. Drizzling is akin to shifting- and-adding with a variable pixel size. The drizzle task was initially developed for the Hubble Deep Field project. Here, its use is demonstrated cookbook-style, using archival images of the edge-on galaxy NGC 4565 from Hubble Space Telescope (HST) program 6092.
Author
Imaging Techniques; Image Processing; Image Reconstruction; Cross Correlation; Cosmic Rays; Masking

19980202083 Space Telescope Science Inst., Baltimore, MD USA
Aperture corrections for WFPC2 stellar photometry
Suchkov, A., Space Telescope Science Inst., USA; Casertano, S., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 378-385; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We examine the impact of the long term and short term focus position variations on small aperture photometry of Wide Field and Planetary Camera 2 (WFPC2) images and present aperture corrections phased with the Hubble Space Telescope (HST) focus drift, as well as mean aperture corrections to large aperture radii (”infinity”).
Author
Apertures; Stellar Spectrophotometry; Imaging Techniques; Correction; Calibrating

19980202084 Liege Univ., Inst. d’Astrophysique, Belgium
WFPC2 photometry from subtraction of observed PSFs
Surdej, J., Liege Univ., Belgium; Baggett, S., Space Telescope Science Inst., USA; Remy, M., Liege Univ., Belgium; Wiggs, M., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 386-391; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Based on observed Point Spread Function (PSFs) from the Wide Field Planetary Camera 2 (WFPC2) calibration programs, a series of PSF subtraction tests have been performed and the resulting photometry analyzed. We find that using a composite observed PSF, constructed from optimally selected PSFs based on location and breathing values, yields single photometric values affected by an RMS dispersion of about 0.01-0.02 mag. While resampling does not appear to have much of an effect on the photometric results, the color of the PSF employed is important.
Author
Calibrating; Image Processing; Point Spread Functions; Subtraction; Astronomical Photometry

19980202087 Space Telescope Science Inst., Baltimore, MD USA
FOC status and overview
Jedrzejewski, R., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instru-

ments; 1997, pp. 405-412; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The calibration status of the Faint Object Camera is described. The best reference files to be used with Corrective Optics Space Telescope Axial Replacement (COSTAR)-corrected data are given, along with some discussion of the accuracies to be expected when these files are used. Finally, some discussion of the calibration of polarimetric and objective-prism spectroscopic observations is given.

Author

Faint Object Camera; Calibrating; Polarimetry; Astronomical Spectroscopy

19980202088 Space Telescope Science Inst., Baltimore, MD USA

F/48 Slit Spectroscopy

Jedrzejewski, R., Space Telescope Science Inst., USA; Voit, M., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 413-419; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The calibration of the Faint Object Camera (FOC) F/48 long-slit spectrograph is described. The time-varying and nonlinear geometric distortion makes both target acquisition and spectral rectification difficult. Here, we describe the methods developed to ensure adequate calibration accuracy, and present our best understanding of the precision achievable with this instrument.

Author

Calibrating; Faint Object Camera; Spectrographs; Slits; Target Acquisition; Spectrophotometry; Geometric Rectification (Imagery); Precision

19980202089 Space Telescope Science Inst., Baltimore, MD USA

The closeout state of the faint object spectrograph

Keyes, Charles D. (Tony), Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 420-429; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Faint Object Spectrograph (FOS) was one of the original Hubble Space Telescope (HST) instruments and was removed from the spacecraft in February, 1997. We present a summary of the state of FOS calibration accuracies as of fall 1997. Modest background information about each of the various calibrations and instrumental operating conditions that limit calibration accuracy is also provided. We also reference other useful documentation for more in-depth discussion of these topics.

Author

Faint Objects; Spectrographs; Calibrating; Geometric Accuracy

19980202090 Space Telescope Science Inst., Baltimore, MD USA

Average inverse sensitivity recalibration of pre-COSTAR faint object spectrograph data and comparison with international ultraviolet explorer data

Koratkar, Anuradha, Space Telescope Science Inst., USA; Evans, Ian, Smithsonian Astrophysical Observatory, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 430-439; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We have recalibrated all pre-COSTAR archival Faint Object Spectrograph (FOS) UV and optical spectrophotometry of active galaxies and quasars in order to extract uniformly calibrated spectrophotometric data for further detailed scientific investigations. In this paper we present results of the average inverse sensitivity (AIS) recalibration of this large dataset. The fluxes derived from the recalibrated data are significantly different from the original pipeline calibrations, as expected, because of the revision of the photometric reference scale. We use this dataset to present statistics of the photometric accuracy in the grating overlap wavelength regions for observations spanning multiple gratings. Where possible we have combined multiple observations to produce a single spectrum for each object with the highest possible signal-to-noise (S/N) ratio and covering the widest wavelength range. The recalibrated spectra will be published shortly as atlases and will be available also in electronic form. As the International Ultraviolet Explorer (IUE) satellite data archive is an important source of historical UV spectroscopic information, combining FOS and IUE spectra obtained at different epochs is often necessary. Consequently, understanding how the measurable quantities depend on the individual instrumental calibrations, and how any conclusions derived from modeling the observations may vary depending on the source of the UV data, is critical. Here we present a comparison of typical FOS and IUE spectra.

Author

Sensitivity; Calibrating; Faint Objects; Spectrographs; Data Processing; Signal to Noise Ratios; IUE; Data Bases; Image Processing

19980202091 Space Telescope Science Inst., Baltimore, MD USA

Estimating scattered light in the FOS

Hayes, Jeffrey J. E., Space Telescope Science Inst., USA; Keyes, Charles D. (Tony), Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 440-442; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We quantitatively assess the impact of grating scatter within the Faint Object Spectrograph (FOS) as a function of intrinsic target spectrum and spectral element employed. bspec, the FOS scattered light optical modeling code of Micheal Rosa, has been used for this analysis. In this presentation we present an example from an atlas of spectra illustrating the amount of predicted scattered light for all high dispersion gratings with both FOS detectors for a representative range of colors and object types. As has been qualitatively noted previously, we find that the intrinsic color of the observed object can affect the amount of scattered light detected and that this scattered light is, in most cases, wavelength independent. For the limited number of spectral elements to which it can be applied, the standard FOS pipeline scattered light correction is, therefore, a good approximation. The figures included in the above mentioned Incoherent Scatter Radar (ISR) can be used as a guide in estimating the degree of scattered light contamination in spectral regions for which the standard pipeline algorithm can not be applied.

Author

Faint Objects; Spectrographs; Gratings (Spectra); Spectral Bands; Light Scattering; Radiation Detectors; Spectrum Analysis; Stellar Spectra

19980202092 Space Telescope Science Inst., Baltimore, MD USA

The HST/FOS wavelength scale

VanderMarel, Roeland P., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 443-448; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

I analyze the accuracy of the Faint Object Spectrograph (FOS) pipeline wavelength calibration for the FOS/RD detector with the G570H grating. I use observations of arc spectra and external targets that I obtained in the context of studies of galactic nuclei, complemented with an observation of the planetary nebula NGC 6833 obtained by the FOS Instrument Science Team. The combined data were obtained in five visits spread over the period August 1995 to January 1997. I find that the absolute wavelength calibration generated by the pipeline for these visits is in error by 0.2-1.2 diodes, in the same direction for all visits. The mean of the errors is 0.62 diodes, where 1 diode = 4.37A. The error is largest for the two visits that used the paired apertures. These results indicate that the grating-wheel non-repeatability is larger than believed, or that (some of) the dispersion solutions in the pipeline may need to be modified by a constant offset. There are variations in the S-distortion between visits at the level of approximately 0.1 diodes. The RMS shift between arc spectra obtained in the same visit, as a result of residual GIM errors, is less than or equal to 0.04 diodes. The average internal/external offset determined from these data is consistent with the constant value that has been used by the pipeline since 1992. No dependence is found on aperture or epoch. However, there is an indication that the internal/external offset varies systematically by 0.15 diodes between the blue and the red ends of the grating. If true, this translates directly into a systematic error in the relative wavelength scale for all C570H FOS/RD data in the Hubble Space Telescope (HST) Data Archive.

Author

Wavelengths; Calibrating; Gratings (Spectra); Accuracy; Radiation Detectors; Faint Objects; Spectrographs

19980202095 Texas Univ., Astronomy Dept., Austin, TX USA

Maintaining the FGS3 optical field angle distortion calibration

McArthur, B., Texas Univ., USA; Benedict, G. F., Texas Univ., USA; Jefferys, W. H., Texas Univ., USA; Nelan, E., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 472-480; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAG5-1603; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

To date four OFAD (Optical Field Angle Distortion) calibrations have been performed on FGS3 in M35 and analyzed by the Astrometry Science Team. Two have been performed since the last HST (Hubble Space Telescope) Calibration Workshop. The ongoing Long Term Stability Tests have also been analyzed and incorporated into the calibration. A lateral color calibration has been derived from calibration and science data. Descriptions of these tests and the results of our analysis of the resulting data are given. The astrometric science supported by these calibrations is briefly reviewed.

Author

Distortion; Calibrating; Stability Tests; Guidance Sensors; Color; Field of View; Astrometry

19980202096 Wien Univ., Inst. of Astronomy, Austria

Stability of FGS photometry

Kuschnig, R., Wien Univ., Austria; Weiss, W. W., Wien Univ., Austria; Zwintz, K., Wien Univ., Austria; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 481-485; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The three Fine Guidance Sensors produce time series photometry of thousands of stars while providing a pointing reference to the Hubble Space Telescope (HST). In 1993 we started a project focused on the search for variable Guide Stars by performing a time series analysis of all accessible data sets. This project requires a detailed knowledge of the photometric stability and systematic effects of Fine Guidance Sensor (FGS) time series photometry. We found that the photometric accuracy in general is limited by photon noise with an average noise level for our sample of about 10(exp -4) and the highest accuracy presently obtained being 30 ppm. About 15% of all data sets are influenced by the South Atlantic Anomaly and by stray light from the Moon and/or the Sun. The two FGS data sets obtained during the Deep Field program of the HST in December 1995 are perfectly suited for an investigation of these effects.

Author

Guidance Sensors; Astronomical Photometry; Hubble Space Telescope; Stability; Variable Stars; Time Series Analysis

19980202097 Space Telescope Science Inst., Baltimore, MD USA

The Goddard High Resolution Spectrograph

Soderblom, David R., Space Telescope Science Inst., USA; Sherbert, Lisa E., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 486-496; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Goddard High Resolution Spectrograph(GHRS) was on Hubble Space Telescope (HST) at the time of its launch in 1990, and was withdrawn from HST during the second servicing mission in 1997. This paper summarizes key events during the operational history of the GHRS and provides a recapitulation of results from the many calibrations that have been done.

Author

High Resolution; Hubble Space Telescope; Spectrographs; Calibrating; Fluxes

19980202098 Space Telescope Science Inst., Baltimore, MD USA

GHRS calibration changes since February 1997

Sherbert, L. E., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 497-501; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Space Telescope Science Institute (STScI) Goddard High Resolution Spectrograph (GHRS) Group has made some changes relating to CHRS calibration since the instrument was removed from Hubble Space Telescope (HST) in February 1997. These changes include an alternative method for calculating and removing background from observations, updates to most of the sensitivity files based on updates to the reference star data, and improvements and corrections to other Calibration Database (CDBS) files. This presentation highlights 9 improvements that have been or could be made.

Author

Calibrating; Data Bases; Correction; High Resolution; Spectrographs; Data Management

19980202103 European Southern Observatory, Space Telescope European Coordinating Facility, Garching, Germany

Calibrating echelle spectra using instrument models

Rosa, M. R., European Southern Observatory, Germany; Ballester, P., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 533-536; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We have developed a generic model of echelle spectrographs, based on first optical principles, fully treating 3-dimensions. The geometrical part of it is capable of predicting detector positions for wavelength calibration spectra within 0.2 pix (1 sigma), solely using engineering parameters such as focal lengths, grating constants and configuration angles. First results are also available from the modeling code for grating efficiencies (blaze functions) for any given polarization, surface accuracy and random or periodic groove errors. Combined, these tools allow one to carry calibrations of well observed modes into less well or even uncalibrated modes of operation.

Author

Calibrating; Spectrographs; Echelle Gratings; Spectra; Wavelengths; Three Dimensional Models; Optical Correction Procedure; Optical Data Processing

19980202402 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Interlaboratory Study (ILS) of the Standard Test Method for Measuring the Night Vision Goggle-Weighted Transmissivity of Transparent Parts ***Interim Report, Apr. 1995 - Dec. 1997***
Pinkus, Alan R., Air Force Research Lab., USA; Task, Harry L., Air Force Research Lab., USA; Mar. 1998; 108p; In English
Contract(s)/Grant(s): AF Proj. 7184
Report No.(s): AD-A342777; AFRL-HE-WP-TR-1998-0016; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

There are several ASTM Standards that address light transmissivity through transparencies (ASTM Standards F 1316-90D and 1003-61) in the visible spectrum (400 through 700 nm). However, night vision goggles (NVGs) are now being used in aircraft and other applications (e.g., marine navigation, surveillance, personnel carriers) with increasing frequency. These devices amplify both visible and near-infrared (NIR) spectral energy. A transparency may have excellent visible transmissive characteristics but could have poor NIR transmissivity. Overall visual performance (acuity) can be degraded if the observer uses the NVGs while looking through a transparency that has attenuated transmissivity in the NIR region (Pinkus and Task, 1997, see Appendix A). ASTM P94-02, Standard Test Method for Measuring Night Vision Goggle-Weighted Transmissivity of Transparent Materials (see draft in Appendix B) addresses this issue.
DTIC
Transmissivity; Visual Acuity; Goggles; Surface Navigation; Night Vision

19980202589 Naval Postgraduate School, Monterey, CA USA
Analysis of the Use of the Mach-Zender Coupler in Demodulating Multiplexed Fiber Optic Signals
Wehner, Paul W., Naval Postgraduate School, USA; Sep. 1997; 68p; In English
Report No.(s): AD-A341210; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Fiber optic communications are the future of US Navy shipboard communications. They present tremendous bandwidths with no susceptibility to electro magnetic interference (EMI) and outstanding signal to noise ratios. Current technology uses Wavelength Division Multiplexing (WDM) to allow multiple users on a single fiber simultaneously. The optical filters necessary to demodulate the WDM signal can be expensive. A less costly alternative could be achieved if Hadamard-Walsh Code Shift Keyed (CSK) encoded signals were used. An optical receiver was proposed, using the Mach-Zender coupler, capable of demodulating a Hadamard-Walsh CSK encoded signal. Building on previous work studying the characteristics of the Mach-Zender coupler, a relationship between the probability of bit error and signal-to-noise ratio (SNR) was developed for a single user and a DPSK optical signal. This relationship was then used to develop an understanding of the bit error rate to SNR relationship for a multiple-user CSK optical signal. Using the theoretical performance as a guide, a MATLAB model was then constructed to investigate the sensitivity of the receiver to non-ideal components.
DTIC
Fiber Optics; Optical Communication; Couplers; Demodulation; Mach-Zehnder Interferometers

19980202601 Massachusetts Inst. of Tech., Research Lab. of Electronics, Cambridge, MA USA
Interferometric Measurement with Squeezed Light ***Annual Report, 1 Jan - 31 Dec. 1997***
Haus, H. A., Massachusetts Inst. of Tech., USA; Ippen, E. P., Massachusetts Inst. of Tech., USA; Apr. 01, 1998; 9p; In English
Contract(s)/Grant(s): N00014-92-J-1302
Report No.(s): AD-A341075; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The theoretical and experimental work in this reporting period was concerned with the generation and utilization of squeezed pulsed radiation. Improved sensitivity of fiber gyros with noise levels below the shot noise level is one possible utilization of such radiation.
DTIC
Fiber Optics; Quantum Electronics; Interferometry; Pulsed Radiation; Pulse Generators; Solitary Waves

19980202665 Institute for Human Factors TNO, Soesterberg, Netherlands
Observer Performance and Ergonomic Evaluation of the Lion Hand held Thermal Viewer ***Final Report Waarnemingsprestaties en ergonomie van de Lion hand held warmtebeeld-kijker***
Valeton, J. M., Institute for Human Factors TNO, Netherlands; Dec. 05, 1997; 32p; In Dutch
Contract(s)/Grant(s): A97/KL/344
Report No.(s): TNO-TM-97-A071; TD-97-0256; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

The DMKL Trial Department of the Royal Netherlands Army asked the TNO-Human Factors Research Institute to investigate the visual performance and ergonomics of the 'Lion' hand held thermal viewer. Three investigations were carried out: a short

exploratory recognition experiment in the field, an ergonomic questionnaire and some visual performance tests in the laboratory. The field trial yielded the following results. Detection of tanks at 1800 m is possible, both during day and night. Recognition and identification of armoured and small wheeled vehicles at 750 m is just possible (50% correct) in some conditions and not possible in others. Effective vehicle recognition range is estimated to be about 500 m. Identification of personnel targets is not possible at 200 m. A 70 item ergonomic questionnaire was filled out by the nine observers that served in the field trial. The experiences concerning adjustment of the viewer, image quality, system controls, system use and handling were thus recorded in a structured manner. Aspects that can be improved are a/o the grips, the location of some of the buttons, lens cover, and battery caps. The visual resolution and contrast sensitivity of the viewer were determined by three observers viewing a series of thermal test patterns through the Lion. The image quality, and therefore also the observer performance, appeared to be best directly after switching on the system. After 3 hours the resolution had decreased by a factor of 1.4 and the contrast threshold by a factor of 2.5. The Fixed Pattern Noise increased significantly during this period. The brightness control of the system is extremely unstable during the first hour after switching on. The overall conclusion of this study is that the Lion is in principle a useful hand held thermal viewer, but a number of problems must be solved and a few design changes should be made.
Author
Viewing; Image Resolution; Performance Tests; Human Factors Engineering; Target Recognition; Target Acquisition

19980202761 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Altitude and Night Vision Goggles ***Final Report, Jan. 1993 - Sep. 1997***
DeVilbiss, Carita, Air Force Research Lab., USA; Mar. 1998; 23p; In English
Contract(s)/Grant(s): AF Proj. 7184
Report No.(s): AD-A341094; AFRL-HE-BR-TP-1998-0001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents the findings from a study to quantify the effect of mild hypoxia and breathing supplemental oxygen on an aircrew member's static visual acuity while using Night Vision Goggles (NVG). In this within subjects experiment, static NvG visual acuity was measured for 15 subjects at six simulated altitude levels (i.e., ground level, 5,000, 10,000, 15,000, 18,000 and 20,000 feet). Three target contrasts (i.e., high, medium, and low) were used for each visual acuity measurement under both simulated starlight and quarter moon illumination levels. Two supplemental oxygen conditions (i.e., 100% and normal setting) were used at all altitudes and a "no" supplemental oxygen condition was used up to 10,000 feet. Overall, there was a significant decrease in average visual performance across all conditions from the equivalent of 20/44 Snellen acuity at ground level to the equivalent of 20/46 at 20,000 feet. Overall, the "100%" and "normal" oxygen conditions were not significantly different from one another. At the two lowest altitudes, the "no" supplemental oxygen condition did not differ significantly from the other two oxygen conditions. However, at the 10,000 ft. altitude, the "no" supplemental oxygen condition was significantly degraded from both the "100%" and "normal" conditions. Since this study was conducted under an existing generic altitude protocol, the results did not provide complete information on the impact on visual acuity while performing operations at 15,000 feet without supplemental oxygen, applicable to helicopter operations in the mountains. A follow-up study was recommended but not funded.
DTIC
Altitude Simulation; Night Vision; Goggles; Visual Perception; Hypoxia; Breathing; Snellen Tests

19980202901 Syracuse Univ., Office of Sponsored Programs, NY USA
Analysis of Optically Active Material Fibers ***Final Report, Jun. 1996 - Jun 1997***
Kornreich, Philipp, Syracuse Univ., USA; Mar. 1998; 28p; In English
Contract(s)/Grant(s): F30602-96-C-0172; AF Proj. 4600
Report No.(s): AD-A341538; RL-TR-97-248; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes a method of producing, and test results of, optical fibers having an optically active material at the core/cladding boundary. Two fibers were made and tested. The first has a thin AlCu alloy strip running the length of the fiber, the width of the strip covering approximately fifteen degrees of arc as seen looking at the fiber's cross section. The second has a thin CdTe semiconductor layer covering the fiber core. Both the AlCu strip fiber has absorption resonances in the transmission spectrum at 449 nm, 935 nm and 1140 nm, and exhibits both a polarization sensitive absorption at 1140 nm and birefringence at 1320 nm. The CdTe fiber exhibits a step in the transmission spectrum at a wavelength of 630 nm. This step is shifted towards shorter wavelengths from its value of 827 nm in the bulk material of the fiber preform.
DTIC
Fiber Optics; Fabrication; Mechanical Properties; Optical Fibers

19980203098 NASA Langley Research Center, Hampton, VA USA

Optical Flameout Detector

Borg, Stephen E., Inventor, NASA Langley Research Center, USA; West, James W., Inventor, NASA Langley Research Center, USA; Lawrence, Robert M., Inventor, NASA Langley Research Center, USA; Harper, Samuel E., Jr., Inventor, NASA Langley Research Center, USA; Alderfer, David W., Inventor, NASA Langley Research Center, USA; May 05, 1998; 7p; In English; Continuation of abandoned US-Patent-Appl-SN-518853, filed 24 Aug. 1995 which is a continuation of abandoned US-Patent-Appl-SN-141294, filed 19 Oct. 1993

Patent Info.: Filed 16 Jul. 1997; NASA-Case-LAR-14997-3; US-Patent-5,748,090; US-Patent-Appl-SN-892833; US-Patent-Appl-SN-518853; US-Patent-Appl-SN-141294; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A device has been developed which monitors the presence of a flame within a combustion chamber. The optical flameout detection system responds to gross changes in combustor light intensity which is monitored in two spectral bands. A photomultiplier tube makes optical measurements in the ultraviolet portion of the spectrum and a silicon photodiode covers the visible region. The detectors, located outside the combustion chamber, receive the light energy radiated from the combustion process through fiber optic probes designed to operate in a high pressure environment. The optical fibers are aimed diagonally through the center of the injector at the combustion chamber wall downstream of the injector. The probe observes events occurring within a narrow conical-shaped field of view so that the system can quickly detect longitudinal movement of the flame front away from the injector. If a change in intensity of the flame is detected, the fuel supply to the combustion chamber is shut off limiting the amount of unburned fuel in the combustion chamber which could reignite.

Official Gazette of the U.S. Patent and Trademark

Photomultiplier Tubes; Photodiodes; Flameout; Combustion Chambers; Optical Measuring Instruments

19980203138 Brown Univ., Div. of Applied Mathematics, Providence, RI USA

Dynamical Systems Techniques in Nonlinear Optics ***Final Report, 1 Jan. 1995 - 31 Dec. 1997***

Jones, Christopher K., Brown Univ., USA; Mar. 18, 1998; 3p; In English

Contract(s)/Grant(s): F49620-95-1-0085

Report No.(s): AD-A341265; AFRL-SR-BL-TR-98-0304; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The PI and a student have been working in close consultation with researchers at AFRL/DEL on developing a geometric view of the optically injected laser problem. An interesting source of complex behavior (chaos) has been uncovered. This complicated behavior is the result of parametric sweeping across a resonance. From the experimental and practical perspective this is a natural scenario and the possibility of implementing it experimentally has been discussed. This is potentially important in applications (for instance, communications) as the chaotic behavior can be precisely controlled and understood in terms of phase shifting. Some recent work has revealed a direct source of chaotic behavior in the optically injected semiconductor laser equations.

DTIC

Nonlinear Optics; Dynamical Systems; Lasers

19980203149 Naval Postgraduate School, Monterey, CA USA

The Mach-Zehnder Coupler

Gildersleeve, Joseph S., Naval Postgraduate School, USA; Dec. 1997; 54p; In English

Report No.(s): AD-A341338; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis is the second in a series which investigates the possibility of creating a code shift keying (CSK) optical receiver using single mode 2 x 2 couplers and fiber optical delay lines to construct Mach-Zehnder couplers which comprise the main building block of the CSK receiver. There were two main goals of this thesis research. The first was to investigate design and construction modifications which would lower the system loss of a previously designed Mach-Zehnder coupler. As a result of this research, the system loss was reduced from 10.5 dB to 3.3 dB by changing the design to eliminate an unnecessary stage and by replacing several mechanical connections with fusion splices. The second goal was to find a method to measure the inherent phase shift of a 2 x 2 fiber optical coupler. Two separate methods were developed and implemented, and a third previously developed method was used to verify the results. All three methods provided experimental values between 145 and 149 deg. This thesis develops the theory that explains the discrepancy between the measured values and the ideal value of 180 deg for the inherent phase shift.

