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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

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Includes passenger