DTIC

Coupling Circuits; Optical Relay Systems

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19980203143 Hampton Univ., Dept. of Mathematics, VA USA
Theoretical and Computational Investigation of Nonlinear Dynamical and Chaotic Properties of Plasmas ***Final Report, 14 Jun. 1994 - 15 Oct. 1997***
Marable, William P., Hampton Univ., USA; Mar. 27, 1998; 61p; In English
Contract(s)/Grant(s): F49620-94-1-0374
Report No.(s): AD-A341286; AFRL-SR-BL-TR-98-0285; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The study of the nonlinear dynamics of electron beam propagation through a periodically focussed solenoidal channel has resulted in the characterization of the preconditions necessary for the formation of beam halos. The halos are populated by chaotic particles, born from orbital instability within the interior of the electron beam.
DTIC
Electron Beams; Plasmas (Physics)

76
SOLID-STATE PHYSICS

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

19980202221 Lehigh Univ., Packard Lab., Bethlehem, PA USA
A Molecular Dynamics Study of a Trinitro-Benzene Crystal
Macpherson, A. K., Lehigh Univ., USA; Vladimiroff, T., Army Armament Research, Development and Engineering Center, USA; 34th JANNAF Combustion Subcommittee Meeting; Oct. 1997, pp. 467-477; In English; Also announced as 19980202187; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy, Microfiche

The present work uses molecular dynamics to study flexible molecules in a crystal. This is in contrast with the usual molecular mechanics approach in which rigid molecule studies of crystal structure are undertaken. The 6-exp potential with an electrostatic term is used for inter molecular interactions. The intra-molecular potentials were taken from normal coordinate analysis. Thus the present model will extend the usual rigid molecule studies undertaken by molecular mechanics, to include internal vibrational energies. The molecule chosen for the study is trinitro-benzene (TNB). It was found that after an initial time the atoms remained approximately in their correct crystal locations and the total energy remained constant. As it was possible that the minimum energy configuration for the potential may not be the crystal structure a second initial configuration was examined. The atoms were displaced from the crystal locations and after the program was run for a period of time the original structure was restored. Thus a satisfactory molecular potential was developed using a combination of atom-atom potentials and published experimental force constants. It was significant that the resultant potentials were not adjusted for the crystal.
Author
Molecular Dynamics; Molecular Interactions; Crystal Structure; Nitro Compounds; Benzene; Configuration Interaction

19980202498 North Carolina State Univ., Raleigh, NC USA
Defects and Impurities in 4H- and 6H-SiC Homoepitaxial Layers: Identification, Origin, Effect on Properties of Ohmic Contacts and Insulating Layers and Reduction ***Quarterly Report, 1 Oct. - 31 Dec. 1997***
Davis, R. F., North Carolina State Univ., USA; Aboelfotoh, M. O., North Carolina State Univ., USA; Baliga, B. J., North Carolina State Univ., USA; Nemanich, R. J., North Carolina State Univ., USA; Dec. 1997; 24p; In English
Contract(s)/Grant(s): N00014-95-1-1080
Report No.(s): AD-A338756; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A hot wall chemical vapor deposition system has been constructed to deposit thin films of 4H- and 6H-SiC and AlN. The design incorporates a separate load lock from which the growth chamber and a RHEED chamber are attached. Operation awaits the completion of the laboratory upfitting to address the safety requirements necessary to use silane. MOS capacitors were fabricated on 6H- and 4H-SiC with an average effective charge density of 5 x 10(exp 11) x 10(exp -12)/sq cm. Related MOSFETs exhibited excellent gate controlled linear and saturation regimes of operation. The threshold voltage was 2-5 volts for all 4-H and 6H-SiC FETs. Maximum inversion layer mobilites of 60 sq cm/V.s and 72 sq cm/V.s were determined for the MOSFETs fabricated on 4H- and 6H-SiC, respectively. Aluminum nitride thin films were also grown by GSMBE on 4H and 6H-SiC substrates. Streaked

RHEED patterns indicated smooth films and, for the first time, contained surface reconstruction streaks. The smooth surface character was confirmed via atomic force microscopy which showed root mean square values typically between 0.5 nm and 1 nm. X-ray diffraction showed the films to be highly c-axis orientedand single phase. The major impurities in the films were oxygen and carbon, as reveal ed by secondary ion mass spectrometry. Thermal and plasma enhanced chemical vapor deposition were employed with oxygen and nitrous oxide to deposit a silicon oxide on 6H-SiC(0001). The resulting morphology was compared with an analogous oxide produced via thermal oxidation and with the base SiC substrate. The RMS values of the surface roughness of the initial insulator and the control wafers were 0.93 and 0.95 nm, respectively, as measured via atomic force microscopy. The RMS values for PECVD (200-400 deg C) and thermal CVD (400-600 deg C for oxygen-silane) and 800-1000 deg C for nitrous oxide-silane ranged from 1.43 to 1.93 nm.
DTIC
Crystal Defects; Silicon Carbides; Epitaxy; Thermodynamic Properties

19980202609 Illinois Univ., Dept. of Electrical and Computer Engineering, Urbana, IL USA
[Si Microdischarge Devices] ***Final Report, May - Oct. 1997***
Eden, J. G., Illinois Univ., USA; Feb. 1998; 7p; In English
Contract(s)/Grant(s): F49620-97-1-0261; AF Proj. 2301/AS
Report No.(s): AD-A339185; AFRL-SR-BL-TR-98-0241; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The paper focuses on exploring the properties of microdischarge devices fabricated in silicon. Cylindrical devices having diameters between 20 micrometers and 400 micrometers have been fabricated and intense emission on the B yields X transition of xenon monoiodide (XeI) in the ultraviolet (UV) is produced when mixtures of Xe/I2 are introduced to the discharge. Having specific power loadings beyond 100 kW/cu cm on a continuous basis, these devices represent a new realm of discharge operation and are attractive candidates as lamps or for the decomposition of environmentally hazardous gases.
DTIC
Silicon; Electronic Equipment; Electric Discharges; Gas Discharges; Rare Gases; Cylindrical Bodies; Fabrication

19980202680 Technische Univ., Inst. fuer Festkoerperelektronik, Vienna, Austria
THz Radiation Source Through Periodically Modulated Structures ***Interim Report, Dec. 1997 - Feb. 1998***
Gornik, Erich, Technische Univ., Austria; Rauch, Ch., Technische Univ., Austria; Strusser, G., Technische Univ., Austria; Unterrainer, K., Technische Univ., Austria; Boxleitner, W., Technische Univ., Austria; Mar. 10, 1998; 7p; In English
Contract(s)/Grant(s): N68171-96-C-9015
Report No.(s): AD-A341083; R/D-7372-EE-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
We have shown that the quenching of the miniband states is independent of the direction of the applied bias for a 5 period super lattice. Experiments on a 10 period super lattice show that the transmission becomes asymmetric: enhanced for positive bias a and reduced for negative bias. This effect becomes more and more pronounced with increasing length of the SL. From a comparison of the calculated transfer ratio under the presence of interface roughness scattering we are able to estimate the typical island sizes to be of the order of 10 nm. Bow tie structures are developed and optimized for the purpose of a broad band antenna in the range of THz frequencies. The optimized antennas are presently combined with small mesa structures for emission measurements. At present we have difficulties to couple the 'large antennas' to the small 2 microns x 2 microns mesas. A population inversion in non-equilibrium plasmas can be achieved by driving a constant current through the plasma. Based on these ideas we have grown a set of structures where the plasma instability may be realized. The basic concept requires the realization of a large population inversion. The IV curves of the grown structures agree with the calculated IV curves. However from the IV curves it is not directly evident that a plasma instability is present. Therefore emission measurements, using a grid structure for coupling out of the light are under way to prove the existence of these instabilities which are expected to lead to strong THz emission.
DTIC
Quantum Wires; Carrier Injection; Spectroscopy; Large Space Structures; Radiation Sources; Superlattices

19980202719 California Univ., Electronics Research Lab., Berkeley, CA USA
Non-Stoichiometric Layers of 3/4 Semiconductors ***Final Report, 16 Dec. 1994 - 14 Dec 1997***
Weber, Eicke, California Univ., USA; Mar. 24, 1998; 74p; In English
Contract(s)/Grant(s): F49620-95-1-0091
Report No.(s): AD-A341181; UCB/ERL-442427-22507; AFRL-SR-BL-TR-98-0305; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The objective of this research project was the control of defect formation and thermal stability in non-stoichiometric GaAs thin layers. As rich GaAs offers unique device applications in layer isolation and optoelectronics because of its insulating capabili-

ties after a thermal annealing and ultrafast time response in the THz range. The introduction of an optical temperature measurement, utilizing the diffuse reflectance spectroscopy enhanced the accuracy of the growth parameter determination, leading to a fairly reproducible growth. This enabled us to determine the limits of the low temperature growth, a saturation of the lattice dilation at low growth temperatures and/or high BEP ratios, and the onset of polycrystallinity and epitaxial columnar growth as is usually observed in the epitaxial growth of ceramics.
DTIC
Gallium Arsenides; Quality Control; Semiconductors (Materials); Isolation; Diffuse Radiation; Defects

19980202753 Department of the Navy, Washington, DC USA
Polishing Diamond Surface
Pehrsson, Pehr E., Inventor, Department of the Navy, USA; Marchywka, Michael L., Inventor, Department of the Navy, USA; Dec. 30, 1997; 8p; In English; Supersedes US-Patent-Appl-SN-266770, AD-D016502
Patent Info.: Filed 28 Jun. 1994; US-Patent-Appl-SN-266770; US-Patent-5,702,586
Report No.(s): AD-D018778; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Process of smoothing or polishing a diamond surface to reduce asperities thereon to a level as low as about 20 nm from the horizontal by implanting the diamond surface with ions to form a non-diamond carbon damage layer on or below the diamond surface below the disparity depth and dissolving the non-Diamond carbon by submerging the non-diamond carbon in a liquid having sufficient electric field to dissolve the non-diamond carbon.
DTIC
Diamonds; Ion Implantation; Polishing; Surface Finishing; Smoothing

19980202795 NASA Johnson Space Center, Houston, TX USA
Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity, Volume 2
Krishen, Kumar, Editor, NASA Johnson Space Center, USA; Burnham, Calvin, Editor, World Congress on Superconductivity, USA; Apr. 1995; 403p; In English; 4th; World Congress on Superconductivity, Jun. 27 - 1 Jul. 1994, Orlando, FL, USA; Sponsored by World Congress on Superconductivity, USA; Also announced as 19980202796 through 19980202837
Report No.(s): NASA-CP-3290-Vol-2; S-792-Vol-2; NAS 1.55:3290-Vol-2; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

This document contains papers presented at the 4th International Conference Exhibition: World Congress on Superconductivity held at the Marriott Orlando World Center, Orlando, Florida, June 27-July 1, 1994. This conference encompassed research, technology, applications, funding, political, and social aspects of superconductivity. Specifically, the areas of research, technology, and development covered during the conference included high-temperature materials, thin films, C-60 based superconductors, persistent magnetic fields and shielding, fabrication methodology, space applications, physical applications, performance characterization, device applications, weak link effects and flux motion, accelerator technology, superconductivity energy, storage, future research and development directions, medical applications, granular superconductors, wire fabrication technology, computer applications, technical and commercial challenges, and power and energy applications. The key objective of this conference was to provide a forum for the world community to share technological results of recent advances made in the field of superconductivity and to discuss translation of the research to technology which will benefit humanity. More than 150 presentations were made at this conference.
Author
Conferences; Refractory Materials; Superconductivity; Superconductors (Materials); Technology Utilization; Computer Techniques

19980202800 Simon Fraser Univ., Dept. of Physics, Burnaby, British Columbia Canada
Optimization of the Deposition Conditions and Structural Characterization of Y1Ba2Cu3O(7-x) Thin Superconducting Films
Chrzanowski, J., Simon Fraser Univ., Canada; Meng–Burany, S., Simon Fraser Univ., Canada; Xing, W. B., Simon Fraser Univ., Canada; Curzon, A. E., Simon Fraser Univ., Canada; Heinrich, B., Simon Fraser Univ., Canada; Irwin, J. C., Simon Fraser Univ., Canada; Cragg, R. A., CTF Systems, Inc., Canada; Zhou, H., CTF Systems, Inc., Canada; Habib, F., CTF Systems, Inc., Canada; Angus, V., CTF Systems, Inc., Canada; Fife, A. A., CTF Systems, Inc., Canada; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 423-432; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Two series of Y1Ba2Cu3O(z) thin films deposited on (001) LaAl03 single crystals by excimer laser ablation under two different protocols have been investigated. The research has yielded well defined deposition conditions in terms of oxygen partial pres-

sure P(O2) and substrate temperature of the deposition process T(sub h), for the growth of high quality epitaxial films of YBCO. The films grown under conditions close to optimal for both j(sub c) and T(sub c) exhibited T(sub c) greater than or equal to 91 K and j(sub c) greater than or equal to 4 x 10(exp 6) A/sq cm, at 77 K. Close correlations between the structural quality of the film, the growth parameters (P(O2), T(sub h)) and j(sub c) and T(sub c) have been found.
Author
YBCO Superconductors; Single Crystals; Deposition; Substrates; Thin Films

19980202801 Texas A&M Univ., Center for Electronic Materials, College Station, TX USA
Growth and Analysis of Highly Oriented (11n) BCSCO Films for Device Research
Raina, K. K., Texas A&M Univ., USA; Pandey, R. K., Texas A&M Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 433-439; In English; Also announced as 19980202795
Contract(s)/Grant(s): NAGw-1194; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Films of BCSCO superconductor of the type Bi2CaSR2Cu2O(x), have been grown by liquid phase epitaxy method (LPE), using a partially closed growth chamber. The films were grown on (001) and (110) NdGaO3 substrates by slow cooling process in an optimized temperature range below the peritectic melting point (880 C) of Bi2CaSR2Cu2O8. Optimization of parameters, such as seed rotation, soak of initial growth temperature and growth period results in the formation of 2122 phase BCSCO films. The films grown at rotation rates of less than 30 and more than 70 rpm are observed to be associated with the second phase of SR-Ca-Cu-O system. Higher growth temperatures (greater than 860 C) also encourage to the formation of this phase. XRD measurements show that the films grown on (110) NdGaO3 have a preferred (11n)-orientation. It is pertinent to mention here that in our earlier results published elsewhere we obtained c-axis oriented Bi2CaSR2Cu2O8 phase films on (001) NdGaO3 substrate. Critical current density is found to be higher for the films grown on (110) than (001) NdGaO3 substrate orientation. The best values, zero resistance (T(sab co)) and critical current density obtained are 87 K and 10(exp 5) A/sq cm respectively.
Author
Liquid Phase Epitaxy; Substrates; Crystal Growth; Bismuth Compounds; Superconducting Films; Superconducting Devices

19980202802 Academy of Sciences (USSR), Inst. of Thermophysics, Novosibirsk, USSR
Structural, Transport and Microwave Properties of 123/Sapphire Films: Thickness Effect
Predtechensky, M. R., Academy of Sciences (USSR), USSR; Smal', A. N., Academy of Sciences (USSR), USSR; Varlamov, Y. D., Academy of Sciences (USSR), USSR; Vatnik, S. M., Academy of Sciences (USSR), USSR; Tukhto, O. M., Academy of Sciences (USSR), USSR; Vasil'Eva, I. G., Academy of Sciences (USSR), USSR; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 440-446; In English; Also announced as 19980202795; Sponsored in part by Committee for High Temperature Superconducting; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The effect of thickness and growth conditions on the structure and microwave properties has been investigated for the 123/sapphire films. It has been shown that in the conditions of epitaxial growth the Al atoms do not diffuse from substrate into the film and the films with thickness up to 100 nm exhibit the excellent DC properties. The increase of thickness of GdBaCuO films causes the formation of extended line-mesh defects and the increase of the surface resistance (R(sub s)). The low value of surface resistance R(sub s)(75 GHz, 77 K) = 20 mOhm has been obtained for the two layer YiBaCuO/CdBaCuO/sapphire films.
Author
Transport Properties; Microwaves; Sapphire; Crystal Growth

19980202803 Simon Fraser Univ., Dept. of Physics, Burnaby, British Columbia Canada
Scanning Micro-Hall Probe Mapping of Magnetic Flux Distributions and Current Densities in YBa2Cu3O7 Thin Films
Xing, W., Simon Fraser Univ., Canada; Heinrich, B., Simon Fraser Univ., Canada; Zhou, Hu, CTF Systems, Inc., Canada; Fife, A. A., CTF Systems, Inc., Canada; Cragg, A. R., CTF Systems, Inc., Canada; Grant, P. D., National Research Council of Canada, Canada; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 447-456; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Mapping of the magnetic flux density B(sub z) (perpendicular to the film plane) for a YBa2Cu3O7 thin-film sample was carried out using a scanning micro-Hall probe. The sheet magnetization and sheet current densities were calculated from the B(sub z) distributions. From the known sheet magnetization, the tangential B(sub x,y) and normal components of the flux density B were

calculated in the vicinity of the film. It was found that the sheet current density was mostly determined by 2B(sub x,y)/d, where d is the film thickness. The evolution of flux penetration as a function of applied field will be shown.
Author
Mapping; Scanning; Magnetic Flux; Thin Films; YBCO Superconductors; Mass Distribution

19980202804 Technische Univ., Inst. of Physics, Cottbus, Germany
Angular Dependence of Critical Density and Magnetoresistance of Sputtered High-T(sub c)-Films
Geerkens, A., Technische Univ., Germany; Meven, M., Technische Hochschule, Germany; Frenck, H.–J., Technische Univ., Germany; Ewert, S., Technische Univ., Germany; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 457-466; In English; Also announced as 19980202795
Contract(s)/Grant(s): BMFT-13-N-5487/5; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The angular dependence of the critical current density and the magnetoresistance of high-T(sub c)-films in high and low magnetic fields and for different temperatures were measured to investigate the flux pinning and the superconducting properties. A comparison of the results for the different superconductors shows their increasing dependence on the angle theta between the magnetic field and the c-axis of the film due to the anisotropy of the chosen superconductor. Furthermore the influence of the current direction to the theta-rotation plane is discussed.
Author
Current Density; Angular Distribution; Magnetic Fields; Magnetoresistivity

19980202805 Simon Fraser Univ., Dept. of Physics, Burnaby, British Columbia Canada
Correlations Between Critical Current Density (j(sub c)), Critical Temperature (T(sub c)) and Structural Quality of Y1B2Cu3O(7-x) Thin Superconducting Films
Chrzanowski, J., Simon Fraser Univ., Canada; Xing, W. B., Simon Fraser Univ., Canada; Atlan, D., Simon Fraser Univ., Canada; Irwin, J. C., Simon Fraser Univ., Canada; Heinrich, B., Simon Fraser Univ., Canada; Cragg, R. A., CTF Systems, Inc., Canada; Zhou, H., CTF Systems, Inc., Canada; Angus, V., CTF Systems, Inc., Canada; Habib, F., CTF Systems, Inc., Canada; Fife, A. A., CTF Systems, Inc., Canada; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 467-476; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Correlations between critical current density (j(sub c)) critical temperature (T(sub c)) and the density of edge dislocations and nonuniform strain have been observed in YBCO thin films deposited by pulsed laser ablation on (001) LaAlO3 single crystals. Distinct maxima in j(sub c) as a function of the linewidths of the (001) Bragg reflections and as a function of the mosaic spread have been found in the epitaxial films. These maxima in j(sub c) indicate that the magnetic flux lines, in films of structural quality approaching that of single crystals, are insufficiently pinned which results in a decreased critical current density. T(sub c) increased monotonically with improving crystalline quality and approached a value characteristic of a pure single crystal. A strong correlation between j(sub c) and the density of edge dislocations N(sub D) was found. At the maximum of the critical current density the density of edge dislocations was estimated to be N(sub D) approx. equals 1-2 x 10(exp 9)/sq cm.
Author
Critical Temperature; Density (Number/Volume); Yttrium Oxides; Superconducting Films; Epitaxy; Correlation

19980202806 Max-Planck-Inst. fuer Metallforschung, Stuttgart, Germany
The Oxygen Content of the High-Temperature Superconducting Compound Bi(2+x)SR(3-y)Ca(y)Cu2O(8+d) with Respect to Varying Ca and Bi Contents
Majewski, P., Max-Planck-Inst. fuer Metallforschung, Germany; Su, H.–L., Max-Planck-Inst. fuer Metallforschung, Germany; Aldinger, F., Max-Planck-Inst. fuer Metallforschung, Germany; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 483-489; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The oxygen content of Bi(2+x)SR(3-y)Ca(y)Cu2O(8+d) (2212 phase) has been determined as a function of its cation concentration. With increasing Ca and Bi content the oxygen content increases and T(sub c) decreases. The oxygen content of Ca rich 2212 phase increases with decreasing annealing temperatures. The study shows that the T(sub c) of the 2212 phase primarily is controlled by its cation concentration.
Author
Oxygen; Content; High Temperature Superconductors

19980202807 Max-Planck-Inst. fuer Metallforschung, Pulvermetallurgisches Lab., Stuttgart, Germany

Pb Solubility of the High-Temperature Superconducting Phase Bi2SR2Ca2Cu3O(10 + d)

Kaesche, Stefanie, Max-Planck-Inst. fuer Metallforschung, Germany; Majewski, Peter, Max-Planck-Inst. fuer Metallforschung, Germany; Aldinger, Fritz, Max-Planck-Inst. fuer Metallforschung, Germany; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 490-499; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

For the nominal composition of Bi(2.27-x)Pb(x)SR2Ca2Cu3O(10+d) the lead content was varied from x = 0.05 to 0.45. The compositions were examined between 830 C and 890 C which is supposed to be the temperature range over which the so-called 2223 phase (Bi2SR2Ca2Cu3O(10+d) is stable. Only compositions between x=0.18 to 0.36 could be synthesized in a single phase state. For x greater than 0.36 a lead containing phase with a stoichiometry of Pb4(SR,Ca)5CuO(d) is formed, for x less than 0.18 mainly Bi2SR2CaCu2O(8+d) and cuprates are the equilibrium phases. The temperature range for the 2223 phase was found to be 830 C to 890 C but the 2223 phase has extremely varying cation ratios over this temperature range. Former single phase 2223 samples turn to multi phase samples when annealed at slightly higher or lower temperatures. A decrease in the Pb solubility with increasing temperature was found for the 2223 phase.

Author

Solubility; Lead (Metal); High Temperature Superconductors; Temperature Effects

19980202808 Formation, Inc., Madison, WI USA

Superconductivity Theory Applied to the Periodic Table of the Elements

Elifritz, Thomas Lee, Formation, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 500-509; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The modern theory of superconductivity, based upon the BCS to Bose-Einstein transition, is applied to the periodic table of the elements, in order to isolate the essential features of high temperature superconductivity and to predict its occurrence within the periodic table. It is predicted that Sodium-Ammonia, Sodium Zinc Phosphide and Bismuth (I) Iodide are promising materials for experimental explorations of high temperature superconductivity.

Author

Superconductivity; High Temperature; Chemical Elements; Quantum Statistics

19980202809 Tokyo Univ., Dept. of Applied Chemistry, Japan

Chemical Stabilization and High Pressure Synthesis of Ba-Free Hg-Based Superconductors: (Hg,M)SR2Ca(n-1) Cu(n)O(y)(n=1 to 3)

Kishio, K., Tokyo Univ., Japan; Shimoyama, J., Tokyo Univ., Japan; Hahkura, S., Tokyo Univ., Japan; Kitazawa, K., Tokyo Univ., Japan; Yamaura, K., Kyoto Univ., Japan; Hiroi, Z., Kyoto Univ., Japan; Takano, M., Kyoto Univ., Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 510-518; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A homologous series of new Hg-based HTSC compounds, (Hg,M)SR2Ca(n-1)Cu(n)O(y) with n=l to 3, have been synthesized. The stabilization of the pure phases have been accomplished by chemical doping of third elements such as M=Cr, Mo and Re. While the Hg12O1(n=1) phase was readily obtained in this way, it was necessary to simultaneously dope Y into the Ca site to stabilize the Hg1212(n=2) phase. On the other hand, single-phase Y-free Hg1212(n=2) and Hg1223(n=3) samples were synthesized only under a high pressure of 6 GPa. In sharp contrast to the Ba-containing compounds, all the samples prepared in the present study have been quite stable during the synthesis and no deterioration in air has been observed after the preparation.

Author

Chemical Composition; High Pressure; Stabilization; Synthesis (Chemistry)

19980202810 National Inst. for Research in Inorganic Materials, Tsukuba, Japan

A New Series of Oxycarbonate Superconductors (Cu(0.5)C(0.5))(m)Ba(m+1)Ca(n-1)Cu(n)O2(m+n)+1

Takayama–Muromachi, E., National Inst. for Research in Inorganic Materials, Japan; Kawashima, T., National Inst. for Research in Inorganic Materials, Japan; Matsui, Y., National Inst. for Research in Inorganic Materials, Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 522-528; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We found a new series of oxycarbonate superconductors in the Ba-Ca-Cu-C-O system under high pressure of 5 GPa. Their ideal formula is (Cu(0.5)C(0.5))mBa(m+l)Ca(n-l)Cu(n)O2(m+n)+l ((Cu,C)-m(m+l)(n-l)n). Thus far, n=3, 4 members of the m=l series, (Cu,C)-1223 and (Cu,C)-1234, have been prepared in bulk while n=4, 5 members, (Cu,C)-2334 and (Cu,C)-2345, have

been prepared for the m=2 series. (Cu,C)-1223 shows superconductivity below 67 K while T(sub c)'s of other compounds are above 110 K. In particular, (Cu,C)-1234 has the highest T(sub c) of 117 K.
Author
Oxygen; Carbonates; Superconductors (Materials)

19980202811 Kyoto Univ., Inst. for Chemical Research, Uji, Japan
High Pressure Synthesis and Magnetic Studies of Quasi One Dimensional Systems SR(n-1)Cu(n+1)O(2n) (n=3,5)
Azuma, M., Kyoto Univ., Japan; Hiroi, Z., Kyoto Univ., Japan; Takano, M., Kyoto Univ., Japan; Ishida, K., Osaka Univ., Japan; Kitaoka, Y., Osaka Univ., Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 529-536; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

SRCu2O3, and SR2Cu3O5 containing two-leg and three-leg S = 1/2 ladders made of antiferromagnetic Cu-O-Cu linear bonds, respectively, were synthesized at high pressure, and their crystallographic and magnetic properties were investigated. Both susceptibility and T(sub 1) data of NMR revealed the existence of a large spin gap only for SRCu2O3. Superconductivity, which had been predicted theoretically for carrier-doped SRCu2O3 could not be realized although partial substitution of La(3+) for SR(2+) seemed to be carried out successfully. Electron carriers injection seems to remain localized.
Author
High Pressure; Synthesis (Chemistry); Magnetic Properties; Antiferromagnetism

19980202812 Saint Petersburg Technical Univ., Russia
Influence of Calcium on Transport Properties, Band Spectrum and Superconductivity of YBa2Cu3O(y) and YBa(1.5) La(0.5)Cu3O(y)
Gasumyants, V. E., Saint Petersburg Technical Univ., Russia; Vladimirskaya, E. V., Saint Petersburg Technical Univ., Russia; Patrina, I. B., Academy of Sciences (USSR), USSR; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 537-545; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The comparative investigation of transport phenomena in Y(1-x)Ca(x)Ba2Cu3O(y) (O y > 6.87 and 6.73 x)Ca(x)Ba (1.5) La(0.5)Cu3O(y) (0 x)La(x)Cu3O(y) (O
Author
Calcium*;* Transport Properties*;* Spectra*;* Superconductivity*;* YBCO Superconductors

19980202813 Birmingham Univ., Superconductivity Research Group, UK
Structure and Superconductivity in (Bi(0.35)Cu(0.65))SR2YCu2O7 and Related Materials
Jenning, R. A., Birmingham Univ., UK; Williams, S. P., Birmingham Univ., UK; Greaves, C., Birmingham Univ., UK; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 546-554; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The recently reported (Bi/Cu)SR2YCu2O7 phase has been studied by time of flight powder neutron diffraction. The proposed 1212 structure has been confirmed and refinements have shown the oxygen in the (Bi/Cu)O layer is displaced by 0.78 A from the ideal (1/2, l/2, 0) site (P4/mmm space group) along (100). Bond Valence Sum calculations have suggested oxidation states of Bi(5+) and Cu(2+) for the cations in the (Bi/Cu)O layers. The material is non-superconducting and all attempts to induce superconductivity have been unsuccessful. Work on the related material (Ce/Cu)SR2YCu2O7 has shown the ideal Ce content to be 0.5 Ce per formula unit. The introduction of Ba (10%) onto the SR site dramatically increases phase stability and also induces superconductivity (62K).
Author
Superconductivity; Neutron Diffraction; Atomic Structure

19980202814 Allahabad Univ., Physics Dept., India
Structural, Dynamical and Electronic Properties of CaCuO2
Agrawal, Bal K., Allahabad Univ., India; Agrawal, Savitri, Allahabad Univ., India; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 555-563; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The scalar relativistic version of an accurate first principles full potential self-consistent Linearized Muffin Tin Orbital (LMTO) method has been employed for describing the physical properties of the parent system of the high-Tc oxide superconduc-

tors, i.e., CaCuO2. The presently employed modified version of the LMTO method is quite fast and goes beyond the usual LMTO-ASA method in the sense that it permits a completely general shape of the potential and the charge density. Also, in contrast to LMTO-ASA, the present method is also capable of treating distorted lattice structures accurately. The calculated values of the lattice parameters of pure CaCuO2 lie within 3% of the experimentally measured values for the SR-doped system Ca(.86)SR(.14)CuO(2). The computed electronic structures and the density of states is quite similar to those of the other oxide superconductors, except of their three-dimensional character because of the presence of strong coupling between the closely spaced CuO2 layers. The van Hove singularity peak appears slightly below the Fermi level and a small concentration of oxygenation or substitutional doping may pin it at the Fermi level. The calculated frequencies for some symmetric frozen phonons for undoped CaCuO2 are quite near to the measured data for the SR-doped CaCuO2.
Author
Copper Oxides; Calcium Compounds; Lattice Parameters; Electrical Properties; Atomic Structure; Dynamic Structural Analysis

19980202815 State Research Center of Superconductive Radioelectronics, Kiev, Ukraine
High-Performance Passive Microwave Survey on Josephson Junctions
Denisov, A. G., State Research Center of Superconductive Radioelectronics, Ukraine; Radzikhovsky, V. N., State Research Center of Superconductive Radioelectronics, Ukraine; Kudeliya, A. M., State Research Center of Superconductive Radioelectronics, Ukraine; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 568-573; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The quasi-optical generations of images of objects with their internal structure in millimeter (MM) and submillimeter (SMM) bands is one of prime problems of modern radioelectronics. The main advantage of passive MM imaging systems in comparison with visible and infrared (IR) systems is small attenuation of signals in fog, cloud, smoke, dust and other obscurants. However, in panoramic scanning of space the observation time lengthens and thereby the information processing rate becomes restricted, so that single-channel systems cannot image in real time. Therefore we must use many radiometers in parallel to reduce the observation time. Such system must contain receiving sensors as pixels in multibeam antenna. The use of Josephson Junctions (JJ) for this purpose together with the cryoelectronic devices like GaAs FET or SQUIDS for signal amplifications after JJ is of particular interest in this case.
Author
Submillimeter Waves; Imaging Techniques; Infrared Instruments; Josephson Junctions; Microwaves

19980202816 State Research Center Fonon, Kiev, Ukraine
Josephson Frequency Meter for Millimeter and Submillimeter Wavelengths
Anischenko, S. E., State Research Center Fonon, Ukraine; Larkin, S. Y., State Research Center Fonon, Ukraine; Chaikovsky, V. I., State Research Center Fonon, Ukraine; Khabayev, P. V., State Research Center Fonon, Ukraine; Kamyshin, V. V., State Research Center Fonon, Ukraine; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 574-584; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Frequency measurements of electromagnetic oscillations of millimeter and submillimeter wavebands with frequency growth due to a number of reasons become more and more difficult. First, these frequencies are considered to be cutoff for semiconductor converting devices and one has to use optical measurement methods instead of traditional ones with frequency transfer. Second, resonance measurement methods are characterized by using relatively narrow bands and optical ones are limited in frequency and time resolution due to the limited range and velocity of movement of their mechanical elements as well as the efficiency of these optical techniques decrease with the increase of wavelength due to diffraction losses. That requires the apriori information on the radiation frequency band of the source involved. Method of measuring frequency of harmonic microwave signals in millimeter and submillimeter wavebands based on the ac Josephson effect in superconducting contacts is devoid of all the above drawbacks. This approach offers a number of major advantages over the more traditional measurement methods, which is based on frequency conversion, resonance and interferometric techniques. It can be characterized by high potential accuracy, wide range of frequencies measured, prompt measurement and the opportunity to obtain panoramic displays of the results as well as full automation of the measuring process.
Author
Josephson Junctions; Frequency Measurement; Wavelengths; Oscillations; Submillimeter Waves; Electromagnetic Radiation

19980202817 State Research Center Fonon, Kiev, Ukraine
Josephson Junction Spectrum Analyzer for Millimeter and Submillimeter Wavelengths
Larkin, S. Y., State Research Center Fonon, Ukraine; Anischenko, S. E., State Research Center Fonon, Ukraine; Khabayev, P. V.,

State Research Center Fonon, Ukraine; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 585-593; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A prototype of the Josephson-effect spectrum analyzer developed for the millimeter-wave band is described. The measurement results for spectra obtained in the frequency band from 50 to 250 GHz are presented.
Author
Josephson Junctions; Spectrum Analysis

19980202822 Argonne National Lab., IL USA
Mechanical Properties of High-Temperature Superconducting Wires
Goretta, K. C., Argonne National Lab., USA; Cluff, J. A., Argonne National Lab., USA; Joo, J., Argonne National Lab., USA; Lanagan, M. T., Argonne National Lab., USA; Singh, J. P., Argonne National Lab., USA; Vasanthamohan, N., Argonne National Lab., USA; Xin, Y., Midwest Superconductivity, Inc., USA; Wong, K. W., Midwest Superconductivity, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 633-638; In English; Also announced as 19980202795
Contract(s)/Grant(s): W-31-109-eng-38; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Bending strength, fracture toughness, and elastic modulus data were acquired for YBa2Cu3O(x), Bi2SR2CaCu2O(x), (Bi,Pb)2SR2Ca2Cu3O(x), and Tl2Ba2Ca2Cu3O(x) bars. These data and thermal expansion coefficients strongly suggest that the maximum possible tensile strain without fracture of bulk tapes or wires is approx. = 0.2%. In Ag-clad conductors, residual stresses will be of limited benefit, but fractures produced by larger strains can be accommodated by shunting current through the Ag.
Author
Mechanical Properties; Wire; High Temperature Superconductors; Conductors

19980202823 Argonne National Lab., Energy Technology Div., IL USA
Progress in Development of Tapes and Magnets Made From Bi-2223 Superconductors
Balachandran, U., Argonne National Lab., USA; Iyer, A. N., Argonne National Lab., USA; Haldar, P., Intermagnetics General Corp., USA; Hoehn, J. G., Jr., Intermagnetics General Corp., USA; Motowidlo, L. R., IGC Advanced Superconductors, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 639-649; In English; Also announced as 19980202795
Contract(s)/Grant(s): DE-FG02-92ER-81461; W-31-109-eng-38; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Long lengths of (Bi,Pb)2SR2Ca2Cu3O(x) tapes made by powder-in-tube processing have been wound into coils. Performance of the coils has been measured at temperatures of 4.2 to 77 K, and microstructures have been examined by X-ray diffraction and electron microscopy and then related to superconducting properties. A summary of recent results and an overview of future goals are presented.
Author
Fabrication; Magnets; Magnetic Tapes; Superconductors (Materials)

19980202826 Max-Planck-Inst. fuer Metallforschung, Stuttgart, Germany
Introduction of Artificial Pinning Centres in ”Bi2SR2CaCu2O8” Ceramics
Majewski, P., Max-Planck-Inst. fuer Metallforschung, Germany; Elschner, S., Hoechst A.G., Germany; Bestgen, H., Hoechst A.G., Germany; Aldinger, F., Max-Planck-Inst. fuer Metallforschung, Germany; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 677-685; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Considering the phase equilibrium diagram of the system Bi2O3-SRO-CaO-CuO, single phase ”Bi2SR2CaCu2O8” ceramics have been transformed by a simple annealing procedure into multi phase samples. The transformation results in the formation of second phases and in an increase of the intra grain critical current density at 1 T increased five times. This increase is believed to express improved pinning properties of the superconducting crystals. The prepared pinning centres are believed to be e.g. coherent precipitates (Guinier-Preston-zones) within the superconducting crystals.
Author
Ceramics; Pinning; Annealing; Copper Oxides

19980202828 National Chiao Tung Univ., Inst. of Electrophysics, Hsinchu, Taiwan, Province of China
Effect of Microwave-Enhanced Superconductivity in YBa2Cu3O7 Bi-Crystalline Grain Boundary Weak-Links
Fu, C. M., National Chiao Tung Univ., Taiwan, Province of China; Chen, C. M., National Chiao Tung Univ., Taiwan, Province

of China; Lin, H. C., National Chiao Tung Univ., Taiwan, Province of China; Wu, K. H., National Chiao Tung Univ., Taiwan, Province of China; Juang, J. Y., National Chiao Tung Univ., Taiwan, Province of China; Uen, T. M., National Chiao Tung Univ., Taiwan, Province of China; Gou, Y. S., National Chiao Tung Univ., Taiwan, Province of China; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 694-702; In English; Also announced as 19980202795

Contract(s)/Grant(s): NSC82-0212-M009-002; NSC83-0212-M009-022; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We have studied systematically the effect of microwave irradiation on the temperature dependent resistivity R(T) and the current-voltage (I-V) characteristics of YBa2Cu3O(7-x) (YBCO) bicrystalline grain boundary weak-links (GBWLs), with grain boundary of three different tilt angles. The superconducting transition temperature, T(sub c), has significant enhancement upon microwave irradiation. The microwave enhanced T(sub c) is increased as a function of incident microwave power, but limited to an optimum power level. The GBWLs of 45 deg tilt boundary has shown to be most sensitive to the microwave irradiation power, and the GBWLs of 36.8 deg tilt boundary has displayed a moderate response. In contrast, no enhancement of T(sub c) was observed in the GBWLs of 24 deg tilt boundary, as well as in the uniform films. Under the microwave irradiation, the R(T) dependence is hysteretic as the transition taken from superconducting state to normal state and vice versa. Mechanisms associated with the redistribution of nonequilibrium quasiparticles under microwave irradiation are discussed.

Author

Microwave Radiometers; Temperature Dependence; Resistance Heating; Grain Boundaries; YBCO Superconductors; Electrical Resistivity; Microwaves

19980202829 National Chiao Tung Univ., Inst. of Electrophysics, Hsinchu, Taiwan, Province of China

Effects of Oxygen Stoichiometry on the Scaling Behaviors of YBa2Cu3O(x) Grain Boundary Weak-Links

Wu, K. H., National Chiao Tung Univ., Taiwan, Province of China; Fu, C. M., National Chiao Tung Univ., Taiwan, Province of China; Jeng, W. J., National Chiao Tung Univ., Taiwan, Province of China; Juang, J. Y., National Chiao Tung Univ., Taiwan, Province of China; Uen, T. M., National Chiao Tung Univ., Taiwan, Province of China; Gou, Y. S., National Chiao Tung Univ., Taiwan, Province of China; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 703-711; In English; Also announced as 19980202795

Contract(s)/Grant(s): NSC82-0212-M009-002; NSC83-0212-M009-002; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The effects of oxygen stoichiometry on the transport properties of the pulsed laser deposited YBa2Cu3O(x) bicrystalline grain boundary weak-link junctions were studied. It is found that not only the cross boundary resistive transition foot structure can be manipulated repeatedly with oxygen annealing processes but the junction behaviors are also altered in accordance. In the fully oxygenated state i.e with x = 7.0 in YBa2Cu3O(x) stoichiometry, the junction critical current exhibits a power of 2 scaling behavior with temperature. In contrast, when annealed in the conditions of oxygen-deficient state (e.g with x = 6.9 in YBa2Cu3O(x) stoichiometry) the junction critical current switches to a linear temperature dependence behavior. The results are tentatively attributed to the modification of the structure in the boundary area upon oxygen annealing, which, in turn, will affect the effective dimension of the geometrically constrained weak-link bridges. The detailed discussion on the responsible physical mechanisms as well as the implications of the present results on device applications will be given.

Author

Stoichiometry; Oxygen; YBCO Superconductors; Transport Properties

19980202830 Veszprem Univ., Veszprem, Hungary

Effect of Particle Size and Particle Size Distribution on Physical Characteristics, Morphology and Crystal Structure of Explosively Compacted High-T(sub c) Superconductors

Kotsis, I., Veszprem Univ., Hungary; Enisz, M., Veszprem Univ., Hungary; Oravetz, D., Veszprem Univ., Hungary; Szalay, A., Metalltech Ltd., Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 712-721; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A superconductor, of composition Y(Ba,K,Na)2Cu3O(x)/F(y) and a composite, of composition Y(Ba,K,Na)2Cu3O(x)/F(y) + Ag, with changing K, Na and F content, but a constant silver content (Ag = 10 mass per cent) was prepared using a single heat treatment. The resulting material was ground in a corundum lined mill, separated to particle size fractions of 0-40 microns, 0-63 microns and 63-900 microns and explosively compacted, using an explosive pressure of 104 MPa and a subsequent heat treatment.

Best results were obtained with the 63-900 micron fraction of composition Y(Ba(1,95)K(0,01)Cu3O(x)F(0,05/Ag: porosity <0.01cc/gandcurrentdensity800 A/sq cm at 77 K.
Author
Particle Size Distribution; Morphology; Mechanical Properties

19980202831 Technical Univ. of Budapest, Dept. of Electronics Technology, Hungary
Percolation Effect in Thick Film Superconductors (Using a Bi(Pb)SRCaCuO based Paste to Prepare a Superconducting Planar Transformer)
Sali, Robert, Technical Univ. of Budapest, Hungary; Harsanyi, Gabor, Technical Univ. of Budapest, Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 722-729; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A thick film superconductor paste has been developed to study the properties of granulated superconductor materials, to observe the percolation effect and to confirm the theory of the conducting mechanism in the superconducting thick films. This paste was also applied to make a superconducting planar transformer. Due to high T(sub c) and advantageous current density properties the base of the paste was chosen to be of Bi(Pb)SRCaCuO system. For contacts a conventional Ag/Pt paste was used. The critical temperature of the samples were between 110 K and 115 K depending on the printed layer thickness. The critical current density -at the boiling temperature of the liquid He- was between 200-300 A/sq cm. The R(T) and V(I) functions were measured with different parameters. The results of the measurements have confirmed the theory of conducting mechanism in the material. The percolation structure model has been built and described. As an application, a superconducting planar thick film transformer was planned and produced. Ten windings of the transformer were printed on one side of the alumina substrate and one winding was printed on the other side. The coupling between the two sides was possible through the substrate. The samples did not need special drying and firing parameters. After the preparation, the properties of the transformer were measured. The efficiency and the losses were determined. Finally, some fundamental advantages and problems of the process were discussed.
Derived from text
Percolation; Superconductors (Materials); Transformers; Thick Films; Fabrication; Current Density

19980202832 Roland Eotvos Univ., Dept. for Low Temperature Physics, Budapest, Hungary
Line Group Techniques in Description of the Structural Phase Transitions in Some Superconductors
Meszaros, C., Roland Eotvos Univ., Hungary; Balint, A., Agriculture Univ., Hungary; Bankuti, J., Roland Eotvos Univ., Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 730-736; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The main features of the theory of line groups, and their irreducible representations are briefly discussed, as well as the most important applications of them. A new approach in the general symmetry analysis of the modulated systems is presented. It is shown, that the line group formalism could be a very effective tool in the examination of the structural phase transitions in High Temperature Superconductors. As an example, the material YBa2Cu3O(7-x), is discussed briefly.
Author
Group Theory; Phase Transformations; Superconductors (Materials); Formalism

19980202833 Academy of Sciences of the Ukraine, Dept. of Solid State Theory, Kiev, Ukraine
Macroscopic and Bulk-Controlled Elastic Modes in an Interaction of Interstitial Alcali Metal Cations Within a Face-Centered Cubic Crystalline Fullerine
Tatarenko, Valentine A., Academy of Sciences of the Ukraine, Ukraine; Tsysman, Constantin L., Academy of Sciences of the Ukraine, Ukraine; Oltarzhevskaya, Yelena, Academy of Sciences of the Ukraine, Ukraine; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 739-742; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The calculations in a majority of previous works for the fulleride (AqC-60) crystals were performed within the framework of the rigid-lattice model, neglecting the distortion relaxation of the host fullerene (C-60) crystal caused by the interstitial alkali-metal (A) cations. The given paper seeks to find a functional relation between the amplitudes of the doping-induced structure-distortion waves and of statistic concentrations. A semiphenomenological model is constructed here within the scope of statistical-thermodynamic treatment and using the lattice-statistics simulation method.
Derived from text
Alkali Metals; Fullerenes; Fullerides; Elastic Properties; Modulus of Elasticity

19980202834 Midwest Superconductivity, Inc., Lawrence, KS USA

Thallium 2223 High T(sub c) Superconductor in a Silver Matrix and its Magnetic Shielding, Thermal Cycle and Time Aging Properties

Fei, X., Midwest Superconductivity, Inc., USA; He, W. S., Midwest Superconductivity, Inc., USA; Havenhill, A., Midwest Superconductivity, Inc., USA; Ying, Z. Q., Midwest Superconductivity, Inc., USA; Xin, Y., Midwest Superconductivity, Inc., USA; Alzayed, N., Midwest Superconductivity, Inc., USA; Wong, K. K., Midwest Superconductivity, Inc., USA; Guo, Y., Kansas State Univ., USA; Reichle, D., Kansas State Univ., USA; Lucas, M. S. P., Kansas State Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 743-752; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Superconducting Tl2Ba2Ca2Cu3O10 (Tl2223) was ground to powder. Mixture with silver powder (0-80% weight) and press to desired shape. After proper annealing, one can get a good silver-content Tl2223 bulk superconductor. It is time-stable and has good superconducting properties as does pure Tl2223. It also has better mechanical properties and far better thermal cycle properties than pure Tl2223.

Author

Thallium; Superconductors (Materials); High Temperature Superconductors; Silver

19980202836 Hyderabad Univ., School of Physics, India

A Study on the Superconducting Properties of YBa2Cu(3-x)Nb(x)O(y) Thin Films

Srinivas, S., Hyderabad Univ., India; Bhatnagar, A. K., Hyderabad Univ., India; Pinto, R., Tata Inst. of Fundamental Research, India; Pai, S. P., Tata Inst. of Fundamental Research, India; Apte, P. R., Tata Inst. of Fundamental Research, India; Purandare, S. C., Tata Inst. of Fundamental Research, India; DSouza, C. P., Tata Inst. of Fundamental Research, India; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 762-769; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Effect of Niobium substitution at the copper site in YBa2Cu3O(7-x) was studied in thin film form. The films were deposited by the laser ablation technique using the targets of the YBa2Cu(3-x)Nb(x)O(y) where x = 0.0, 0.025, 0.05, 0.1, 0.2, 0.4, 0.8 and 1.0 under identical deposition conditions on SRTiO3

substrates. Films were characterized by XRD, resistivity, I-V and J(sub c) measurements. Films made from x = 0.025 and 0.05 concentrations of Nb substituted targets showed relatively improved superconducting properties compared to that of undoped films. The best J(sub c) realized for x = 0.025 Nb concentration was 1.8 x 10(exp 6) A/sq cm and for 0.05 Nb concentration it was 3.2 x lO(exp 6) A/sq cm at 77 K. However, degradation of the superconducting properties, with the increase of x greater than or equal to 0.1 Nb concentration and drastic suppression and complete loss of superconductivity was noticed for x greater than or equal to 0.4. The growth of impurity phase YBa2NbO6 for x = 0.1 and above of Nb concentration was noticed from XRD patterns. However, the site occupancy of Nb could not be confirmed from these studies.

Author

YBCO Superconductors; Electrical Properties; Thin Films; Superconductivity

19980202837 Tata Inst. of Fundamental Research, Solid State Electronics Group, Bombay, India

Growth and Micro Structural Studies on Yittria Stabilized Zirconia (YSZ) and Strontium Titanate (STO) Buffer Layers

Srinivas, S., Hyderabad Univ., India; Pinto, R., Tata Inst. of Fundamental Research, India; Pai, S. P., Tata Inst. of Fundamental Research, India; Souza, C. P. D., Tata Inst. of Fundamental Research, India; Apte, P. R., Tata Inst. of Fundamental Research, India; Kumar, D., Tata Inst. of Fundamental Research, India; Purandare, S. C., Tata Inst. of Fundamental Research, India; Bhatnagar, A. K., Hyderabad Univ., India; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 770-778; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Microstructure of Yittria Stabilized Zirconia (YSZ) and Strontium Titanate (STO) of radio frequency magnetron sputtered buffer layers was studied at various sputtering conditions on Si

, Sapphire and LaAlO3 substrates. The effect of substrate temperatures up to 800 C and sputtering gas pressures in the range of 50 mTorr growth conditions was studied. The buffer layers of YSZ and STO showed a strong tendency for columnar structure with variation growth conditions. The buffer layers of YSZ and STO showed orientation. The tendency for columnar growth was observed above 15 mTorr sputtering gas pressure and at high substrate temperatures. Post annealing of these films in oxygen atmosphere reduced the oxygen deficiency and strain generated during growth of the films. Strong c-axis oriented superconducting YBa2Cu9O(7-x) (YBCO) thin films were obtained on these buffer layers using the pulsed laser ablation technique. YBCO films deposited on multilayers of YSZ and STO were shown to have better superconducting properties.
Author
Microstructure; Crystal Growth; Strontium Titanates; Yttria-Stabilized Zirconia

19980202876 National Inst. for Fusion Science, Nagoya, Japan
Dynamical Simulation for Sputtering of B4C
Kenmotsu, T., Graduate Univ. for Advanced Studies, Japan; Kawamura, T., National Inst. for Fusion Science, Japan; Ono, T., Okayama Univ. of Science, Japan; Yamamura, Y., Okayama Univ. of Science, Japan; Mar. 1998; ISSN 0915-6364; 19p; In English
Report No.(s): NIFS-DATA-46; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Using ACAT-DIFFUSE code, we have simulated the fluence dependence of B4C sputtering and the associated surface composition change under D(+) ion bombardment. The ACAT-DIFFUSE is a simulation code, which is based on a Monte Carlo method with a binary collision approximation and solves diffusion equations. In the case of near-threshold sputtering, the preferential sputtering of B atoms is enhanced by the threshold effect. As a result, the total sputtering yield at the steady-state is reduced by about 20% compared with low-fluence sputtering. The surface concentration at steady-state is determined by the competitive processes between diffusion and surface-atom removal due to sputtering. At normal incidence the interstitial diffusion contributes appreciably to the steady-state surface concentration, but at grazing incidence this effect is small. Therefore, the steady-state surface concentration ratio at grazing incidence is less than that of normal incidence.
Author
Computerized Simulation; Composition (Property); Diffusion; Ion Irradiation; Surface Layers; Dynamic Models; Monte Carlo Method

19980203099 NASA Pasadena Office, CA USA
Buried Porous Silicon-Germanium Layers in Monocrystalline Silicon Lattices
Fathauer, Robert W., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; George, Thomas, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jones, Eric W., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; May 26, 1998; 10p; In English; Division of US-Patent-Appl-SN-390456, filed 15 Feb. 1995 which is a continuation of abandoned US-Patent-Appl-SN-105728, filed 11 Aug. 1993
Patent Info.: US-Patent-5,757,024; US-Patent-Appl-SN-695322; US-Patent-Appl-SN-390456; US-Patent-Appl-SN-105728; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Monocrystalline semiconductor lattices with a buried porous semiconductor layer having different chemical composition is discussed and monocrystalline semiconductor superlattices with a buried porous semiconductor layers having different chemical composition than that of its monocrystalline semiconductor superlattice are discussed. Lattices of alternating layers of monocrystalline silicon and porous silicon-germanium have been produced. These single crystal lattices have been fabricated by epitaxial growth of Si and Si-Ge layers followed by patterning into mesa structures. The mesa structures are strain etched resulting in porosification of the Si-Ge layers with a minor amount of porosification of the monocrystalline Si layers. Thicker Si-Ge layers produced in a similar manner emitted visible light at room temperature.
Official Gazette of the U.S. Patent and Trademark
Semiconductor Devices; Porous Silicon; Germanium; Fabrication; Single Crystals; Superlattices; Epitaxy

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THERMODYNAMICS AND STATISTICAL PHYSICS

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

19980201952 Army Research Lab., Aberdeen Proving Ground, MD USA
Thermodynamic Relations Along the Principal Hugoniot ***Final Report, Oct. 1992 - Dec. 1997***
Segletes, Steven B., Army Research Lab., USA; Mar. 1998; 44p; In English
Contract(s)/Grant(s): 1L162618AH80
Report No.(s): AD-A339345; ARL-TR-1641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Some thermodynamic relations are derived along the principal Hugoniot of materials for which the Grueneisen relation is a function of volume only. Rather than being expressed in terms of traditional thermodynamic variables, such as volume and temperature, the relations are expressed in terms of the shock Hugoniot behavior and of a term grouping that is related to the Grueneisen function. by so doing, a new perspective is gained on both the nature of the Hugoniot as well as the interrelation of thermodynamic quantities along the Hugoniot.
DTIC
Amount; Thermodynamics; Hugoniot Equation of State

19980202903 University of Central Florida, Dept. of Mechanical Materials and Aerospace Engineering, Orlando, FL USA
Cryo Power and Heat Transfer ***Interim Report, 17 Jul. 1996 - 31 Jul 1997***
Chow, L. C., University of Central Florida, USA; Gu, C. B., University of Central Florida, USA; Lu, W. F., University of Central Florida, USA; Mauriello, R. J., University of Central Florida, USA; Nguyen, D. D., University of Central Florida, USA; Aug. 1997; 74p; In English
Contract(s)/Grant(s): F33615-96-C-2681; AF Proj. 1651
Report No.(s): AD-A341597; WL-TR-97-2093; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The numerous advantages of operating electronics at the cryogenic temperature have made this research increasingly important Because the foremost problem in electronic cooling is achieving high heat removal capacity within small packages, one focus of this study is to investigate the heat transfer characteristics of various cooling techniques. Pool boiling experiment studies the effects of heater angle orientation and confined spacing on CHF (Critical Heat Flux). The horizontal upward-facing heater gives the highest CHF while the downward facing position causes significant drop in CHF. The study also finds a critical value (s=2.5 mm) for the confined spacing situation. For the heaters in an array, at the vertical orientation, the influence from the lower heater causes a lower CHF of the higher heater. Forced convective boiling in this study can achieve 4 to 5 times higher heat removal rates thin those of pool boiling. A model to describe the heat transfer mechanism near CHF is developed. It is demonstrated that the macrolayer thickness plays the most important role in determining CHF. The effect of flow channel height and heater geometry have been investigated. A practical guideline for the design of a flow boiling system is proposed. A MOSFET (Metal Oxide Semiconductor Field Effect Transistor) will be manufactured, simulated and tested at both room temperature and cryogenic temperature. The simulation results will be compared with the measurements of the real device.
DTIC
Heat Transfer; Heat Flux; Cryogenics; Cryogenic Temperature; Specific Heat; Metal Oxide Semiconductors; Field Effect Transistors

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19980202463 NASA, Washington, DC USA
NASA CORE: Central Operation of Resources for Educators-Educational Materials Catalog
1998; 126p; In English
Report No.(s): NASA/TM-1998-207845; NASA-EP-1998-03-365; NAS 1.15:207845; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The NASA Central Operation of Resources for Educators (CORE), established in cooperation with Lorain County Joint Vocational School, serves as the worldwide distribution center for NASA-produced educational materials. For a minimal charge, CORE will provide a valuable service to educators unable to visit one of the NASA Educator Resource Centers by making NASA

educational audiovisual materials available through its mail order service. Through CORE's distribution network, the public has access to more than 200 videocassette, slide, and CD-ROM programs, chronicling NASA!s state-of-the-art research and technology. Through the use of these curriculum supplement materials, teachers can provide their students with the latest in aerospace information. NASAs educational materials on aeronautics and space provide a springboard for classroom discussion of life science, physical science, astronomy, energy, Earth resources, environment, mathematics, and career education.
Derived from text
Schools; Life Sciences; Earth Resources; Catalogs (Publications); Audio Equipment

19980202702 Naval Postgraduate School, Monterey, CA USA
Cost Effectiveness Analysis of Converting a Classroom Course to a Network Based Instruction Module
green, Samantha J., Naval Postgraduate School, USA; Dec. 1997; 52p; In English
Report No.(s): AD-A341611; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The Superintendent of the Naval Postgraduate School (NPS) presented a State-of-the-School address that profiled the university of the future. This futuristic university included Network Based Learning (NBL) to provide training to a dispersed audience. Through a Jackson Foundation Grant, the NPS Institute for Education and Analysis (IDEA) is funding two contractors to convert two Executive Management Education (EME) classes into NBL modules. This thesis performs a cost effectiveness analysis on converting the two modules and discusses the intangible costs and benefits associated with converting traditional classroom courses. Using data collected from IDEA and the Bureau of Medicine and Surgery, this thesis analyzes the total cost per student as a greater number of courses are converted to NBL modules as compared to an EME conference format with no NBL modules. The findings revealed that converting only two modules is by no means cost effective in the short term. However, cost savings can be realized by converting more modules. As the same modules are used repeatedly, the high start-up costs eventually become cost effective. The many intangible benefits of NBL also add to the effectiveness of this endeavor.
DTIC
Cost Effectiveness; Cost Analysis; Cost Reduction; Education; Modules; Networks

19980202923 Institute for Human Factors TNO, Soesterberg, Netherlands
Development of a Generic Didactic Model for Simulator Training ***Interim Report***
vanEmmerik, M. L., Institute for Human Factors TNO, Netherlands; vanJoolingen, W. R., Institute for Human Factors TNO, Netherlands; vanRooij, J. C., Institute for Human Factors TNO, Netherlands; Nov. 07, 1997; 28p; In Dutch
Report No.(s): AD-A341681; TNO-TM-97-B022; TDCK-TD-97-0262; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With advances in simulation technology, simulators are increasingly used as a medium for training and instruction. This report contains a description of a proposal for a research project aimed at the development of a generic didactic model for training simulators; notably as it applies to learning requisite skills for performing high-performance tasks. A didactic model specifies the relation between learning, and training and instruction factors. The development of such a model is motivated by the need to control training and instruction factors in research on simulator fidelity, the need to assess the benefit of training simulators, e.g., relative to other training media, and the need for developing more efficient instructional systems to support simulator-based training and instruction. For several reasons, it is proposed to focus the empirical work on tutoring aspects associated with car driving skills.
DTIC
Computerized Simulation; Training Devices; Training Simulators; Systems Simulation; Performance; Computer Aided Design

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19980201919 Georgia Inst. of Tech., Construction Engineering and Management Program, Atlanta, GA USA
Partnering on Small Construction Projects
Conley, Michael A., Georgia Inst. of Tech., USA; Jul. 15, 1997; 17p; In English
Report No.(s): AD-A339893; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This investigation will address the possibility that partnering concepts are underutilized in small government projects. If Government Contracting Officers utilized partnering concepts on small construction projects, there could be a potential for saving millions of dollars annually. The primary objective of this report is to inform Contracting Officers of the benefits of partnering on small construction projects. Small projects will be considered to have a value of less than $3 million, mid-size projects range

from $3 million to $10 million, and large projects will be considered to have a value greater than $10 million. The report will highlight the partnering practices of the United States Army Corps of Engineers in regard to small projects, while also serving as a primer for the implementation of partnering.
DTIC
Government Procurement; Contracts; Contract Management

19980202247 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Preston, UK
Cost Engineering: A Feature Based Approach
Taylor, Ian M., British Aerospace Public Ltd. Co., UK; May 1998; 10p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper will outline British Aerospace's (BAe's) development of Cost Prediction/Management methodologies and toolsets and their relationship to feature based modelling. It will place these developments within the context of the in-house implementation of Integrated Product Definition (IPD) currently being addressed within BAe Military Aircraft & Aerostructure's (MA&A's) requirements for Business Process Re-engineering (BPR) and Operational Efficiency Improvement (OEI). An outline of BAe's commitment to the philosophy and implementation of Integrated Product Development is given in Section 2. Section 3 provides a history of Cost Engineering and it's Design to Cost (DTC) toolset developments. Multi-Disciplinary Optimisation (MDO) as an enabler to efficient Cost Prediction is discussed in Section 4 together with an example of an MDO toolset currently in use within BAe's Airbus Operations Company at Filton. Section 5 introduces Feature Based Costing. How "features" relate to both the design and costing processes is discussed together with an outline of BAe MA&A's development of its "Cost Prediction and Management system" pilot study. Conclusions related to the Cost Prediction process and the importance of "features" are offered in Section 6.
Author
Management Systems; Design to Cost; Parameter Identification; Multidisciplinary Design Optimization; Computer Aided Design; Product Development; Production Costs

19980202322 Haifa Univ., Ray D. Wolfe Centre for Study of Psychological Stress, Israel
Enhancing Effective Decision Making by Information Management Techniques ***Final Report, Dec. 1993 - Sep. 1994***
Breznitz, Shlomo, Haifa Univ., Israel; Ben–Zur, Hasida, Haifa Univ., Israel; Wardi, Naomi, Haifa Univ., Israel; Sep. 1997; 81p; In English
Contract(s)/Grant(s): DAJA45-93-C-0026
Report No.(s): AD-A340602; ARI-RN-97-37; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Four experiments varying in complexity of decision tasks were conducted to study the effects of information about expected length of task on decision processes and choices. All experiments utilized a combined between and within subjects design with two initial levels of information (long vs. short expected list of items) and subsequent information change (reducing the long and increasing the short). In two experiments, a computerized process methodology provided detailed data on information search, speed, and strategy used. Individual differences were tested using a battery of personality characteristics. The results indicated that initially encouraging information enhances the quality of decision processes, particularly during the first phase of the task. The impact of information change was less prominent, although it produced full reversals in several indices of decision performance. Personality characteristics interacted with the information manipulations. The role of cognitive resource allocation in decision tasks and several practical implications are discussed.
DTIC
Decision Making; Information Management

19980202796 InterFact, Inc., USA
Policy Issues Inherent in Advanced Technology Development
Baumann, Philip D., InterFact, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 400-404; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

In the development of advanced technologies, there are several forces which are involved in the success of the development of those technologies. In the overall development of new technologies, a sufficient number of these forces must be present and working in order to have a successful opportunity at developing, introducing and integrating into the marketplace a new technology. This paper discusses some of these forces and how they enter into the equation for success in advanced technology research, development, demonstration, commercialization and deployment. This paper limits itself to programs which are generally governmental funded, which in essence represent most of the technology development efforts that provide defense, energy and environ-

mental technological products. Along with the identification of these forces are some suggestions as to how changes may be brought about to better ensure success in a long term to attempt to minimize time and financial losses.
Derived from text
Technology Assessment; Policies; Consistency

19980203200 Naval Postgraduate School, Monterey, CA USA
An Assessment of the Implementation of the Single Process Initiative by the Department of Defense
Bergan, Bradley A., Naval Postgraduate School, USA; Dec. 1997; 195p; In English
Report No.(s): AD-A341579; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

One tenet of acquisition reform is to reduce the number of military specifications and standards contained in Department of Defense (DoD) contracts and to allow contractors the opportunity to use their own best practices to satisfy contractual requirements. The Single Process initiative (SPI) is DoD's effort to incorporate this policy into existing contracts, via a streamlined process. The SPI process supports the elimination or replacement of existing military specifications and standards with industry-wide practices and promotes the use of single manufacturing and management processes within a contractor facility. This thesis uses the results from 43 surveys of Government and industry participants in SPI to examine the extent to which SPI has been successful in promoting the use of single manufacturing and management processes at contractor facilities.
DTIC
Data Acquisition; Defense Program

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DOCUMENTATION AND INFORMATION SCIENCE

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

19980201985 NASA Goddard Space Flight Center, Greenbelt, MD USA
Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems
Kobler, Benjamin, Editor, NASA Goddard Space Flight Center, USA; Hariharan, P. C., Editor, Systems Engineering and Security, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998; 440p; In English, 23-26 Mar. 1998, College Park, MD, USA; Also announced as 19980201986 through 19980202025
Report No.(s): NASA/CP-1998-206850; Rept-98B00027; NAS 1.55:206850; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This document contains copies of those technical papers received in time for publication prior to the Sixth Goddard Conference on Mass Storage Systems and Technologies which is being held in cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems at the University of Maryland-University College Inn and Conference Center March 23-26, 1998. As one of an ongoing series, this Conference continues to provide a forum for discussion of issues relevant to the management of large volumes of data. The Conference encourages all interested organizations to discuss long term mass storage requirements and experiences in fielding solutions. Emphasis is on current and future practical solutions addressing issues in data management, storage systems and media, data acquisition, long term retention of data, and data distribution. This year's discussion topics include architecture, tape optimization, new technology, performance, standards, site reports, vendor solutions. Tutorials will be available on shared file systems, file system backups, data mining, and the dynamics of obsolescence.
Author
Conferences; Data Storage; Data Acquisition; CD-ROM; Computer Storage Devices; Management Systems

19980201986 Minnesota Univ., Dept. of Electrical and Computer Engineering, Minneapolis, MN USA
Shared file systems and fibre channel
OKeefe, Matthew T., Minnesota Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 1-16; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Shared file systems like Cray's SFS, DEC's VAXcluster file system, and Oracle's Parallel Server exploit network-attached storage by creating serverless distributed file systems that allow efficient, simultaneous access to shared, network-attached storage devices. In the past, these shared file system designs relied on proprietary network- attached storage like DEC's Cl network or

higher-cost interfaces like HIPPI, or used software to emulate shared storage networks. With the advent of Fibre Channel, a high-volume, open standard in network-attached storage interfaces is now available. In this paper we will review past work in traditional distributed file systems like NFS and AFS and work in shared file systems by Cray, DEC, CMU and others. New file system architectures for shared network storage will also be described. We will give a brief overview of Fibre Channel technology, describing its protocol layers, how higher level protocols like IP and SCSI are mapped to this protocol, and the topologies supported. Finally we will sketch the future evolution of network-attached storage as it moves from high-end, high-capacity requirements into mid-range and lower- end desktop computing. We believe these trends may be affected by Fibre Channel's potential to function as both a network and storage interface.
Author
Computer Networks; Cray Computers; Fibers

19980201987 Georgia Tech Research Inst., Atlanta, GA USA
Protecting file systems: A survey of backup techniques
Chervenak, Ann L., Georgia Tech Research Inst., USA; Vellanki, Vivekanand, Georgia Tech Research Inst., USA; Kurmas, Zachary, Georgia Tech Research Inst., USA; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 17-31; In English; Also announced as 19980201985
Contract(s)/Grant(s): NSF CCR-97-02609; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents a survey of backup techniques for protecting file systems. These include such choices as device-based or file-based backup schemes, full vs. incremental backups, and optional data compression. Next, we discuss techniques for on-line backup (backups performed while users continue to access the file system); these techniques include file system locking and creating instantaneous, copy-on-write 'snapshots' of the file system. Last, we discuss protecting data from site disasters and media deterioration. The paper then classifies several research and commercial backup systems according to the parameters already described. The classified systems include the UNIX dump and tar utilities; hierarchical storage managers such as IBM's AD-STAR Distributed Storage Manager, Legato's NetWorker, and UniTree; and several research and academic systems. We conclude with measurements of full and incremental backups over a one-year period in a large networked UNIX environment at Georgia Tech's College of Computing.
Author
Backups; Data Storage; Networks; Data Compression; CD-ROM; Optical Memory (Data Storage); File Maintenance (Computers)

19980201988 DataSure Services, Victoria, British Columbia Canada
The dynamics of obsolescence and the challenges of legacy data storage
MacKinnon, Gordon E., DataSure Services, Canada; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 33-39; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The constant improvement in mass storage technology is not without risks. The dynamic nature of the storage technology and market demands for improvements in price and performance put at risk the long-term viability of data stored on legacy media. The risks come from a number of factors at work in the market and industry. Despite the efforts of groups such as AIIM, IEEE and THIC toward the adoption of open standards there is still a tendency of manufacturers and developers to create proprietary solutions, ostensibly to enhance performance through unique advances. The problems arise on a number of levels; in media, hardware, software and operating system to varying degrees depending on the media, form factor, format and maturity of the technology. One of the few constants is that the market itself is by far the most significant influence. What we will cover in this paper are specific examples of these kinds of problems, and some suggested solutions.
Author
Data Storage; File Maintenance (Computers); Data Transfer (Computers); Document Storage; Optical Data Storage Materials; Cost Effectiveness; Networks

19980201989 Minnesota Univ., Dept. of Electrical and Computer Engineering, Minneapolis, MN USA
The design and performance of a shared disk file system for IRIX
Soltis, Steve, Minnesota Univ., USA; Erickson, Grant, Minnesota Univ., USA; Preslan, Ken, Minnesota Univ., USA; OKeefe, Matthew, Minnesota Univ., USA; Ruwart, Tom, Minnesota Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 41-56; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we present a new storage architecture for clusters that creates a shared memory of disk storage that is uniformly accessible to all cluster clients, scales to large capacity, and provides very high performance and connectivity. The cluster structure resembles a symmetric multiprocessor (SMP) in that clients (processors) can access disk data (memory) across a local area network like Fibre Channel (a bus or other interconnection network). All clients can see and access the same disk data with perfect consistency. Our approach avoids buffer copy overheads and server bottlenecks found in traditional file systems while scaling to potentially large numbers of clients and large capacity disk systems. We provide a description of the basic file system design, our current implementation on SGI IRIX operating system, and detailed benchmarking and performance analysis results. Good speedup and throughput is achieved for large files across 3 clients and 4 high performance disk arrays and on other client-array configurations.
Author
Networks; Data Storage; Local Area Networks; Memory (Computers); Multiprocessing (Computers); Optical Memory (Data Storage)

19980201990 Transarc Corp., Pittsburgh, PA USA
HPSS/DFS: Integration of a distributed file system with a mass storage system
Agarwalla, Rajesh, Transarc Corp., USA; Chetuparambil, Madhu, Transarc Corp., USA; Everhart, Craig, Transarc Corp., USA; Niranjan, T. N., Transarc Corp., USA; Mecozzi, Donna, Lawrence Livermore National Lab., USA; Pehkonen, Jean E., International Business Machines Corp., USA; Haynes, Rena, Sandia National Labs., USA; Jones, Hilary, Sandia National Labs., USA; Parliman, Bart, Los Alamos National Lab., USA; Ruef, Richard, International Business Machines Corp., USA; Wilbanks, Benny, International Business Machines Corp., USA; White, Vicky, Oak Ridge National Lab., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 57-69; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

To provide cost-effective access to data in storage-intensive computing environments, mass storage systems must be integrated with underlying file systems. Previous projects have presented specialized client interfaces or have integrated mass storage with local file systems. Our approach is to integrate the distributed file system DFS, with support for DMAPI, and HPSS, a high performance mass storage system. The result is a mass storage system that includes a fully distributed file system, data transfer rates that scale to the gigabyte/sec range, and archival storage, scalable to multiple petabytes.
Author
Networks; Cost Effectiveness; Data Storage; Data Transfer (Computers); Document Storage; Information Management; Data Systems

19980201991 Impactdata, Monrovia, CA USA
A method to share data between compute clients with network attached storage implementation, operation, and performance results
Fallon, Ken, Impactdata, USA; Bullers, Bill, Impactdata, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 71-79; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A Distributed Storage Node Architecture (DSNA) where multiple compute clients can concurrently share the same data through a high-bandwidth file system will be installed at the National Energy Research Scientific Computing Center (NERSC) and at the NASA Ames Research Center. A storage protocol defined by the DSNA, includes methods that produce applied, distributed, concurrent data management capabilities designed to allow multiple SGI and CRAY clients to reliably share data through network attached storage. This paper discusses the implementation, operation, and measured performance of the DSNA and the applied protocol. Implementation issues and initial test results are discussed. DSNA is an available, open standard. A Network Peripheral Adapter (NPA) is embodied within the Distributed Storage Node Architecture of a network-centric computing and data storage enterprise. The NPA is an intelligent controller and optimized file server that empowers network-attached processors with DSNA protocol the means to unlock the potential of distributed data access while enjoying the benefits of centralized management and control. Optimized for high-performance and peer-level storage, the NPA is fabric-independent and capable of linking virtually any workstation, high-performance computer and/or network with any type of storage device. by connecting high-performance disk arrays and tape drives to high-speed networks, the NPA creates network storage and allows computers to access and share data. First integrations target data sharing between multiple SGI, CRAY, and NT systems but will be extended to include SUN, HP, and AIX clients.
Author
Computer Networks; Data Storage; Data Transfer (Computers); Distributed Processing; Operating Systems (Computers); Data Management

19980201992 International Business Machines Corp., Tucson, AZ USA

Towards improved tape storage and retrieval response time

Gniewek, John J., International Business Machines Corp., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 81-94; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Magnetic tape has maintained a prominent place in the computer data storage hierarchy for in excess of forty years. As a result of continuing technology advances, the improvements made in both areal and volumetric recording density have assured that magnetic tape remains the lowest cost storage medium for most computer data storage applications. Relative to the impressive advances in reduction of disk storage costs, tape storage has maintained a 10 X to 100 X advantage in lower cost per Gigabyte. For applications such as back-up, disaster recovery, and passive archive of very infrequently accessed files, this lower cost, as well as the removability and transportability of the tape storage media, has ensured a continuing role for magnetic tape. The frequent projections of the demise of magnetic tape as a result of disk storage price-performance improvements have ignored the enablement of new applications that require significantly more storage capacity and hence, provide the driving force to maintain the 40+ year storage hierarchy paradigm. Several of these new applications place increased demands on the ability to retrieve data objects quickly and require that the tape storage serve as an active member of the hierarchy, not merely a passive member, as in applications such as disaster recovery. Until recently however, not much effort had been made to improve the retrieval response time of tape. In this metric, tape storage has continued to be disadvantaged by three to four orders of magnitude relative to disk storage. Concomitant with the very significant tape technology advancements in the last several years, there has been, and continues to be a proliferation of new types of recording devices and robot systems. In order to provide a means for judging suitability of particular types of devices for these new emerging tape applications, it would be desirable to be able to develop a figure of merit for comparing different recording systems, each with widely different component characteristics. The analyses presented here has been of value to design engineers and can be expected to be of value to application systems engineers and system integrators.
Author

Data Storage; Magnetic Tapes; Computer Networks; Data Transfer (Computers); Magnetic Storage; Bandwidth; Information Retrieval

19980201993 American Telephone and Telegraph Co., Research, Florham Park, NJ USA

Benchmarking tape system performance

Johnson, Theodore, American Telephone and Telegraph Co., USA; Miller, Ethan L., Maryland Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 95-112; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In spite of the rapid decrease in magnetic disk prices, tertiary storage (i.e., removable media in a robotic storage library) is becoming increasingly popular. The fact that so much data can be stored encourages applications that use ever more massive data sets. Application drivers include multimedia databases, data warehouses, scientific data-bases, data-intensive scientific research, and digital libraries and archives. The research community, has responded with investigations into systems integration, performance modeling, and performance optimization. Tertiary storage systems present special challenges because of their unusual performance characteristics. Access latencies can range into minutes even on unloaded systems, but transfer rates can be very high. Tertiary storage is implemented with a wide array of technologies, each with its own performance quirks. However, little detailed performance information about tertiary storage devices has been published. As a result, mass storage system (MSS) implementers must rely on vendor-reported numbers or their own tests to select appropriate tertiary storage devices. Additionally, MSS designers must have detailed knowledge of the performance characteristics of their devices to optimally place files on media and perform other optimizations. In this paper we present detailed measurements of several tape drives and describe the tests used to gather this data. The tape drives we measured include the DLT 4000, Ampex 310, IBM 3590,4mm DAT, and the Sony DTF drive. This mixture of equipment includes high and low performance drives, serpentine and helical scan drives, and cartridge and cassette tapes. This data is suitable for system performance modeling or system performance optimization studies. by measuring and modeling a variety of devices in a single study, we are able to characterize a wide range of tertiary storage devices. In addition, we hope that our simple benchmarks will become more widely used to gauge tape performance and identify potential performance bottlenecks.
Author

Computer Networks; Multimedia; Magnetic Disks; Data Compression; Data Flow Analysis; Data Bases; Data Management

19980201994 Bell Telephone Labs., Inc., Murray Hill, NJ USA

Scheduling non-contiguous tape retrievals

Hillyer, Bruce K., Bell Telephone Labs., Inc., USA; Silberschatz, Avi, Bell Telephone Labs., Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 113-123; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Large data installations normally archive relatively inactive data to a near-line tape library. The tape library performs reasonably well for sequential-access retrieval work-loads. However, if the retrieval access slices across multiple data sets, or makes retrievals from scattered portions of a large data set, then the performance can suffer drastically. In this paper, we use modeling and simulation to study several scheduling algorithms for random-access retrievals from tape. This study is based on extensive measurements of the IBM 3570 Magstar MP tape library, which is designed for fast random access. We study the retrieval performance of the Magstar MP as a function of the request size and the queue length (i.e., retrievals per tape switch). The following data point illustrates the performance. Averaged over many trials, the execution time of a schedule of 4 random retrievals from one tape (each retrieval transfers 12 MB) is 98 seconds, including the overhead of rewind, unload, eject, tape switch, and load. This schedule gives an average data rate of 0.5 MB/s, which is comparable to the average data rate of a magnetic hard disk that is fetching randomly-located pages.

Author

Computer Networks; Data Transmission; Data Storage; Magnetic Disks; Data Transfer (Computers); Information Management

19980201995 TeraStor Corp., San Jose, CA USA

Near-field recording TeraStor's mass storage benchmark technology for the next decade

Knight, Gordon, TeraStor Corp., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 125-137; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

TeraStor is developing storage products based on near-field recording that deliver a significant areal density improvement over conventional technologies. The solid immersion lens (SIL) has its origins in microscopy and was refined for use in storage applications at Stanford University. Near-field recording, using the SIL, has a substantial history and the products being developed are the result of many years of research and refinement. The basic properties and advantages of near-field recording are discussed in detail to help the reader understand how density increases are achieved.

Author

Near Fields; Data Storage; Computer Networks

19980201996 Norsam Technologies, Inc., Los Alamos, NM USA

Charged particle technology for ultra high density data storage

Bartlett, Andrew H., Norsam Technologies, Inc., USA; Fatemi, Homi, Norsam Technologies, Inc., USA; Eberle, Marc H., Norsam Technologies, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 139-143; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Long term archival storage of valuable documents is rapidly approaching a critical juncture. The introduction of reliable and acceptable microfilm techniques over sixty years ago allowed preservationists to address the 'slow fires' of deteriorating, acid-based paper documents in a cost-effective manner. Since that time, microfilm standards and techniques have evolved to allow for a relatively secure manner in which to store a variety of document types, ranging from black and white texts to color photographs. However, the advent of digital information creation and retrieval has created numerous new problems that conventional archival storage techniques are hard-pressed to address. Most notably, the capability to create huge amounts of data, often stored only in electronic format, has led to a crisis not only in the need for preservation standards for digital documents, but as well has resulted in impossible demands upon the physical storage capabilities of microfilm storage vaults. With the limited lifespan of organic-based microfilms, particularly older films, the need to replace microfilm with a more durable and dense storage medium is acute. Norsam Technologies is developing an ultra-long term storage solution in which analog, i.e. eye-readable, images are placed at unprecedented densities into nickel substrates, allowing for near geologic storage lives of data that, as eye-readable images, are not subject to the vagaries of changing formats and media to which digitally stored data is so susceptible. Specifically, using focused beams of Ga(+1) ions, data can be written at pixel sizes as small as 25 nanometers (nm), allowing, for example, the storage of one million pages of data in less than a cubic inch of material. Readback of this data is direct, requiring no intermediate bitstream interpreter. This paper will outline the process by which the data is written and stored using focused ion beam (FIB) technology.

In addition, Norsam is developing a digital product written using focused charged particle technology that will allow for the introduction of a digital technology capable of storing 165 GigaBytes (GB) of data on a CD-sized disc.
Author
Data Storage; Information Retrieval; Digital Data; Computer Networks

19980201997 American Telephone and Telegraph Co., Research, Florham Park, NJ USA
Analytic performance models of robotic storage libraries: Status update
Johnson, Theodore, American Telephone and Telegraph Co., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 145-150; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Large tertiary storage systems tend to be expensive, so performance models are needed for sizing and for performance optimization. Several researchers (including ourselves) have attempted to supply these models in recent years. In this paper we report on our progress in the development of a previously published model. The improvements we have made include a more accurate model of the robot arm, experimental validation of the model, and the integration of the model into PC analysis tools through a Perl interface.
Author
Robotics; Data Storage; Data Processing Equipment; Robot Arms

19980201998 Library of Congress, Preservation Directorate, Washington, DC USA
Monitoring the life expectancy of compact discs
Manns, Basil, Library of Congress, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 151-155; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This report measures the condition of 125 CDs that are statistically selected from a collection of over 60,000 discs. This small sample was selected to demonstrate a testing program and to get some feeling as to the general condition of the discs in the collection. Using this small sample, a complete set of ISO measurements were performed. A CD-CATS system was used to perform such measurements. Based upon the findings of these initial tests of 125 CDs, a more detailed test of the complete collection may be recommended. In any case, it is the intent that, at a minimum, these tests be repeated using these same discs in a few years to determine if any and what kind of changes may occur. With these data, information regarding the life expectancy of the collection may be determined.
Author
CD-ROM; Statistical Analysis; Data Storage; Samplers

19980201999 University of Southern California, Computer Science Dept., Los Angeles, CA USA
On configuring hierarchical storage structures
Dashti, Ali Esmail, University of Southern California, USA; Ghandeharizadeh, Shahram, University of Southern California, USA; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 157-162; In English; Also announced as 19980201985
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The rapid progress in mass storage technology is enabling designers to implement large databases for a variety of applications. The possible configurations of the hierarchical storage structures (HSS) are numerous and result in various tradeoffs, e.g., storage cost, throughput, initial latency, etc. A naive design might waste system resources and result in high cost. For example, one naive design decision is to add disk caches for those applications whose bandwidth is already satisfied by the tertiary storage device and can tolerate a high latency. In this study, we introduce a configuration planner for HSS in support of video-on- demand applications. The input to the planner are the number of simultaneous displays required by the target application (i.e., throughput), database size, and expected pattern of access to the objects. It's output are the choice of mass storage devices at each level of the hierarchy. The resulting configuration supports the application requirements at a minimum cost per display. It is possible to extend this study to consider other application requirements, such as: initial latency and storage reliability.
Author
Data Storage; Hierarchies; Configurations; Data Bases; Cost Effectiveness; Display Devices

19980202000 California Univ., Computer Science Div., Berkeley, CA USA
The Berkeley-San Francisco Fine Arts Image Database
Talagala, Nisha, California Univ., USA; Asami, Satoshi, California Univ., USA; Patterson, David, California Univ., USA; Futer-

nick, Bob, Fine Arts Museum, USA; Hart, Dakin, Fine Arts Museum, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 163-167; In English; Also announced as 19980201985
Contract(s)/Grant(s): N00600-93-K-2481; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes the world's largest on-line art collection, provided by a collaboration between the Fine Arts Museums of San Francisco and the University of California at Berkeley. The collection contains over 70,000 images of artworks and is accessible over the web. Each image will be available at a resolution of up to 3,000 by 2,000 pixels. This paper describes the storage system and the image database that make up the web site.
Author
Imaging Techniques; Arts; Data Bases; On-Line Systems

19980202001 North Dakota State Univ., Computer Science Dept., Fargo, ND USA
Eliminating the I/O bottleneck in large web caches
Rousskov, Alex, North Dakota State Univ., USA; Soloviev, Valery, North Dakota State Univ., USA; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 169-173; In English; Also announced as 19980201985; Sponsored in part by RIA
Contract(s)/Grant(s): NSF OSR-95-53368; NSF IRI-94-09845; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents a technique for eliminating the disk bottleneck in large Web Caches. Our approach objective is twofold. First, the presented algorithm substantially decreases disk activity during peak server load. Second, it maintains the hit ratio at the level of traditional caching policies. We evaluate the performance of the algorithm using trace driven simulations based on access logs from several top-level Web caches.
Author
Algorithms; Loads (Forces); Input/Output Routines; Procedures; Evaluation

19980202002 NASA Ames Research Center, Moffett Field, CA USA
Building and managing high performance, scalable, commodity mass storage systems
Lekashman, John, NASA Ames Research Center, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 175-179; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The NAS Systems Division has recently embarked on a significant new way of handling the mass storage problem. One of the basic goals of this new development are to build systems at very large capacity and high performance, yet have the advantages of commodity products. The central design philosophy is to build storage systems the way the Internet was built. Competitive, survivable, expandable, and wide open. The thrust of this paper is to describe the motivation for this effort, what we mean by commodity mass storage, what the implications are for a facility that performs such an action, and where we think it will lead.
Author
Manufacturing; Management; Space Storage

19980202003 Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA
The designs of RAID systems with XOR-Capable disks
Chang, Tai–Sheng, Minnesota Univ., USA; Shim, Sangyup, San Jose State Univ., USA; Du, David H. C., Minnesota Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 181-186; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recently, the exclusive-or computation capability was added on high performance disks to provide an alternative way of implementing RAID (Redundant Arrays of Independent Disks). This alternative approach reduces the traffic on the storage channel and eliminates the XOR computation load on the host or RAID controllers. Therefore, it may be a better approach than the traditional RAID design to implement RAIDs in a mass storage arena. In this paper, we propose two new approaches with the XOR capability on disks to implement RAID systems. Simulation results are also provided.
Author
Data Storage; Magnetic Disks; Information Management; Optical Disks; Arrays

19980202004 INTEL Corp., Server Architecture Lab., Beaverton, OR USA
Optimizing configuration for hierarchical storage based continuous media server
Won, Youjip, INTEL Corp., USA; Srivastava, Jaideep, Minnesota Univ., USA; Zhang, Zhi–Li, Minnesota Univ., USA; Sixth God-

dard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 187-191; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recent advances in computing and communication technologies have made it technically feasible and economically viable to provide on-line access to a variety of information services over high speed networks. Particularly, convergence of various technological factors, namely in network access and in video coding and transmission, have recently brought a rapid growth of interest in on-line access to multimedia services. The problem of large-scale provision of services has several implications for the design of a storage server. Voluminous nature of a multimedia file is one of the primary reasons which makes the design of the server non trivial. With MPEG-2 compression technique a movie file of 110 min length requires more than 3 G bytes of storage space. Storing thousands of files of this size on a disk subsystem requires huge amounts of disk space. According to user surveys, file-access frequency is strictly biased in favor of a small number of popular titles, while the rest of the files are rarely accessed in commercial video rental. This characteristic of the user-access pattern enables the storage architecture designer to exploit the hierarchical storage structure in managing a large volume of information. The advantage of using hierarchical storage architecture is to exploit the popularity or hotness of a file and assign space the appropriate storage hierarchy to each file, thereby maximizing the cost-performance ratio. The efficiency of hierarchical storage architecture is maximized when the capacity of each hierarchy is well balanced and the behavior of each storage hierarchy is well harmonized. Thus, in configuring hierarchical storage, these system parameters have to be carefully taken into account. From the server's point of view, maximizing throughput is primary concern in various aspects of the design. Throughput can be thought as the number of requests which can be handled or serviced by the server per unit time. When user request needs to be serviced immediately, the number of requests which can be handled per unit time, throughput is inversely proportional to the probability that the incoming request is blocked. Thus, Blocking probability, is an important concern in achieving a desired cost-effectiveness. In hierarchical storage architecture which consists of tertiary storage and secondary storage, the request blocking can be due to congestion in tertiary storage or due to congestion in secondary storage In this work, the effort is concentrated on finding a minimum amount of storage resources for each hierarchy to achieve a given throughput. Storage capacity and bandwidth capacity of a unit device, e.g. a disk drive, a tape drive is fixed. Blocking probability is a metric for throughput.

Author

Information Systems; Computer Networks; On-Line Systems; Hierarchies; Data Storage; Document Storage

19980202005 NASA Goddard Space Flight Center, Greenbelt, MD USA

The mass storage testing laboratory at GSFC

Venkataraman, Ravi, Systems Engineering and Security, Inc., USA; Williams, Joel, Systems Engineering and Security, Inc., USA; Michaud, David, Systems Engineering and Security, Inc., USA; Gu, Heng, Systems Engineering and Security, Inc., USA; Kalluri, Atri, Systems Engineering and Security, Inc., USA; Hariharan, P. C., Systems Engineering and Security, Inc., USA; Kobler, Ben, NASA Goddard Space Flight Center, USA; Behnke, Jeanne, NASA Goddard Space Flight Center, USA; Peavey, Bernard, NASA Goddard Space Flight Center, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 193-200; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Industry-wide benchmarks exist for measuring the performance of processors (SPECmarks), and of database systems (Transaction Processing Council). Despite storage having become the dominant item in computing and IT (Information Technology) budgets, no such common benchmark is available in the mass storage field. Vendors and consultants provide services and tools for capacity planning and sizing, but these do not account for the complete set of metrics needed in today's archives. The availability of automated tape libraries, high-capacity RAID systems, and high- bandwidth interconnectivity between processor and peripherals has led to demands for services which traditional file systems cannot provide. File Storage and Management Systems (FSMS), which began to be marketed in the late 80's, have helped to some extent with large tape libraries, but their use has introduced additional parameters affecting performance. The aim of the Mass Storage Test Laboratory (MSTL) at Goddard Space Flight Center is to develop a test suite that includes not only a comprehensive check list to document a mass storage environment but also benchmark code. Benchmark code is being tested which will provide measurements for both baseline systems, i.e. applications interacting with peripherals through the operating system services, and for combinations involving an FSMS. The benchmarks are written in C, and are easily portable. They are initially being aimed at the UNIX Open Systems world. Measurements are being made using a Sun Ultra 170 Sparc with 256MB memory running Solaris 2.5.1 with the following configuration: 4mm tape stacker on SCSI 2 Fast/Wide; 4GB disk device on SCSI 2 Fast/Wide; and Sony Petaserve on Fast/Wide differential SCSI 2.

Author

Information Systems; Document Storage; Data Storage; Information Retrieval; Data Retrieval

19980202006 Deutsches Elektronen-Synchrotron, Hamburg, Germany

EuroStore-A European mass storage management project

Gasthuber, Martin, Deutsches Elektronen-Synchrotron, Germany; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 201-204; In English; Also announced as 19980201985

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A European consortium formed by science and industrial partners have started the EuroStore project to develop and market a Hierarchical Storage Management System (HSM) together with a high performance parallel file system (PFS). The EuroStore project aims to design and develop a high performance file store. It will combine the features of a Hierarchical Storage Manager (HSM) with the performance of a parallel file system to provide a system capable of meeting the requirements of the most demanding applications in industry, commerce, and science. The few existing HSM and parallel file system products do not fully address all the needs of the user community, and in some cases represent a major investment that users are not willing to undertake. This paper will outline the current state of the design and implementation ideas.

Author

Data Storage; Computer Networks; Information Management

19980202007 Auspex Systems, Inc., Santa Clara, CA USA

Transparent continuous access to infinite data: A new vision for enterprise data management

Banks, Don, Auspex Systems, Inc., USA; Mercier, Christina, Auspex Systems, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 205-209; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents the 'Transparent Continuous Access to Infinite Data' (TCAID) architecture, developed at Auspex Systems, which addresses the enterprise data management challenge. The model presented here separates policy from mechanism and treats the solution space as a bounded area described by simple data management parameters which encompasses a wide spectrum of possible data management solutions. Using this model existing data management point products become a series of customer-specified policies implemented by pre-packaged mechanisms that operate on customer-specified target data.

Author

Computer Networks; Data Storage; Distributed Processing; Data Transfer (Computers)

19980202008 George Mason Univ., Dept. of Computer Science, Fairfax, VA USA

A scalability model for ECS's data server

Menasce, Daniel A., George Mason Univ., USA; Singhal, Mukesh, Ohio State Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 211-228; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents a model for the scalability analysis of the Data Server sub-system of the EOSDIS Core System (ECS). The goal of the model is to analyze to determine if the planned architecture of the Data Server will support an increase in the workload with the possible components upgrade. We provide a summary of the ECS's Data Server architecture and of a high level description of the Ingest and Retrieval operations in the ECS's Data Server. This description forms the basis for the development of our scalability model. Then we present details of the scalability model and the methodology used to solve it. We describe the structure of the scalability model, input parameters, expressions for computing parameters of the scalability model solver, and algorithms for solving the scalability model. The scalability model is very general and allows the modeling of data servers with numerous configurations.

Author

Computer Networks; Interprocessor Communication; Protocol (Computers); Network Control

19980202009 Maryland Univ., Dept. of Computer Science, College Park, MD USA

A study on the use of tertiary storage in multimedia systems

Golubchik, Leana, Maryland Univ., USA; Rajendran, Raj Kumar, Columbia Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 229-247; In English; Also announced as 19980201985

Contract(s)/Grant(s): NSF CCR-96-25013; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In spite of the dramatic improvements in the cost of secondary storage, magnetic disks alone are inadequate for meeting the storage and delivery needs of many mod- em applications. Novel designs of storage hierarchies are needed if we wish to take advantage of the low cost of tape media but still provide reasonable performance characteristics, in the context of modem applica-

tions. Specifically, we are interested in multimedia storage server applications, which in addition to high storage and high bandwidth requirements must support display of continuous data streams (e.g., video) and thus satisfy real time constraints. In this paper we focus on the issues and tradeoffs involved in the design of multimedia tertiary storage systems that store and retrieve heterogeneous multimedia objects.
Author
Design Analysis; Magnetic Disks; Real Time Operation; Low Cost; Data Flow Analysis; Computer Storage Devices

19980202010 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA
SLEDs: Storage Latency Estimation Descriptors
VanMeter, Rodney, University of Southern California, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 249-260; In English; Also announced as 19980201985
Contract(s)/Grant(s): DABT63-93-C-0062; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Managing the latency of storage systems is a key to creating effective very large scale information systems, such as web interfaces to satellite image databases and video-on-demand servers. Storage Latency Estimation Descriptors (SLEDS) are architecture-independent descriptions of the retrieval time of a unit of data. They describe the latency to the first byte, and the bandwidth expected. SLEDs are an important enabling technology for true end-to-end Quality of Service (QoS) because they can be used to predict and schedule data transfer with multimedia (guaranteed 1/0 rate) file systems. SLEDs provide the interface that allows database management systems (DBMS) and clients of Hierarchical Storage Management (HSM) systems to optimize their data access patterns by choosing to read data in specific sequences or not at all. SLEDs are designed to work in intra-machine, local-area network (LAN) and wide-area network (WAN) storage systems, and to scale through twelve orders of magnitude in latency, from thousands of seconds down to nanoseconds.
Author
Computer Storage Devices; Data Base Management Systems; Information Systems; Data Bases

19980202011 Data Storage Technologies, Inc., Banner Elk, NC USA
Window NT clustered storage solutions for enterprise computing
Lee, Richard R., Data Storage Technologies, Inc., USA; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 261-263; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The vast majority of all high-performance storage subsystems in the field today rely on the use of proprietary high-end computing platforms and OS's to act as a data server, e.g., IBM RS/6000, SGI Power Challenge, Sun Ultra Enterprise, etc.. These are characterized as Server Centric and require large server CPU's to meet end-user data demands, e.g., UniTree, FileServ, etc. In addition to Storage Centric systems, there are a small, but growing number of sites that are beginning to utilize a distributed/high-speed switched architecture, e.g., HPSS. These are referred to as Network Attached and utilize expensive and exotic storage devices and switching fabrics to meet end-user data demands. These too rely on the use of proprietary CPU's and OS's to act as "data movers", e.g., IBM SP/2. As data demand requirements continue to increase (some 60%+ CAGR) the need for truly distributed, low-cost, non-proprietary, high-performance storage subsystems will become more critical. In fact, many analysts, including this author believe that the solution to this challenge is key to the continued growth of computing across the enterprise. One such solution that capitalizes on both the lessons learned from Server Centric and Network Attached storage subsystems, as well as taking advantage of low-cost, scalable, and open computing platforms is based upon the use of the emerging enterprise OS - Windows NT.
Author
Architecture (Computers); Computer Storage Devices; Data Collection Platforms

19980202012 American Telephone and Telegraph Co., Research, Florham Park, NJ USA
An architecture for using tertiary storage in a data warehouse
Johnson, Theodore, American Telephone and Telegraph Co., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 265-276; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper, we present an architecture for a data warehouse that provides convenient, flexible, and high-performance access to tape-resident data. Data warehouses allow an organization to store and analyze operational data. Many data warehouses (e.g., for telecommunications) create very large data sets that can be economically stored only on tertiary storage. At the same time, data analysts need to make a wide variety of decision support and data mining queries on the data. While one can (and typically

does) extract compact summaries of the warehoused data, many queries can only be answered by using data from the full data set. Using database systems to access large tape resident tables of small objects is conventionally viewed as a difficult problem, because it is easy to express an query that takes a very long time to process (e.g., the join of two tape-resident tables). Fortunately, decision support queries can usually be expressed in a way that can be implemented efficiently on tape-resident data. In addition, many data mining algorithms have been optimized to make a small number of passes over a data set. We present the features of a tape-based data warehousing system that provides efficient support for data mining and decision support queries on very large collections of small objects, a prototype implementation, and preliminary performance results.
Author
Architecture (Computers); Data Systems; Computer Storage Devices

19980202013 Erlangen-Nuerenberg Univ., Dept. of Database Systems, Erlangen, Germany
On the design and implementation of the multidimensional CUBEStore storage manager
Lehner, Wolfgang, Erlangen-Nuerenberg Univ., Germany; Sporer, Wolfgang, Erlangen-Nuerenberg Univ., Germany; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 277-291; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

CUBEStore is a storage manager designed within the CUBESTAR project to fit the special needs of multidimensional applications as found in the area of Statistical and Scientific DataBases (SSDB). Some of the goals being achieved within this project were built-in support for multiple dimensions and good performance for range queries regard- less of the dimensionality of the data. The general characteristics of SSDB-applications, the derived requirements with regard to a storage management system and the specific open architecture as well as the reference implementation of CUBEStore are described in this paper.
Author
Design Analysis; Management Systems; Computer Storage Devices

19980202014 EMASS, Inc., Englewood, CO USA
Petabyte file systems based on tertiary storage
Teller, Marc J., EMASS, Inc., USA; Rutherford, Paul G., EMASS, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 293-305; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In a matter of a few short years, the computing industry has moved from terabyte storage systems to petabyte environments. While manufacturers and implementors alike are struggling with access to 1000's of gigabytes, planners are requesting bids for systems in excess of 1,000 terabytes of data. The requirements for petabyte systems are much the same as for terabyte systems. Access must be the same as disk-based file systems; consequently, it is transparent to applications. In addition, performance should be predictable and meet minimal application requirements. Finally, system management should require few resources. In addition to these operational requirements, the size of the system requires strict attention be paid to the cost of each component. As a vendor of storage solutions, EMASS was interested in validating its AMASS product against these requirements. This paper documents a project for benchmarking a petabyte storage system residing in our Denver facility. In addition to profiling the ability of AMASS to scale to a petabyte, the study looks at the operation of a large file system, alternate tools for dealing with large file systems, and additional development and research to support petabyte file systems. Results of the project indicate a high degree of scalability for AMASS up to the initial project-imposed limit of 16 million files and identified specific areas for enhancement of the AMASS product.
Author
Computer Storage Devices; Augmentation; Support Systems; Management Information Systems

19980202015 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA
Internet protocols for network-attached peripherals
Hotz, Steve, University of Southern California, USA; VanMeter, Rodney, University of Southern California, USA; Finn, Gregory, University of Southern California, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 307-322; In English; Also announced as 19980201985
Contract(s)/Grant(s): DABT63-93-C-0062; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents our thesis that the advantages of the internet protocol framework make it the best choice for communications protocols to, and between, network-attached peripherals (NAPs). Moreover, the IP suite is more appropriate than the specialized protocol stacks being developed for commercial NAPs. The benefits of using IP include support for heterogeneous network

me- dia, wide-area connectivity, and reduced research and development effort. We, examine the issues for use of the internet protocols (TCP/UDP/IP) for NAPs, address commonly held concerns regarding its performance, and describe the Netstation project's prototype implementations of IP peripherals.
Author
Protocol (Computers); Internets; Communication Networks; Heterogeneity

19980202016 Silicon Graphics, Inc., Mountain View, CA USA
Experiences with open vault, a prototype implementation of a standards effort
Anderson, Curtis, Silicon Graphics, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 323-331; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Storage Systems Standards Working Group (http://www.ssswg.org) is developing new removable media management standards-defining a set of testable standards that can be used by end users and industry to build multi-vendor storage environments. These standards will allow end users to combine the most appropriate pieces from each vendor to best meet their needs. Silicon Graphics has provided engineering resources to implement a prototype of the proposed design to validate the architectural approach. That prototype is called Open Vault. This paper describes that effort and what we have learned so far.
Author
Computer Storage Devices; Document Storage; Fabrication; Standards

19980202017 NASA Goddard Space Flight Center, Greenbelt, MD USA
An emerging network storage management standard: Media error monitoring and reporting information (MEMRI) - to determine optical tape data integrity
Podio, Fernando, National Inst. of Standards and Technology, USA; Vollrath, William, LOTS Technology, Inc., USA; Williams, Joel, Systems Engineering and Security, Inc., USA; Kobler, Ben, NASA Goddard Space Flight Center, USA; Crouse, Don, Large Storage Configurations, Inc., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 333-343; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Sophisticated network storage management applications are rapidly evolving to satisfy a market demand for highly reliable data storage systems with large data storage capacities and performance requirements. to preserve a high degree of data integrity, these applications must rely on intelligent data storage devices that can provide reliable indicators of data degradation. Error correction activity generally occurs within storage devices without notification to the host. Early indicators of degradation and media error monitoring 333 and reporting (MEMR) techniques implemented in data storage devices allow network storage management applications to notify system administrators of these events and to take appropriate corrective actions before catastrophic errors occur. Although MEMR techniques have been implemented in data storage devices for many years, until 1996 no MEMR standards existed. In 1996 the American National Standards Institute (ANSI) approved the only known (world-wide) industry standard specifying MEMR techniques to verify stored data on optical disks. This industry standard was developed under the auspices of the Association for Information and Image Management (AIIM). A recently formed AIIM Optical Tape Subcommittee initiated the development of another data integrity standard specifying a set of media error monitoring tools and media error monitoring information (MEMRI) to verify stored data on optical tape media. This paper discusses the need for intelligent storage devices that can provide data integrity metadata, the content of the existing data integrity standard for optical disks, and the content of the MEMRI standard being developed by the AIIM Optical Tape Subcommittee.
Author
Data Storage; Data Management; Computer Storage Devices; Standards; Error Analysis

19980202018 Southeastern Univ. Research Association, Jefferson Lab., Newport News, VA USA
Evaluating RAID in the real world
Bird, Ian, Southeastern Univ. Research Association, USA; Chambers, Rita, Southeastern Univ. Research Association, USA; Davis, Mark, Southeastern Univ. Research Association, USA; Kowalski, Andy, Southeastern Univ. Research Association, USA; Lukens, Bob, Southeastern Univ. Research Association, USA; Philpott, Sandy, Southeastern Univ. Research Association, USA; Whitney, Roy, Southeastern Univ. Research Association, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 345-354; In English; Also announced as 19980201985
Contract(s)/Grant(s): DE-AC05-84ER-40150; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

High energy nuclear physics experiments at the Thomas Jefferson National Accelerator Facility (”Jefferson Lab”) will have a data collection rate of 10 MB/second, generating I Terabyte (TB) of raw data per day of accelerator running, and a similar amount after processing. The requirement for on-line disk storage for raw and reduced data sets will exceed I TB during 1998. This paper discusses the on-line storage strategy that provides both high performance as well as high capacity, and focuses on the in-house evaluation of RAID (Redundant Arrays of Independent Disks) systems to fulfill the needs of both data acquisition and analysis.
Author
Evaluation; Computer Storage Devices; High Energy Interactions; Data Acquisition; Data Processing

19980202019 Maryland Univ., Dept. of Computer Science and Electrical Engineering, Baltimore, MD USA
Long-Term file activity patterns in a UNIX workstation environment
Gibson, Timothy J., Maryland Univ., USA; Miller, Ethan L., Maryland Univ., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 355-371; In English; Also announced as 19980201985
Contract(s)/Grant(s): NAG2-1094; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

As mass storage technology becomes more affordable for sites smaller than supercomputer centers, understanding their file access patterns becomes crucial for developing systems to store rarely used data on tertiary storage devices such as tapes and optical disks. This paper presents a new way to collect and analyze file system statistics for UNIX-based file systems. The collection system runs in user-space and requires no modification of the operating system kernel. The statistics package provides details about file system operations at the file level: creations, deletions, modifications, etc. The paper analyzes four months of file system activity on a university file system. The results confirm previously published results gathered from supercomputer file systems, but differ in several important areas. Files in this study were considerably smaller than those at supercomputer centers, and they were accessed less frequently. Additionally, the long-term creation rate on workstation file systems is sufficiently low so that all data more than a day old could be cheaply saved on a mass storage device, allowing the integration of time travel into every file system.
Author
Computer Storage Devices; Workstations; Time; Relativistic Effects; Collection

19980202020 Lockheed Martin Space Mission Systems and Services, Upper Marlboro, MD USA
Performance tuning of a high capacity/high performance archive for the earth observing systems project
Lake, Alla, Lockheed Martin Space Mission Systems and Services, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 373-383; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Archive for the Earth Observing Systems (EOS) Project reflects the scale of the project itself. Its data holdings over all the Distributed Active Archive Centers (DAACs) are projected to exceed two Petabytes by the year 2002. This paper describes the experience and results of the integration and tuning process for the hardware and Commercial Off The Shelf (COTS) software used today in the EOS Core System (ECS) archive. Sizable performance improvements have been realized to date through the combined efforts of the vendors and the tuning team. The process is still continuing and, indeed, will continue through the life of the archive. The effort to date centered around improving the throughput for the individual data streams to the archive tape drives and the cumulative throughput to all the drives. The work was specifically directed towards the COTS hardware and software integration and tuning adjustments. Throughput performance improvement via efficient data organization on tape was not addressed during this effort, but will be in the future work.
Author
Data Bases; Data Storage; Data Management

19980202021 European Organization for Nuclear Research, Geneva, Switzerland
Building a database for the LHC - the exabyte challenge
Shiers, Jamie, European Organization for Nuclear Research, Switzerland; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 385-395; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

CERN, the European Laboratory for Particle Physics, is currently building a new accelerator, the Large Hadron Collider (LHC). Scheduled to enter operation in 2005, the experiments at the LHC will generate some 5 PB of data per year with data rates ranging from 100 MB to 1.5 GB per second. Data taking is expected to last 15 or more years, leading to a total data sample of some 100 PB. Designing a system that can handle such enormous data volumes implies a solution that can theoretically handle at least one order of magnitude more data than is currently anticipated, namely 1 EB (exabyte). Although the production phase

of the LHC is still in the distant future, elements of the proposed system have been used in physics experiments at CERN since 1996. In addition, a number of pre-LHC experiments, both at CERN and at other laboratories including SLAC in the US, have adopted the strategy described below. We expect some tens of TB to be stored during 1998 (CERN-NA45) and a few hundred TB per year in 1999 and beyond (the COMPASS experiment at CERN and the BaBar experiment at SLAC). A strong goal of the project is to use standard, commodity solutions wherever possible. We describe the progress on the project to date, the standards and solutions that are currently being used, performance and scalability measurements as well as plans for the future. Further information on this project may be found via http://www.cern.ch/ via the link Research and Development and then RD45.
Author
Data Bases; Data Processing Equipment; Rates (Per Time)

19980202022 San Diego Supercomputer Center, La Jolla, CA USA
A data handling architecture for a prototype federal application
Baru, Chaitanya K., San Diego Supercomputer Center, USA; Moore, Reagan W., San Diego Supercomputer Center, USA; Rajasekar, Arcot, San Diego Supercomputer Center, USA; Schroeder, Wayne, San Diego Supercomputer Center, USA; Wan, Michael, San Diego Supercomputer Center, USA; Klobuchar, Richard L., Science Applications International Corp., USA; Wade, David M., Science Applications International Corp., USA; Sharpe, Randall K., National Center for Supercomputing Applications, USA; Terstriep, Jeff, National Center for Supercomputing Applications, USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 397-408; In English; Also announced as 19980201985; Sponsored in part by The US Patent and Trademark Office.
Contract(s)/Grant(s): F19628-96-C-0020; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Distributed Object Computation Testbed (DOCT) Project is a collaboration led by the San Diego Supercomputer Center (SDSC) and funded by the Defense Advanced Research Projects Agency (DARPA) and the US Patent and Trademark Office (USPTO). The DOCT project was initiated with the objective of creating a testbed system for handling complex documents on geographically distributed data archives and computing platforms. The project focuses on technologies that apply to the information needs of federal agencies, such as the National Science Foundation, the National Institutes of Health, the Nuclear Regulatory Commission, the Environmental Protection Agency (EPA), the Department of Energy, and the Department of Defense. In particular, the patent filing and amendment processing application of the USPTO is used as the prototype application for this testbed. This paper describes the DOCT system architecture and the USPTO application.
Author
Architecture (Computers); Data Processing; Documents; Environment Protection

19980202023 Pacific Northwest National Lab., Richland, WA USA
Scientific data archive at the environmental molecular sciences laboratory
Adams, Daniel R., Pacific Northwest National Lab., USA; Hansen, David M., Pacific Northwest National Lab., USA; Walker, Kevin G., Pacific Northwest National Lab., USA; Gash, John D., Lawrence Livermore National Lab., USA; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 409-417; In English; Also announced as 19980201985
Contract(s)/Grant(s): DE-AC06-76RL-01830; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The U.S. Department of Energy's Pacific Northwest National Laboratory (PNNL) has developed a Scientific Data Management system (SDM) that is an integral component of the DOE's Environmental Molecular Sciences Laboratory (EMSL). EMSL is a national scientific user facility that is supported by the DOE Office of Biological and Environmental Research. It is designed to focus Environmental Molecular Science on the puzzles and challenges of environmental restoration. The EMSL provides several major facilities to begin addressing these challenges, including the Molecular Sciences Computing Facility, a laser surface dynamics laboratory, a high field nuclear magnetic resonance laboratory, and a mass spectrometry laboratory. Each of these component laboratories will generate vast amounts of data that must be reliably stored and made available on demand for decades. The SDM system addresses this challenge by providing a hierarchical storage management system to store data files, as well as a database that captures information about those files (i.e., metadata). The SDM system is a distributed client-server application that runs in a heterogeneous hardware, software, and networking environment. It provides EMSL scientists with 20 terabytes of near-line archival storage together with a metadata database describing the contents of the archive and the context within which archived files exist. This makes it possible to locate information based on what the data is about, not just the name someone gave to a file. The SDM system has been in use at the EMSL since July, 1997.
Author
Data Management; Technologies; Computer Programs; Management Systems; Data Bases

19980202024 Storage Technology Corp., Louisville, CO USA

Virtual storage manager

Blendermann, Stephen H., Storage Technology Corp., USA; Reed, Dennis F., Storage Technology Corp., USA; Sixth Goddard conference on mass storage systems and technologies held in cooperation with the fifteenth IEEE symposium on mass storage systems; Mar. 1998, pp. 419-427; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Storage Technology corporation (StorageTek(R)) has developed Virtual Storage Manager (TM) (VSM) as a solution to the problems of inefficient use of type media and type transport. VSM solves the media use problem by stacking multiple user tape volumes onto a single, physical type cartridge. The stacking operation occurs transparent to the user and the actual movement of data to accomplish volume stacking occurs outboard of host system being serviced. VSM solves the tape transport use problem by emulating more type transport than physically exist. VSM satisfies peak concurrent transport demand without requiring additional transports that would not be needed or used at other times. Physical tape transports are attached to an Automated Cartridge System (ACS). The solution is comprised of hardware, microcode, host software and PC software.

Author

Computer Storage Devices; Computer Programs; Management Information Systems

19980202025 Primelink Technologies, Inc., Advanced Technology Centre, Edmonton, Alberta Canada

Petabyte mass memory system using the Newell Opticel, Part 2

Newell, Chester W., Primelink Technologies, Inc., Canada; Sixth Goddard Conference on Mass Storage Systems and Technologies held in Cooperation with the Fifteenth IEEE Symposium on Mass Storage Systems; Mar. 1998, pp. 429-439; In English; Also announced as 19980201985; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A random access system for storage of up to a Petabyte was described by the author in a paper given at the Fourth NASA Goddard Conference on Mass Storage Systems and Technologies, March 28, 1995. This system is called the ”Opticel” system. The Opticel has been modeled in feasibility building blocks of a tape drive and associated optics. The Opticel cartridge geometry is compatible with the standard magnetic DLT cartridge, and can be interfaced with a standard robotic library system to provide open-ended expandability into a Petabyte system in nine square feet of floor space. All essential parameters described in the earlier paper have been verified in subsystems. The currently proposed Opticel system is being developed to employ 19 mm WORM optical tape and sixteen parallel red laser heads in a 5-1/4-inch half-high drive. A comparison of the Opticel in the proposed Petabyte System is made, using Opticel drives in two typical DLT-compatible multiple cartridge systems as reference A parallel advanced development is now beginning using magnetic erasable metal-evaporated tape and thin-film heads. Studies to date indicate all parameters of the optical system will be equaled or exceeded with this combination.

Author

Memory (Computers); Computer Storage Devices; Random Access

19980202047 NASA Goddard Space Flight Center, Greenbelt, MD USA

Analysis of STIS time-tag data

Lindler, Don J., Advanced Computer Concepts, Inc., USA; Gull, Theodore R., NASA Goddard Space Flight Center, USA; Kraemer, Steven B., Catholic Univ. of America, USA; Hulbert, Stephen J., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 138-143; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Very high time resolution data can be obtained from the Space Telescope Imaging Spectrograph (STIS) Multi-Anode Microchannel Array (MAMA) detectors using the time-tag observing mode. In this mode, the photon events are not accumulated onboard the spacecraft. Instead, each event is recorded internally and transmitted to the ground as an X and Y location with an event time. Event times are recorded in units of 125 microseconds. Analysis of STIS Crab Pulsar data demonstrates that a time resolution of approaching 125 microseconds can be achieved. Furthermore, the time-tag observing mode has been demonstrated to be a very powerful diagnostic tool and can be used to increase the resolution of both imaging and spectral data.

Author

Hubble Space Telescope; Multi-Anode Microchannel Arrays; Emission Spectra; Data Processing; Radiation Detectors; Photons; Imaging Spectrometers; Spectrum Analysis

19980202063 Space Telescope Science Inst., Baltimore, MD USA

The NICMOS data handbook

Calzetti, Daniela, Space Telescope Science Inst., USA; Bushouse, Howard, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 255-258; In English; Also announced as 19980202026;

No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Data Handbook contains important information on the Hubble Space Telescope (HST) data GOs and GTOs receive, including explanations on the data format, on the data reduction steps performed by the automatic pipelines, on sources of uncertainties in the data, and on available tools for data analysis. The Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) sections of the Data Handbook will soon be available, and a draft can be already retrieved from the NICMOS WWW Documentation Page. In this presentation we present the organization of the NICMOS sections of the Data Handbook, and the relevant topics there covered.

Author

Near Infrared Radiation; Handbooks; Data Reduction; Image Processing; Format; Instrument Errors; Data Processing; Calibrating

19980202068 Arizona Univ., Steward Observatory, Tucson, AZ USA

NICMOS file formats

Lytle, D., Arizona Univ., USA; Stobie, E., Arizona Univ., USA; Ferro, A., Arizona Univ., USA; Barg, I., Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 277-280; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Near Infrared Camera and Multi-Object Spectrometer (NICMOS) adopted the FITS image extension format for storing data instead of GEIS format (ippssoot.c0h, ipppssoot.cod) used by previous Hubble Space Telescope (HST) instruments. The primary advantages are: (1) The files are machine-independent (2) Images of different data types may be stored in the same file. This is a quick overview of some key points about the NICMOS data formats to help the user understand and manage his or her data.

Author

Format; Computer Programming; Data Management; Image Processing; Calibrating

19980202069 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA USA

NICRED: Reduction of NICMOS MULTIACCUM data with IRAF

McLeod, Brian A., Harvard-Smithsonian Center for Astrophysics, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 281-286; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

I describe a set of algorithms and associated Interactive Data Reduction and Analysis Facility (IRAF) packages, NICRED, for reducing Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) MULTIACCUM data. In particular, this package addresses the problems of cosmic ray rejection, and the bias problems seen in early NICMOS data.

Author

Data Reduction; Computer Programs; Algorithms; Bias; Radiation Effects

19980202072 Space Telescope Science Inst., Baltimore, MD USA

Making maps and mosaics

Storrs, Alex, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 303-307; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This document attempts to clarify some of the ways in which maps and mosaics can be made with Near-Infrared Camera and Multi-Object Spectrometer (NICMOS). Some of the tradeoffs inherent in these are discussed.

Author

Mosaics; Computer Aided Mapping; Astronomical Maps

19980202078 European Southern Observatory, Garching, Germany

Associations of WFPC2 exposures

Micol, A., European Southern Observatory, Germany; Bristow, P., North Atlantic Treaty Organization, Belgium; Pirenne, B., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 349-354; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Unlike Near Infrared Camera and Multi-Object Spectrometer (NICMOS) and Space Telescope Imaging Spectrograph (STIS), where a dataset might be constituted of a set of exposures, the Wide Field and Planetary Camera 2 (WFPC2) data set's structure was thought to be a repository of all the files belonging to a single exposure. Lacking higher levels of abstraction, there is no simple way of tracing back which observation strategy (e.g., cosmic ray rejection, dithering) a WFPC2 PI decided to employ. Building associations of WFPC2 exposures can therefore be considered an important step towards a comprehensive description of the HST archive contents. Space Telescope European Coordinating Facility (ST-ECF) has started a project to build such associ-

ations and to store them into a database. Knowing what are the shifts among the exposures belonging to an association will allow the ST-ECF Archive to provide its users not only with on-the-fly recalibrated exposures, but also with cosmic ray-rejected and resolution-enhanced mosaics of WFPC2 images.
Author
Calibrating; Data Bases; Stellar Spectrophotometry; Data Management; Image Processing; Image Analysis

19980202085 Space Telescope Science Inst., Baltimore, MD USA
The WFPC2 PSF library
Wiggs, Michael S., Space Telescope Science Inst., USA; Baggett, Sylvia, Space Telescope Science Inst., USA; Surdej, Jean, Liege Univ., Belgium; Tullos, Calvin, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 392-397; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We describe the development of the Wide Field and Planetary Camera 2 (WFPC2) Point Spread Function (PSF) Library. The extraction of observed Point Spread Functions from standard calibration observations, as well as the creation of their associated header files are discussed. We then describe the development of the WWW-based PSF Library Search Tool, and use of the Tool.
Author
Point Spread Functions; Information Retrieval; Subroutine Libraries (Computers); Software Development Tools; World Wide Web; Image Processing

19980202086 Space Telescope Science Inst., Baltimore, MD USA
WFPC2 Clearinghouse
Wiggs, Michael S., Space Telescope Science Inst., USA; Whitmore, Brad, Space Telescope Science Inst., USA; Heyer, Inge, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 398-401; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We discuss the development and use of the Wide Field and Planetary Camera 2 (WFPC2) Clearinghouse, a Web-based search tool designed to provide WFPC2 users with a listing of astronomical publications which report results based on the use of WFPC2 data. The database can be searched on a variety of WFPC2 calibration related topics, ranging from astrometry to UV throughput.
Author
Data Bases; World Wide Web; Astronomical Photometry; Documents; Information Retrieval; Periodicals

19980202093 Space Telescope Science Inst., Baltimore, MD USA
Astrometry with the FGS in POSITION mode and TRANSFER mode: Observing strategies, pipeline processing and data reduction
Nelan, Ed, Space Telescope Science Inst., USA; Lupie, Olivia, Space Telescope Science Inst., USA; Nagel, Lauretta, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 449-462; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present an overview of Hubble Space Telescope (HST) astrometry, data analysis techniques, calibrations, errors, and pipeline processing steps for Fine Guidance Sensor (FGS) astrometry data.
Author
Astrometry; Guidance Sensors; Calibrating; Data Reduction; Instrument Errors; Data Processing; Spectral Signatures; Interferometers; Optical Correction Procedure

19980202099 Space Telescope Science Inst., Baltimore, MD USA
The new HST FITS format, the FITS kernel and OpenIRAF
Greenfield, P., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 505-512; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The pipeline calibration of Space Telescope Science Institute (STIS) and Near Infrared Camera and Multi-Object Spectrometer (NICMOS) involves a number of changes from how previous Hubble Space Telescope (HST) instrument data were calibrated in the pipeline. These changes include a change in the data formats, what software language and libraries were used to write the programs, and the methods used to access the new data format. This paper will summarize the new STIS and NICMOS data formats, how to access these files using the new FITS kernel in Interactive Data Reduction and Analysis Facility (IRAF), and the changes in how the software is written.
Author
Format; Kernel Functions; Calibrating; Computer Programming; Subroutine Libraries (Computers); Data Processing

19980202102 York Univ., Dept. of Physics and Astronomy, Ontario Canada

Deconvolution of substepped 1-D and 2-D HST data

Wu, Nailong, York Univ., Canada; Caldwell, John, York Univ., Canada; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 529-532; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Substepping is a technique in which data are acquired in steps smaller than the normal pixel size, such that resolution after restoration will be comparable to the subpixel size. Substepped data have been acquired by first generation Hubble Space Telescope (HST) instruments in both one-dimensional (spectroscopic) and two-dimensional (imaging) modes. In this presentation, we first introduce the principle of the substepping technique and then demonstrate numerical examples of MEM (Maximum Entropy Method) deconvolution of an Faint Object Spectrograph (FOS) ACQ image of a star as well as of an FOS stellar spectrum. Author

Image Reconstruction; Stellar Spectra; Maximum Entropy Method; Pixels; Astronomical Spectroscopy; Data Reduction; Image Processing; Data Acquisition

19980202174 Environmental Protection Agency, Washington, DC USA

Some Remarks on Research Directions in Statistical Data Protection

Cox, L. H., Environmental Protection Agency, USA; 1998; 22p; In English

Report No.(s): PB98-141286; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modern research on statistical data protection (SDP) draws upon a rich, diverse subset of the mathematical sciences--statistics, mathematical programming, combinatorics, graph theory, and theoretical computer science. This paper offers observations on selected recent SDP research directions.

NTIS

Statistical Analysis; Mathematical Programming; Graph Theory; Data Reduction

19980202454 Naval Postgraduate School, Monterey, CA USA

The Democratizing Power of the Internet in Southeast Asia

Parker, Kevin J., Naval Postgraduate School, USA; Dec. 1997; 107p; In English

Report No.(s): AD-A342664; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis argues that the Internet is likely to he a strong, positive facilitating factor for the transition to and consolidation of democracy for states in Southeast Asia. U.S. policy makers intent on promoting democracy in Southeast Asia should consider the Internet's potential as a tool for promoting democratization. A review of the existing democratization literature, coupled with quantitative analysis of the societal impact of computer networking technologies, suggests that the level of Internet connectivity is a powerful indicator of democratization. Compared to education and income, Internet connectivity provides greater statistical explanatory power in predicting democracy. The Internet experience in Indonesia and Malaysia, two Southeast Asian states ruled by non%democratic authoritarian regimes, supports this argument. internet expansion in both states has co-varied with increasing levels of political liberalization and this may enhance the prospects for democratic transition. Both states have abandoned strict controls on press freedom and free speech on the internet. A democracy assistance program designed to increase the level of internet connectivity in Southeast Asia may serve the purpose of promoting democracy while also advancing U.S. economic interests. Such a program may he viewed with less suspicion and as more politically neutral than traditional forms of democracy assistance. DTIC

Computer Networks; Internets; Economics; Education; Foreign Policy; Technology Assessment

19980202594 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA

Effective Retrieval with Distributed Collections

Xu, Jinxi, Massachusetts Univ., USA; Callan, Jamie, Massachusetts Univ., USA; Jan. 1997; 16p; In English

Contract(s)/Grant(s): F19628-95-C-0235

Report No.(s): AD-A341194; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper evaluates the retrieval effectiveness of distributed information retrieval systems in realistic environments. We find that when a large number of collections are available, the retrieval effectiveness is significantly worse than that of centralized systems, mainly because typical queries are not adequate for the purpose of choosing the right collections. We propose two techniques to address the problem. One is to use phrase information in the collection selection index and the other is query expansion. Both techniques enhance the discriminatory power of typical queries for choosing the right collections and hence significantly

improve retrieval results. Query expansion, in particular, brings the effectiveness of searching a large set of distributed collections close to that of searching a centralized collection.
DTIC
Collection; Information Retrieval; Distributed Processing

19980202597 Massachusetts Univ., Amherst, MA USA
On Computing Local and Global Similarity in Images
Manmatha, R., Massachusetts Univ., USA; Ravela, S., Massachusetts Univ., USA; Chitti, Y., Massachusetts Univ., USA; Jan. 1997; 12p; In English
Contract(s)/Grant(s): F19628-95-C-0235
Report No.(s): AD-A341128; MM-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The retrieval of images based on their visual similarity to an example image is an important and fascinating area of research. Here, we discuss various ways in which visual appearance may be characterized for determining both global and local similarity in images. One popular method involves the computation of global measures like moment invariants to characterize global similarity. Although this means that the image may be characterized using a few numbers, the performance is often poor. Techniques based on moment invariants often perform poorly. They require that the object be a binary shape without holes which is often not practical. In addition, moment invariants are sensitive to noise. Visual appearance is better represented using local features computed at multiple scales. Such local features may include the outputs of images filtered with Gaussian derivatives, differential invariants or geometric quantities like curvature and phase. Two images may be said to be similar if they have similar distributions of such features. Global similarity may, therefore, be deduced by comparing histograms of such features. This can be done rapidly. Histograms cannot be used to compute local similarity. Instead, the constraint that the spatial relationship between the features in the query be similar to the spatial relationship between the features of its matching counterparts in the database provides a means for computing local similarity. The methods presented here do not require prior segmentation of the database. In the case of local representation objects can be embedded in arbitrary backgrounds and both methods handle a range of size variations and viewpoint variations up to 20 or 25 degrees.
DTIC
Image Processing; Data Management; Information Retrieval

19980202722 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA
Some Issues in the Automatic Classification of US Patents
Larkey, Leah S., Massachusetts Univ., USA; Jan. 1997; 5p; In English
Contract(s)/Grant(s): ARPA ORDER-D468
Report No.(s): AD-A341100; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The classification of US patents poses some special problems due to the enormous size of the corpus, the size and complex hierarchical structure of the classification system, and the size and structure of patent documents. The representation of the complex structure of documents has not been a standard area of research in text categorization, but we have found it to be an important factor in our previous work on classifying patient medical records and in our current work on US patents. Our classification approach is to combine the results of k-nearest-neighbor classifiers with those of Bayesian classifiers. The k-nearest-neighbor classifier allows us to represent the document structure using the query operators in the Inquiry information retrieval system. The Bayesian classifiers can use the hierarchical relations among patent subclasses to select closely related negative examples to train more discriminating classifiers.
DTIC
Documents; Patents; Classifications

19980202890 Georgia Inst. of Tech., Coll. of Computing, Atlanta, GA USA
A Knowledge-Based Approach to Integrating and Querying Distributed Information Systems Heterogeneous Intelligent Processing for Engineering Design (HIPED) ***Final Report, 30 Sep. 1993 - 30 Mar. 1997***
Navathe, Shamkant B., Georgia Inst. of Tech., USA; Aug. 1997; 238p; In English
Contract(s)/Grant(s): F33615-93-1-1338; AF Proj. A522
Report No.(s): AD-A341697; WL-TR-97-1165; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This program develops techniques which allows for the interactive access of dissimilar data sources; the informed processing of the resultant search; and the capture of the associated knowledge gained from the interative usage of the system.
DTIC
Data Bases; Management Information Systems; Knowledge Based Systems; Heterogeneity; Engineering Drawings

19980203057 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA

Aspect Windows, 3-D Visualizations, and Indirect Comparisons of Information Retrieval Systems

Swan, Russell C., Massachusetts Univ., USA; Allan, James, Massachusetts Univ., USA; Jan. 1997; 13p; In English

Contract(s)/Grant(s): NSF-IRI96-19117

Report No.(s): AD-A341759; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We built two Information Retrieval systems that were targeted for the TREC-6 'aspect oriented' retrieval track. The systems were built to test the usefulness of different visualizations in an interactive IR setting-in particular, an 'aspect window' for the chosen task, and a 3-D visualization of document inter-relationships. We studied 24 users of the system in order to investigate: whether the systems were more effective than a control system, whether experienced users outperformed novices, whether spatial reasoning ability was a good predictor of effective use of 3-D, and whether the systems could be compared indirectly via a control system. Our results show substantial differences in user performance are related to spatial reasoning ability and to a lesser degree other traits. We also obtained markedly different results from the direct and indirect comparisons.

DTIC

Information Retrieval; Data Retrieval

19980203058 Klein Associates, Inc., Fairborn, OH USA

Implications of the Naturalistic Decision Making Framework for Information Dominance ***Interim Report, Jan - Sep. 1997***

Klein, Gary, Klein Associates, Inc., USA; Jul. 1997; 62p; In English

Contract(s)/Grant(s): AF Proj. 7284

Report No.(s): AD-A341758; AL/CF-TR-1997-0155; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report explores the implications of the Naturalistic Decision Making (NDM) framework for the domain of Information Dominance, defined as an operational advantage obtained through superior effectiveness of informational activity. NDM is the study of how people use their experience to make decisions in field settings. Expertise was considered at both the individual and the team level of decision making. The report defines the components of expertise and identifies obstacles to the acquisition of Information Dominance. These obstacles include: (1) excessive data, (2) pre-processed data, (3) excessive procedures, (4) performing formal analyses, (5) passive data handling and limited ability for information seeking, and (6) interfaces that obscure the big picture. The danger exists that these obstacles will severely limit the use of expertise at the individual and the team level, and that information technology will result in reduced rather than increased performance. The application of the NDM perspective demonstrates how information technologies can interfere with expertise, and provides assistance in the development of procedures which ensure that information technologies support Information Dominance functions. Directions for future research into the nature of the obstacles are identified.

DTIC

Software Engineering; Management Information Systems; Data Processing; Decision Making

19980203130 Massachusetts Univ., Computer Science Dept., Amherst, MA USA

Browsing, Discovery and Search in Large Distributed Databases of Complex and Scanned Documents, ***1 Jan. 1998 - 31 Mar. 1998***

Croft, W. Bruce, Massachusetts Univ., USA; Apr. 09, 1998; 11p; In English

Contract(s)/Grant(s): F19628-95-C-0235

Report No.(s): AD-A341107; TR-5281810498; No Copyright; Avail: CASI; A03, 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 disc techniques for large text databases, image retrieval and scanned document retrieval techniques, and architectures for large, distributed databases.

DTIC

Scanning; Data Bases; Information Retrieval; Data Retrieval; Distributed Processing; Texts; Images

19980203131 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA

Visual Interactions with a Multidimensional Ranked List

Leouski, Anton, Massachusetts Univ., USA; Allan, James, Massachusetts Univ., USA; Jan. 1998; 14p; In English

Contract(s)/Grant(s): F19628-95-C-0235

Report No.(s): AD-A341114; IR-127; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Performance analysis of an interactive visualization system generally requires an extensive user study, a method that is very expensive and that often yields inconclusive results. to do a successful user study, the researcher has to be well aware of the system's possibilities. In this paper we present a different kind of analysis. We show how the system behavior and performance could be investigated off line, without direct user intervention. We introduce an evaluation measure to assess the quality of a multidimensional visualization. Next, we suggest two methods for dealing with user's feedback. We also discuss the effect the dimensionality of the visualization has on the actual performance.

DTIC

Information Retrieval; Graphical User Interface; Data Management

19980203135 Synectics Corp., Rome, NY USA

Molecular Dynamics Simulation Upgrade-Software User's Manual ***Final Report, Jan - Jun. 1997***

Kolek, Lisa, Synectics Corp., USA; Rogers, Geraldine W., Synectics Corp., USA; Oct. 1997; 62p; In English

Contract(s)/Grant(s): F30602-95-D-0028; AF Proj. 2982

Report No.(s): AD-A341124; WH-94-RY-09; RL-TR-97-202-VOL-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of the MDEM simulation upgrade was to improve performance, enhance the 'user-friendly' features and generally clean up the source code for the MDEM simulation software tool. Performance improvement was primarily focused on the attainment of MDEM processing speedup. This was achieved at a low level by examining the existing code structure, as well as at a high level by modifying the simulation algorithm. Enhancement of user-friendly features included the implementation of a prototype graphical user interface (GUI) and the creation of the user's guide for both the command-line and GH versions of MDEM. Code cleanup involved deletion of unnecessary code and comments, and reorganization of variables. In addition to this, miscellaneous software engineering and development support was provided to Rome Laboratory on an 'as required' basis.

DTIC

Software Engineering; Molecular Dynamics; Simulation; User Manuals (Computer Programs); Computerized Simulation; Graphical User Interface; Document Markup Languages

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

19980202797 Texas Utilities Services, Inc., Dallas, TX USA

Financial Options Methodology for Analyzing Investments in New Technology

Wenning, B. D., Texas Utilities Services, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 405-409; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The evaluation of investments in longer term research and development in emerging technologies, because of the nature of such subjects, must address inherent uncertainties. Most notably, future cash flow forecasts include substantial uncertainties. Conventional present value methodology, when applied to emerging technologies severely penalizes cash flow forecasts, and strategic investment opportunities are at risk of being neglected. Use of options valuation methodology adapted from the financial arena has been introduced as having applicability in such technology evaluations. Indeed, characteristics of superconducting magnetic energy storage technology suggest that it is a candidate for the use of options methodology when investment decisions are being contemplated.

Author

Procedures; Investment; Energy Technology

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.

19980202798 Bechtel Corp., San Francisco, CA USA
SMES: Redefining the Path to Commercial Demonstration
Bingham, W. G., Bechtel Corp., USA; Lightipe, R. W., San Diego Gas and Electric Co., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress on Superconductivity; Apr. 1995; Volume 2, pp. 410-415; In English; Also announced as 19980202795; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Environmental, economic, and regulatory forces are reshaping the way utilities generate, transport, and distribute electricity. Electric power has always been available on instant demand with a high degree of reliability, flexibility, and control. Environmental limits on generation and the advent of renewables, deregulation and competition, and the increasing complexity of transmission systems, all point towards the need for a reliable and cost-effective means to store and retrieve electric power. This report describes the recent design breakthroughs, and the current efforts by San Diego Gas & Electric and the Bechtel Team to proceed with a utility demonstration of the technology: SMES- 1.
Derived from text
Alternating Current; Cost Effectiveness; Cost Reduction; Economics; Energy Storage; Reliability Engineering; Transmission Lines; Utilities

89
ASTRONOMY

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

19980202026 Space Telescope Science Inst., Baltimore, MD USA
The 1997 HST Calibration Workshop with a New Generation of Instruments
Casertano, S., Editor, Space Telescope Science Inst., USA; Jedrzejewski, R., Editor, Space Telescope Science Inst., USA; Keyes, T., Editor, Space Telescope Science Inst., USA; Stevens, M., Editor, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997; 564p; In English; 1997 HST Calibration Workshop, 22-24 Sep. 1997, Baltimore, MD, USA, Held at the Space Telescope Science Inst.; Sponsored by Space Telescope Science Inst., USA; Also announced as 19980202027 through 19980202103
Report No.(s): NASA/TM-97-208141; NAS 1.15:208141; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

The Second Servicing mission in early 1997 has brought major changes to the Hubble Space Telescope (HST). Two of the original instruments, Faint Object Spectrograph (FOS) and Goddard High Resolution Spectrograph (GHRS), were taken out, and replaced by completely new instruments, the Space Telescope Imaging Spectrograph (STIS) and the Near Infrared Camera Multi-Object Spectrograph (NICMOS). Two new types of detectors were installed, and for the first time, HST gained infrared capabilities. A new Fine Guidance Sensor (FGS) was installed, with an alignment mechanism that could improve substantially both guiding and astrometric capabilities. With all these changes come new challenges. The characterization of the new instruments has required a major effort, both by their respective Investigation Definition Teams and at the Space Telescope Science Institute. All necessary final calibrations for the retired spectrographs needed to be carried out, and their properties definitively characterized. At the same time, work has continued to improve our understanding of the instruments that have remained on board. The results of these activities were discussed in the 1997 HST (Hubble Space Telescope) Calibration Workshop. The main focus of the Workshop was to provide users with the tools and the understanding they need to use HST's instruments and archival data to the best of their possibilities. This book contains the written record of the Workshop. As such, it should provide a valuable tool to all interested in using existing HST data or in proposing for new observations.
Derived from text
Hubble Space Telescope; Calibrating; Instrument Compensation; Imaging Spectrometers; Infrared Spectrometers; Imaging Techniques; Spectrographs; Cameras; Infrared Astronomy; Conferences

19980202027 Space Telescope Science Inst., Baltimore, MD USA
STIS Overview: Capabilities and Basic Operations
Baum, S. A., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments;

1997, pp. 3-7; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

STIS, the Space Telescope Imaging Spectrograph, was built by Ball Aerospace Corporation. STIS is an extremely diverse instrument which can be used both for spectroscopy and imaging and which operates from the near-infrared through the ultraviolet. This paper summarizes the basic capabilities of STIS and describes its successful early on-orbit operation for Cycle 7.
Derived from text

Hubble Space Telescope; Spectrographs; Spectroscopy; Imaging Spectrometers; General Overviews

19980202028 NASA Goddard Space Flight Center, Greenbelt, MD USA

The on-orbit performance of the STIS detectors

Kimble, Randy A., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 8-17; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Space Telescope Imaging Spectrograph (STIS), successfully installed into the Hubble Space Telescope in February 1997, achieves its advances over the first-generation HST spectrographs primarily through the use of modern large-format, two-dimensional array detectors. The performance of the STIS detectors, two Multi-Anode Microchannel Arrays (MAMAS) and one CCD, has been evaluated on-orbit as part of the Servicing Mission Orbital Verification (SMOV) program. All three detectors are functioning well. We report highlights of the results to date here.
Author

Hubble Space Telescope; Multi-Anode Microchannel Arrays; Charge Coupled Devices; Spectrographs; Spectroscopy; Infrared Detectors; Spacecraft Instruments; Imaging Spectrometers

19980202029 NASA Goddard Space Flight Center, Greenbelt, MD USA

The on-orbit optical performance of STIS

Bowers, Charles W., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 18-28; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Space Telescope Imaging Spectrograph (STIS) is a versatile, general purpose instrument installed aboard the Hubble Space Telescope in February, 1997. During the following Servicing Mission Orbital Verification (SMOV) period, STIS has been made operational and aligned, and initial checkout and calibration completed. The overall optical performance goals have largely been achieved and a summary of these results is presented.
Author

Calibrating; Hubble Space Telescope; Spectrographs; Orbital Servicing; Instrument Errors; Imaging Spectrometers; Spacecraft Instruments; Multi-Anode Microchannel Arrays; Onboard Equipment

19980202030 Johns Hopkins Univ., Dept. of Physics and Astronomy, Baltimore, MD USA

The flat fielding and achievable signal-to-noise of the MAMA detectors

Kaiser, Mary Elizabeth, Johns Hopkins Univ., USA; Lindler, Don J., Advanced Computer Concepts, Inc., USA; Bohlin, Ralph C., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 29-38; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Space Telescope Imaging Spectrograph (STIS) was designed to achieve a signal-to-noise (S/N) of at least 100:1 per resolution element. Multi-Anode Microchannel Arrays (MAMA) observations during Servicing Mission Orbital Verification (SMOV) confirm that this specification can be met. From analysis of a single spectrum of GD153, with counting statistics of approximately 165 a S/N of approximately 125 is achieved per spectral resolution element in the far ultraviolet (FUV) over the spectral range of 1280A to 1455A. Co-adding spectra of GRW+7OD5824 to increase the counting statistics to approximately 300 yields a S/N of approximately 190 per spectral resolution element over the region extending from 1347A to 1480A in the FUV. In the near ultraviolet (NUV), a single spectrum of GRW+7OD5824 with counting statistics of approximately 200 yields a S/N of approximately 150 per spectral resolution element over the spectral region extending from 2167 to 2520A. Details of the flat field construction, the spectral extraction, and the definition of a spectral resolution element will be described in the text.
Author

Hubble Space Telescope; Multi-Anode Microchannel Arrays; Signal to Noise Ratios; Calibrating; Spectrographs; Radiation Detectors; Imaging Spectrometers; Ultraviolet Spectroscopy; Ultraviolet Spectra

19980202031 NASA Goddard Space Flight Center, Greenbelt, MD USA

STIS target acquisition

Kraemer, Steve, NASA Goddard Space Flight Center, USA; Downes, Ron, Space Telescope Science Inst., USA; Katsanis, Rocio, Space Telescope Science Inst., USA; Crenshaw, Mike, NASA Goddard Space Flight Center, USA; McGrath, Melissa, Space Telescope Science Inst., USA; Robinson, Rich, NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 39-46; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We describe the STIS autonomous target acquisition capabilities. We also present the results of dedicated tests executed as part of Cycle 7 calibration, following post-launch improvements to the Space Telescope Imaging Spectrograph (STIS) flight software. The residual pointing error from the acquisitions are

Author

Target Acquisition; Hubble Space Telescope; Calibrating; Applications Programs (Computers); Performance Tests; Imaging Spectrometers; Instrument Errors

19980202033 Space Telescope Science Inst., Baltimore, MD USA

The cycle 7 calibration plan for STIS

Goudfrooij, Paul, European Space Agency, France; Baum, Stefi A., Space Telescope Science Inst., USA; Ferguson, Henry C., Space Telescope Science Inst., USA; Hayes, Jeffrey J. E., Space Telescope Science Inst., USA; Hulbert, Steve J., Space Telescope Science Inst., USA; Leitherer, Claus, Space Telescope Science Inst., USA; McGrath, Melissa A., Space Telescope Science Inst., USA; Sahu, Kailash C., Space Telescope Science Inst., USA; Shaw, Richard A., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 52-59; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We give a short overview of the Cycle 7 calibration plan for STIS, discussing its challenge, its general goals and philosophy, the expected calibration accuracies after Cycle 7, and the way the GO and CTOs will be informed on the progress of the calibration efforts. A list of all calibration proposals with a brief description of each is also included.

Author

Calibrating; Hubble Space Telescope; Imaging Spectrometers; Multi-Anode Microchannel Arrays; Charge Coupled Devices; Systems Health Monitoring

19980202036 National Optical Astronomy Observatories, Tucson, AZ USA

STIS observations of the nuclear ionized gas in the elliptical galaxy M84

Bower, G. A., National Optical Astronomy Observatories, USA; Green, R. F., National Optical Astronomy Observatories, USA; Lindler, D., Advanced Computer Concepts, Inc., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 70-76; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We present optical long-slit spectroscopy of the nucleus of the nearby radio galaxy M84 (NGC 4374 = 3C 272.1) obtained with STIS aboard HST. The velocity curve has an S-shape with a peak amplitude of 400 km/s at 0”.1 = 8 pc from the nucleus. to model the observed gas kinematics, Bower et al. fit a thin Keplerian disk model to these data, leading to the conclusion that a is approx. = 1.5 x 10(exp 9) Solar mass dark compact mass (most likely a supermassive black hole) resides in the nucleus of M84.

Author

Black Holes (Astronomy); Elliptical Galaxies; Ionized Gases; Spectroscopy; Radio Galaxies; Interstellar Gas; Galactic Nuclei

19980202037 Hughes STX, Inc., Greenbelt, MD USA

STIS first-order low-resolution mode point-source sensitivity curves

Collins, Nicholas, Hughes STX, Inc., USA; Bohlin, Ralph, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 77-83; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Point source sensitivity curves have been derived for the first order modes G140L (Lambda(sub central)=1425A), G230L (2376A), G230LB (2375A), G430L (4300A), and G750L (7751A), spanning a wavelength range from 1140A to 10320A. The curves are determined by comparing wide slit (52” x 2”) observations of the spectrophotometric standard star CD 153 to a pure hydrogen white dwarf model. The calibration is tested by applying the curves to a Space Telescope Imaging Spectrograph (STIS)

observation of the spectrophotometric standard star BD+75D325, and comparing these flux calibrated observations to a calibrated FOS spectrum.
Author
Hubble Space Telescope; Point Sources; Sensitivity; Calibrating; Spectrophotometry; Data Reduction; Error Analysis; Spectral Resolution; Spectrographs

19980202038 NASA Goddard Space Flight Center, Greenbelt, MD USA
Simulations of the STIS CCD clear imaging mode PSF
Cornett, R. H., Hughes STX, Inc., USA; Grusczak, A., Hughes Danbury Optical Systems, Inc., USA; Ftaclas, C., Michigan Technological Univ., USA; Heap, S. R., NASA Goddard Space Flight Center, USA; Woodgate, B. E., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 84-89; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Detailed understanding of the properties of the point-spread function (PSF) of Space Telescope Imaging Spectrograph (STIS) imaging modes is necessary to separate real effects of geometrically complex astronomical sources, such as protoplanetary disks surrounding bright stars, from instrumental effects, such as scattering and diffraction. In order to investigate STIS imaging properties we have numerically simulated broadband stellar PSFs generated by STIS in CCD clear imaging mode, including the effects of the Lyot stop and the coronagraphic wedges. The input spectrum is a stellar model atmosphere of the appropriate spectral type, convolved with the pre-flight STIS CCD response function. The PSF modeler generates broadband PSFs by co-adding weighted monochromatic PSFs across the waveband.
Author
Hubble Space Telescope; Charge Coupled Devices; Point Spread Functions; Stellar Models; Coronagraphs; Image Processing; Spectrographs

19980202039 Space Telescope Science Inst., Baltimore, MD USA
A test of the STIS CCD flatfielding accuracy on small scales
Ferguson, H., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 90-93; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This is a preliminary report on the reliability of Space Telescope Imaging Spectrograph (STIS) Charged Coupled Devices (CCD) flatfielding on small scales. The STIS CCD flatfield images are constructed from internal calibration lamp observations. As the calibration subsystem does not have the same focal ratio as the input path from the sky, shadows from dust particles on the detector face plate may not be corrected perfectly by the internal calibration. To test the repeatability of stellar photometry in the presence of these flatfield variations, observations of the core of the globular cluster 47 Tuc were made with the telescope offset repeatedly by small amounts between exposures. Preliminary results indicate that photometry is repeatable to better than 1%.
Author
Calibrating; Charge Coupled Devices; Hubble Space Telescope; Stellar Spectrophotometry; Imaging Spectrometers; Accuracy

19980202040 NASA Goddard Space Flight Center, Greenbelt, MD USA
The STIS parallel survey: Introduction and first results
Gardner, Jonathan P., NASA Goddard Space Flight Center, USA; Hill, Robert S., NASA Goddard Space Flight Center, USA; Baum, Stefi A., Space Telescope Science Inst., USA; Collins, Nicholas R., NASA Goddard Space Flight Center, USA; Ferguson, Henry C., Space Telescope Science Inst., USA; Fosbury, Robert A. E., European Southern Observatory, Germany; Gilliland, Ronald L., Space Telescope Science Inst., USA; Green, Richard F., National Optical Astronomy Observatories, USA; Gull, Theodore R., NASA Goddard Space Flight Center, USA; Heap, Sara R., NASA Goddard Space Flight Center, USA; Lindler, Don J., NASA Goddard Space Flight Center, USA; Malumuth, Eliot M., NASA Goddard Space Flight Center, USA; Micol, Alberto, European Southern Observatory, Germany; Pirzkal, Norbert, European Southern Observatory, Germany; Sandoval, Jennifer L., NASA Goddard Space Flight Center, USA; Tolstoy, Eline, European Southern Observatory, Germany; Walsh, Jeremy R., European Southern Observatory, Germany; Woodgate, Bruce E., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 94-99; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The installation of the Space Telescope Imaging Spectrograph (STIS) on the Hubble Space Telescope (HST) allows for the first time two-dimensional optical and ultraviolet slitless spectroscopy of faint objects from space. The STIS Parallel Survey (SPS) routinely obtains broad band images and slitless spectra of random fields in parallel with HST observations using other instruments. The SPS is designed to study a wide variety of astrophysical phenomena, including the rate of star formation in galaxies

at intermediate to high redshift through the detection of emission-line galaxies. We present the first results of the SPS, which demonstrate the capability of STIS slitless spectroscopy to detect and identify high-redshift galaxies.
Author
Hubble Space Telescope; Spectrographs; Ultraviolet Spectroscopy; Faint Objects; Spectral Bands; Galaxies; Sky Surveys (Astronomy); Imaging Spectrometers

19980202041 Space Telescope Science Inst., Baltimore, MD USA
Fringe correction for STIS near-IR long-slit spectra using contemporaneous tungsten flat fields
Goudfrooij, Paul, European Space Agency, France; Baum, Stefi A., Space Telescope Science Inst., USA; Walsh, Jeremy R., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 100-105; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We report on the accuracy of fringe removal for Space Telescope Imaging Spectrograph (STIS) long-slit near-IR spectra using contemporaneous flats (taken during the course of science data collection). In case of point sources, we use tungsten flats taken through a small slit to mimic illumination by a point source. In case of extended sources, we use long-slit spectra of Jupiter's moon Io as test cases. We find that in case of the G750L grating, fringe residuals can be reduced to below the 1% level, for both point sources and extended objects.
Author
Near Infrared Radiation; Point Sources; Infrared Spectra; Hubble Space Telescope; Slits; Diffraction Patterns; Image Analysis; Pattern Recognition

19980202042 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal motion of the STIS optical bench
Gull, Theodore R., NASA Goddard Space Flight Center, USA; Taylor, Mary Jane, Loras Coll., USA; Shaw, Richard, Space Telescope Science Inst., USA; Robinson, Richard, Computer Sciences Corp., USA; Hill, Robert S., Hughes STX, Inc., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 106-113; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Various tests have been done of the Space Telescope Imaging Spectrograph (STIS) using internal wavecals to measure thermal motion of the spectral format on the detectors. In most cases, the spectral format moves less than the specification not to exceed 0.2 pixels per hour. Primary causes of the motion are (1) changes to the thermal design dictated by the warmer Aft Shroud environment and (2) on-orbit power cycling of Multi-Anode Microchannel Arrays (MAMA) electronics to minimize the effects of radiation hits on the MAMA detectors. The rear portion of the STIS optical bench is too warm to be held at a constant temperature by internal heaters. Electronics swing in temperature with an orbital and daily frequency. The thermal drift of the optical formats is not negligible, but is well behaved in most circumstances. The observer is advised to examine the trade-off between the most accurate wavelengths with best spectral/spatial resolutions versus increased overheads that directly affect the observing times. A long term concern is that the Aft Shroud thermal environment is predicted to heat up as much as one Centigrade degree per year. Progressively more of the bench would move out of thermal control. Thus the external cooler for STIS, being considered for the Third Servicing Mission is of major importance to the long term operation of STIS.
Author
Multi-Anode Microchannel Arrays; Thermal Environments; Temperature Effects; Temperature Control; Radiation Effects; Thermal Stability; Hubble Space Telescope; Imaging Spectrometers

19980202043 NASA Goddard Space Flight Center, Greenbelt, MD USA
Correction for the STIS echelle blaze function
Heap, Sara R., NASA Goddard Space Flight Center, USA; Brown, Thomas M., NASA Goddard Space Flight Center, USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 114-119; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Using the Early Release Observation of 9 Comae, we demonstrate an iterative method for correcting Space Telescope Imaging Spectrograph (STIS) echelle spectra for the effects of the echelle ripple. This analytic approach allows the actual spectrum of interest to be used in the determination of its calibration. The late F star 9 Comae is not an ideal candidate for this method, due to the many absorption lines present in its E230M spectrum, yet, given this difficulty, the method still works quite well.
Author
Echelle Gratings; Optical Correction Procedure; Calibrating; Hubble Space Telescope; Line Spectra; Spectrum Analysis; Iterative Solution; Imaging Spectrometers

19980202044 Hughes STX, Inc., Greenbelt, MD USA

Cosmic ray and hot pixel removal from STIS CCD images

Hill, Robert S., Hughes STX, Inc., USA; Landsman, Wayne B., Hughes STX, Inc., USA; Lindler, Don, Advanced Computer Concepts, Inc., USA; Shaw, Richard, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 120-125; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The problem of cosmic ray (CR) removal is a general one plaguing space-borne Charge Coupled Devices (CCDs), as is the gradual accumulation of single high-dark-rate pixels between CCD annealings. The STIS team at Goddard has developed IDL implementations of standard techniques for dealing with these problems as part of the STIS GTO software. This report summarizes the methods and discusses the pitfalls.

Author

Charge Coupled Devices; Hubble Space Telescope; Cosmic Rays; Pixels; Imaging Spectrometers; Algorithms

19980202045 Rutgers Univ., New Brunswick, NJ USA

Laboratory test data on the stability of the STIS MAMAs

Joseph, Charles L., Rutgers Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 126-131; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAG5-3158; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

STIS has two MAMA detectors systems with distinctly different tube configurations. The first (designated BAND 1) has an opaque CsI photocathode deposited on the microchannel plate (MCP) providing wavelength coverage from 1150A to 1700A. The other MAMA (designated BAND 2) has a semitransparent CS2Te photocathode deposited on the faceplate in close proximity to the input of the MCP. It covers the 1650A to 3100A bandpass and serves as a backup for the short wavelength detector. Laboratory test data indicate that both of these detectors have good sensitivity, have good uniformity and provide stable response, making each capable of collecting data with a signal-to-noise ratio in excess of 100 per Space Telescope Imaging Spectrograph (STIS) optical resolution element. Over a multiyear development effort, a substantial body of laboratory test data (more than 6 GBytes spanning more than 6 years of collection) has accumulated on more than a dozen fabricated tubes. These tests even included a few destructive evaluations to examine the limitations and operating life. In addition, analyses where conducted regarding impact caused by the specified electronic tolerances and expected changes in the Hubble Space Telescope (HST) thermal environment. Perhaps the simplest test of stability is to collect a sequence of images, each with a uniform illumination, and use these individual ”flat fields” to remove the pixel-to-pixel sensitivity in the other flat fields. These sequences typically spanned 3-5 weeks of time. The detectors are very stable, allowing the pixel-to-pixel sensitivity to be removed with good precision. The STIS specification for stability is 1% (sufficient for data with a S/N = 100) over a 1 week period and 2% over 30 days. All Engineering Model Units as well as Flight Detectors tested exceeded this specification.

Derived from text

Signal to Noise Ratios; Hubble Space Telescope; Multi-Anode Microchannel Arrays; Data Acquisition; Stability; Imaging Spectrometers; Radiation Detectors

19980202051 Arizona Univ., Steward Observatory, Tucson, AZ USA

NICMOS status and plans

Thompson, Rodger I., Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 163-170; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAS5-31289; NAS5-26555; NAG5-3042; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Near Infrared Camera and Multi-Object Spectrometer (NICMOS) has been in orbit for about 8 months. This is a report on its current status and future plans. Also included are some comments on particular aspects of data analysis concerning dark subtraction, shading, and removal of cosmic rays. At present NICMOS provides excellent images of high scientific content. Most of the observations utilize cameras 1 and 2 which are in excellent focus. Camera 3 is not yet within the range of the focus adjustment mechanism, but its current images are still quite excellent. In this paper we will present the status of various aspects of the NICMOS instrument.

Author

Cameras; Data Processing; Imaging Spectrometers; Photometry; Coronagraphs; Spectroscopy

19980202052 Space Telescope Science Inst., Baltimore, MD USA

Characteristics of the NICMOS detectors

Skinner, C. J., Space Telescope Science Inst., USA; Bergeron, L. E., Space Telescope Science Inst., USA; Daou, D., Space Tele-

scope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 171-181; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present an overview of the properties of the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) flight detectors as measured on-orbit, including the flat-field response, the dark current, the linearity, and the read-noise. We show for the first time all the dependencies of the various components of a NICMOS dark exposure, and show how to generate 'synthetic' dark current calibration files. An unexpected time-varying bias known as the 'pedestal', is described, along with some efforts to remedy it. We describe the effects on the detectors of exposure to very bright sources, and finally, we briefly describe the sensitivity of NICMOS to cosmic rays.

Author

Cameras; Calibrating; Cosmic Rays; Radiation Detectors; Imaging Spectrometers; Onboard Equipment; Radiation Tolerance

19980202054 Space Telescope Science Inst., Baltimore, MD USA

NICMOS PSF variations and tiny tim simulations

Krist, John E., Space Telescope Science Inst., USA; Hook, Richard N., European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 192-201; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Analysis of Near Infrared Camera and Multi-Object Spectrometer (NICMOS) images indicates that the instrument's optics provide high quality imaging over the wavelength range and field of view of the cameras (assuming that NICMOS 3 can be placed in-focus during campaign modes). Optical misalignments and low-level field- and focus-dependent aberrations have slight effects on the imaging performance. Variations of the point-spread functions (PSFs) with wavelength may be important when comparing images through different filters, especially in NICMOS 1 due to its high resolution. The NICMOS 1 and 2 camera cold masks are shifted with respect to the telescope obscurations, causing elliptical diffraction rings and alteration of the diffraction spike patterns. The mask shift varies with time, altering the diffraction structure mostly in the wings and spiders. It is not currently known whether the NICMOS 3 mask is similarly shifted. The effects of these alignment and optical surface errors can be studied using the Tiny Tim PSF modeling software. The NICMOS field and focus dependent aberrations and obscuration misalignments derived from the image measurements are included in the simulated PSFs, along with variations due to the filter passbands. The model PSFs match the observed ones well.

Author

Near Infrared Radiation; Point Spread Functions; Cameras; Hubble Space Telescope; Applications Programs (Computers); Imaging Spectrometers

19980202055 Arizona Univ., Steward Observatory, Tucson, AZ USA

Narrow-Band emission line imaging with NICMOS: Lessons learned from the data reduction of OMC-1

Stolovy, Susan R., Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 202-206; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Narrow-band emission-line imaging with Near-Infrared Camera Multi-Objects Spectrometer (NICMOS) is discussed, with an emphasis on what has been learned from the data reduction of the molecular hydrogen imaging of OMC-1 with Camera 2. Issues discussed here include: continuum subtraction, photometry, electronic ghosts, and mosaicking images with different sky orientations.

Author

Cameras; Near Infrared Radiation; Narrowband; Emission Spectra; Data Reduction; Astronomical Photometry; Molecular Clouds; Imaging Spectrometers

19980202056 European Southern Observatory, Space Telescope-European Coordinating Facility, Garching, Germany

The NICMOS grism mode

Freudling, Wolfman, European Southern Observatory, Germany; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 207-216; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In addition to broad band, medium band and wide band filter sets, the Near-Infrared Camera Multi-Object Spectrometer (NICMOS) Camera 3 (NIC3) filter wheel contains three grisms. These grisms provide low-resolution slitless spectroscopic capabilities. Servicing Mission Observatory Verification (SMOV) data verified basic properties of the grisms. Two weeks of grism data with the best possible focusing for NIC3 have been collected in late July and early August 1997. Spectra have been extracted

from all visible sources in that data set using software developed at the Space Telescope - European Coordinating Facility. No emission lines or absorption lines are found in any of the objects.
Author
Near Infrared Radiation; Cameras; Astronomical Spectroscopy; Infrared Imagery; Filter Wheel Infrared Spectrometers; Image Filters; Imaging Spectrometers

19980202057 Arizona Univ., Steward Observatory, Tucson, AZ USA
The polarimetric capabilities of NICMOS
Hines, D. C., Arizona Univ., USA; Schmidt, G. D., Arizona Univ., USA; Lytle, Dyer, Arizona Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 217-222; In English; Also announced as 19980202026
Contract(s)/Grant(s): NAG5-3042; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The polarimetric capabilities of Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) are demonstrated from data obtained during the Early Release Observations of IRC+10216 and CRL 2688 (the Egg Nebula). Preflight Thermal Vacuum tests revealed that each polarizer has a unique polarizing efficiency, and that the position angle offsets differ from the nominal positions of O deg, 120 deg and 240 deg. Therefore an algorithm different from that of an ideal polarizer is required for proper reduction of astronomical polarimetry data. We discuss this new algorithm and the results of its application to NICMOS data. We also present preliminary estimates of the Instrumental Polarization, the sensitivity of the grisms to polarized light, and the accuracy of NICMOS imaging polarimetry for faint and low polarization objects. Finally, we suggest strategies for maximizing the success of NICMOS polarimetry observations.
Author
Algorithms; Astronomical Polarimetry; Cameras; Thermal Vacuum Tests; Polarizers; Near Infrared Radiation; Data Reduction; Imaging Spectrometers

19980202058 Space Telescope Science Inst., Baltimore, MD USA
The NICMOS CALNICA and CALNICB pipelines
Bushouse, Howard, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 223-232; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes the Space Telescope Science Institute (STScI) Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) calibration pipeline tasks CALNICA and CALNICB. Section 1 describes the input and output files for each task. Sections 2 and 3 describe features that are common to both tasks, and how to run them. Sections 4 and 5 describe in detail the processing steps applied by CALNICA and CALNICB, respectively. Section 6 gives information on the version histories of both tasks.
Author
Calibrating; Cameras; Near Infrared Radiation; Applications Programs (Computers); Data Processing; Algorithms

19980202059 Space Telescope Science Inst., Baltimore, MD USA
Improving on the NICMOS calibration pipeline products
Skinner, C. J., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 233-239; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We describe a variety of operations which can be carried out using Interactive Data Reduction and Analysis Facility (IRAF) software to improve upon the quality of the calibrated data when a variety of problems are present in it. The problems covered include such diverse topics as the pedestal, problems with Cosmic Ray rejection, problems with saturated or non-linear pixels, and multiple coronagraphic holes appearing in images.
Author
Calibrating; Data Reduction; Near Infrared Radiation; Cameras; Imaging Spectrometers; Image Processing; Dark Current

19980202060 Space Telescope Science Inst., Baltimore, MD USA
Understanding the NICMOS darks
Bergeron, L. E., Space Telescope Science Inst., USA; Skinner, C. J., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 240-244; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

This paper describes the characteristics of the ”dark current” for the Near-Infrared and Multi-Object Spectrometer (NICMOS) flight detectors, namely the instrumental signal present in exposures made in the absence of any external illumination. We show how this comprises three distinct components - the shading, amplifier glow, and the true dark current. We then describe a recipe

for generating ”synthetic” dark current calibration reference files, which could in principle be used to generate darks for any arbitrary sequence of MULTIACCUM reads.
Author
Dark Current; Near Infrared Radiation; Calibrating; Cameras; Image Processing; Imaging Spectrometers

19980202062 Space Telescope Science Inst., Baltimore, MD USA
NICMOS sensitivity to cosmic rays
Calzetti, Daniela, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 250-254; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) dark frames obtained during Servicing Mission Observatory Verification (SMOV) were used to derive the sensitivity of the detectors to cosmic ray hits. The number of cosmic ray events (5 sigma detections) is about 1.2-1.6 events/camera/sec, comparable to the WFPC2 detection rate for the same detector area. The mean size of the 5 sigma cosmic ray hits is 1.65 to 2 pixels, similar to the value measured during the NICMOS System Level Thermal Vacuum (SLTV) experiments. The number of pixels affected by cosmic ray hits is between 2 and 3 pix/camera/sec. This value depends on the position of the telescope relative to the South Atlantic Anomaly (SAA), and variations up to 60% in the rate of affected pixels have been observed between different dark frames during the same orbit. Information in the affected pixels can be partially recovered with the use of the MULTIACCUM read-out mode. However, seldomly (once-twice per month), cosmic ray hits have been observed to persist between frames during an orbit.
Author
Cosmic Rays; Sensitivity; Cameras; Near Infrared Radiation; Radiation Effects; Radiation Detectors; Imaging Spectrometers; Image Processing

19980202066 Space Telescope Science Inst., Baltimore, MD USA
NICMOS pointed thermal background: results from on-orbit data
Daou, Doris, Space Telescope Science Inst., USA; Skinner, C. J., Space Telescope Science Inst., USA; Axon, David, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 267-270; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

We present the results of the analysis of Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) pointed thermal background data taken as part of the Servicing Mission Observatory Verification (SMOV). Observations in NICMOS Camera 3 are taken at different pointings and analysis of the data determines Hubble Space Telescope (HST) thermal emission to be stable. Furthermore, data obtained with multiple filters show no differences from the background calculated with the NICMOS Exposure Time Calculator.
Author
Near Infrared Radiation; Thermal Radiation; Thermal Emission; Background Radiation; Orbital Servicing

19980202067 Space Telescope Science Inst., Baltimore, MD USA
Subtraction of well-exposed NICMOS 2 PSFs
Krist, John E., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 271-276; In English; Also announced as 19980202026; Sponsored in part by HST GO.; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A SNAP program (7420) is underway to search for companions to nearby stars using Near Infrared Camera and Multi-Object Spectrometer (NICMOS) 2 (f/45, 0.076 sec/pix). Well-to over-exposed star images are obtained at the center of the detector in four filters: F110W, F180M, F207M, and F222M. The stars are typically saturated to allow for the detection of faint companions. The point spread function (PSF) often fills the entire field of view, with diffraction rings visible out to a radius of 10 sec. The program was designed with the expectation that a large number of the stars would not have any companions or material around them, making them suitable for use as reference PSFs to subtract from other star images. The reference PSF would be shifted and intensity scaled to provide the best subtraction. In addition to the possible discoveries of companions, the high signal-to-noise structures in the wings of these PSFs have provided new, unexpected information on the optical characteristics of the NICMOS 2 camera which cannot be obtained from the current PSF monitoring program.
Author
Near Infrared Radiation; Subtraction; Point Spread Functions; Signal to Noise Ratios; Optical Properties; Applications Programs (Computers); Companion Stars

19980202080 Carnegie-Mellon Univ., Dept. of Physics, Pittsburgh, PA USA

Calibrating the WFPC2 astrometry for MDS

Ratnatunga, Kavan U., Carnegie-Mellon Univ., USA; Ostrander, Eric J., Carnegie-Mellon Univ., USA; Griffiths, Richard E., Carnegie-Mellon Univ., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 361-367; In English; Also announced as 19980202026

Contract(s)/Grant(s): NAS5-26555; STScI-GO-2684; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Hubble Space Telescope (HST) Medium Deep Survey has optimized an automated procedure to associate and stack WFPC2 data. The coordinates listed in HST WFPC2 image and/or jitter file headers are often found to be insufficient to stack images for cosmic ray removal. We discuss results from software developed for the HST Medium Deep Survey (MDS) pipeline to evaluate these shifts by cross-correlation of the images. We will also discuss the distortion of the pre-cool-down WFPC2 field and attempts to derive absolute coordinates for MDS WFPC2 observations using the USNO-Al.0 half billion object catalog.

Author

Calibrating; Astrometry; Data Processing; Image Processing; Distortion; Software Development Tools; Sky Surveys (Astronomy)

19980202081 Liege Univ., Inst. d'Astrophysique, Belgium

HST observations of the gravitational lens systems HE 1104-1805 and J03.13

Remy, M., Liege Univ., Belgium; Claeskens, J. F., Liege Univ., Belgium; Surdej, J., Liege Univ., Belgium; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 368-373; In English; Also announced as 19980202026; Sponsored in part by SSTC/PRODEX.

Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

High angular resolution Principle Component Image (PC1) images of the gravitational lens systems HE 1104-1805 and J03.13 are presented. Using a method described in Remy et al. (1997a), optimal TinyTim Point Spread Function (PSFs) are constructed to fit at best the lensed point-like components. The derived photometry of the GL components and the detection of the lens galaxy for HE 1104-1805 are discussed. Textbook case Faint Object Spectrograph (FOS) spectra of J03.13 A and B clearly show that this double QSO is a cosmic mirage.

Author

Faint Objects; Gravitational Lenses; Angular Resolution; Quasars; Stellar Spectra; Point Spread Functions; Image Processing; Astronomical Photography; Astronomical Photometry

19980202082 Liege Univ., Inst. d'Astrophysique, Belgium

WFPC2 photometry from subtraction of TinyTim PSFs

Remy, M., Liege Univ., Belgium; Surdej, J., Liege Univ., Belgium; Baggett, S., Space Telescope Science Inst., USA; Wiggs, M., Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 374-377; In English; Also announced as 19980202026; Sponsored in part by SSTC/PRODEX.

Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Based upon the subtraction of TinyTim Point Spread Function (PSFs) from Principle Component Image (PC1) point-like objects, a method has been developed to determine the optimal values for the telescope jitter and the Z4 relative focus during calibration or science observations. Using these jitter and focus values, an optimal TinyTim PSF, computed over a resampled grid, is then iteratively fitted to the object, yielding an improvement in the PSF centering, more accurate photometric results and a better detection of underlying structures. Preliminary results seem to indicate that appropriate synthetic TinyTim PSFs perform as well as observed PSFs.

Author

Point Spread Functions; Image Processing; Calibrating; Computational Grids; Astronomical Photometry

19980202094 Space Telescope Science Inst., Baltimore, MD USA

FGSIR: Potentially HST's astrometry science workhorse

Lupie, Olivia, Space Telescope Science Inst., USA; Nelan, Ed, Space Telescope Science Inst., USA; Nagel, Lauretta, Space Telescope Science Inst., USA; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 463-471; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We review the enhancements to the flight spare Fine Guidance Sensor (FGS) (called FGS1R) which was installed in the Second Servicing Mission in February 1997, and present the latest results of the FGS1R monitoring program. The performance of

FGS1R and the current astrometer, FGS3, are compared and we present simulations of expected performance of FGS1R once the instrument reaches in-orbit stability.
Author
Guidance Sensors; Hubble Space Telescope; Astrometry; Alignment; S Curves

19980202542 Colorado Univ., Boulder, CO USA
A Search for X-Ray Evidence of a Compact Companion to the Unusual Wolf-Rayet Star HD 50896 (EZ CMa)
Skinner, Stephen L., Colorado Univ., USA; Itoh, Masayuki, Kobe Univ., Japan; Nagase, Fumiaki, Tokyo Univ., Japan; New Astronomy; 1998; ISSN 1384-1076; Volume 3, pp. 37-49; In English
Contract(s)/Grant(s): NAG5-3224
Report No.(s): NASA/CR-1998-208149; NAS 1.26:208149; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

We analyze results of a approx.25 ksec ASCA X-ray observation of the unusual Wolf-Rayet star HD 50896 (= EZ CMa). This WN5 star shows optical and ultraviolet variability at a 3.766 day period, which has been interpreted as a possible signature of a compact companion. Our objective was to search for evidence of hard X-rays (greater than or equal to 5 keV) which could be present if the WN5 wind is accreting onto a compact object. The ASCA spectra are dominated by emission below 5 keV and show no significant emission in the harder 5-10 keV range. Weak emission lines are present, and the X-rays arise in an optically thin plasma which spans a range of temperatures from less than or equal to 0.4 keV up to at least approx. 2 keV. Excess X-ray absorption above the interstellar value is present, but the column density is no larger than N(sub H) approx. 10(exp 22)/sq cm. The absorption-corrected X-ray luminosity L(sub x)(0.5 - 10 keV) = 10(exp 32.85) erg/s gives L(sub x)/ L(sub bol) approx. 10(exp -6), a value that is typical of WN stars. No X-ray variability was detected. Our main conclusion is that the X-ray properties of HD 50896 are inconsistent with the behavior expected for wind accretion onto a neutron star or black hole companion. Alternative models based on wind shocks can explain most aspects of the X-ray behavior, and we argue that the hotter plasma near approx. 2 keV could be due to the WR wind shocking onto a normal (nondegenerate) companion.
Author
X Rays; Wolf-Rayet Stars; Emission Spectra; Plasmas (Physics)

90
ASTROPHYSICS

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

19980202077 Lund Observatory, Sweden
HST, uvby photometry and system calibration
Linde, P., Lund Observatory, Sweden; Ardeberg, A., Lund Observatory, Sweden; Bensby, T., Lund Observatory, Sweden; Snel, R., Lund Observatory, Sweden; The 1997 HST Calibration Workshop with a New Generation of Instruments; 1997, pp. 343-348; In English; Also announced as 19980202026; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Galactic evolution is studied in a field in the centre of the Large Magellanic cloud (LMC) Bar. We obtain data of high quality with the Hubble Space Telescope (HST) Wide Field and Planetary Camera 2 (WFPC2) and uvby photometry. To match the photometric accuracy and make use of the potential of the uvby system in terms of evolutionary parameters and chemical abundance, we need adequate calibration of the data observed. Conversion of the observing system into that of the international uvby system is made from observations of reference stars in cluster fields. These fields are first observed with a ground based telescope together with selected sets of standard stars for the uvby system. This way, the cluster field reference stars are tied into the international uvby system. Subsequently, the reference stars are observed with the HST WFPC2 used with its set of uvby filters, thus providing final system conversion. We here discuss the observations and present some initial results.
Author
Hubble Space Telescope; Calibrating; Cameras; Stellar Spectrophotometry; Image Processing

19980202398 Notre Dame Univ., Dept. of Physics, IN USA
Comet Shoemaker-Levy 9: An Active Comet
Rettig, Terrence W., Notre Dame Univ., USA; Hahn, Joseph M., Lunar and Planetary Inst., USA; Planet. Space Sci.; 1997; ISSN 0032-0633; Volume 45, No. 10, pp. 1271-1277; In English
Contract(s)/Grant(s): NAS5-26555; NASw-4575; STSI-5624.21-93A

Report No.(s): NASA/CR-97-207773; NAS 1.15:207773; LPI-Contrib-924; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

The important elements of the debate over the activity versus dormancy of comet Shoemaker Levy 9 (S-L 9) are reviewed. It is argued that the circularity of the isophotes in the inner comae of S-L 9 as well as the spatial dependencies of the comae brightness profiles are indicators of sustained dust production by S-L 9. It is also shown that the westward tail orientations, which were formerly interpreted as a sign of the comet's dormancy, are not a good indicator of either activity or dormancy. Rather, the tail orientations simply place constraints on the dust production rate for grains smaller than approx. equals 5(micron). All the available evidence points to S-L 9 as having been an active, dust-producing comet. Synthetic images of an active comet are fitted to Hubble Space Telescope images of the S-L 9 fragment K, and its grain size and outflow velocity distributions are extracted. These findings show that the appearance of the dust coma was dominated by large grains having radii between approx. equals 30 (micron) and approx. equals 3 mm, produced at a rate of M approx. equals 22 kg/ s, and ejected at outflow velocities of approx. equals 0.5 m/ s. Only upper limits on the production rates of smaller grains are obtained. The nucleus of fragment K was not observed directly but its size is restricted to lie within a rather narrow interval 0.4 less than or equal to Rf less than or equal to 1.2 km.
Author

Shoemaker-Levy 9 Comet; Velocity Distribution; Spatial Dependencies; Hibernation; Grain Size; Dust

19980202600 Naval Postgraduate School, Monterey, CA USA

Comparative Analysis of Selected Radiation Effects in Medium Earth Orbits

Bolin, Jennifer A., Naval Postgraduate School, USA; Dec. 1997; 154p; In English

Report No.(s): AD-A341085; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Satellite design is well developed for the common Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO) and Highly Elliptical Orbits (HEO), i.e., Molniya, cases; Medium Earth Orbit (MEO) satellite design is a relatively new venture. MEO is roughly defined as being altitudes above LEO and below GEO. A primary concern, and a major reason for the delay in exploiting the MEO altitudes, has been the expected radiation environment and corresponding satellite degradation anticipated to occur at MEO altitudes. The presence of the Van Allen belts, a major source of radiation, along with the suitability of GEO and LEO orbits, has conventionally discouraged satellite placement in MEO. As conventional Earth orbits become increasingly crowded, MEO will become further populated. This thesis investigates the major sources of radiation (geomagnetically trapped particles, solar particle events and galactic cosmic radiation) with respect to specific Naval Research Laboratory (NRL) designated MEO (altitudes between 3,000 nautical miles (nmi) and 9,000 nmi; (inclination angle of 15 degrees). The contribution of each of these components to the total radiation experienced in MEO and the effects of the expected radiation on a representative spacecraft are analyzed in comparison to a baseline LEO orbit of 400 nmi and 70 degrees inclination. Dose depth curves are calculated for several configurations, and show that weight gains from necessary expected shielding are not extreme. The radiation effects considered include proton displacement dose and solar cell degradation.
DTIC

Unmanned Spacecraft; Radiation Effects; Solar Corpuscular Radiation; Aerospace Environments

92
SOLAR PHYSICS

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

19980202344 Hughes STX, Inc., Lanham, MD USA

Influence of Short-Term Solar UV Variability on the Determination of Solar Cycle Minimum

Cebula, Richard P., Hughes STX, Inc., USA; DeLand, Matthew T., Hughes STX, Inc., USA; 1997; 20p; In English; AGU Meeting, 12 Dec. 1997, San Francisco, CA, USA

Contract(s)/Grant(s): NASw-4864

Report No.(s): NASA/CR-97-207713; NAS 1.26:207713; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Smoothing solar UV data on rotational timescale (approx. 27 days) improves identification of solar minimum. Smoothing intervals which are not multiples of rotational period (e.g. 35 days) can leave measurable residual signal. No evidence found for periodic behavior on intermediate (50-250 days) time scales during Cycle 22, based on data from three solar UV instruments.
Author

Influence Coefficient; Time; Ultraviolet Emission; Solar Cycles

19980202564 Hokkaido Univ., Dept. of Nuclear Engineering, Sapporo, Japan

Calculation of Dose for Skyshine Radiation From a 45 MeV Electron LINAC

Hori, M., Hokkaido Univ., Japan; Hikoji, M., Hokkaido Univ., Japan; Takahashi, H., Hokkaido Univ., Japan; Takahashi, K., Hokkaido Univ., Japan; Kitaichi, M., Hokkaido Univ., Japan; Sawamura, S., Hokkaido Univ., Japan; Nojiri, I., Power Reactor and Nuclear Fuel Development Corp., Japan; Proceedings of the Sixth EGS4 Users' Meeting in Japan; Nov. 1996, pp. 113-121; In English; Also announced as 19980202550; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Dose estimation for skyshine plays an important role in the evaluation of the environment around nuclear facilities. We performed calculations for the skyshine radiation from a Hokkaido University 45 MeV linear accelerator using a general purpose user's version of the EGS4 Monte Carlo Code. to verify accuracy of the code, the simulation results have been compared with our experimental results, in which a gated counting method was used to measure low-level pulsed leakage radiation. In experiment, measurements were carried out up to 600 m away from the LINAC. The simulation results are consistent with the experimental values at the distance between 100 and 400 m from the LINAC. However, agreements of both results up to 100 m from the LINAC are not as good because of the simplification of geometrical modeling in the simulation. It could be said that it is useful to apply this version to the calculation for skyshine.

Author

Computation; Radiation Dosage; Simulation; Counting

99
GENERAL

19980202741 NASA, Washington, DC USA

Exploring the Unknown: Selected Documents in the History of the US Civilian Space Program, Volume 3, Using Space

Logsdon, John M., Editor, NASA, USA; Launius, Roger D., Editor, NASA, USA; Onkst, David H., Editor, NASA, USA; Garber, Stephen J., Editor, NASA, USA; 1998; 640p; In English

Report No.(s): NASA/SP-4407-Vol-3; NAS 1.21:4407-Vol-3; LC-96-9066; ISBN 0-16-049546-6; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

One of the most important developments of the twentieth century has been the movement of humanity into space with machines and people. The underpinnings of that movement -why it took the shape it did; which individuals and organizations were involved; what factors drove a particular choice of scientific objectives and technologies to be used; and the political, economic, managerial, and international contexts in which the events of the space age unfolded- are all important ingredients of this epoch transition from an earthbound to spacefaring people. This desire to understand the development of spaceflight in the USA sparked this documentary history series. 'Exploring the Unknown' is a multi-volume series containing a selection of key documents in history of the U.S. civil space program. This current volume, Volume III, focusing on the use of space for practical applications, prints 112 key documents on the history of satellite communications, remote sensing of earth, and space as an investment in economic growth, edited for ease of use. Each is introduced by a headnote providing context, bibliographical information, and background information necessary to understanding the document.

Derived from text

Space Programs; Histories; Satellite Communication; Earth Observations (From Space); Economic Impact; Space Missions; Remote Sensing

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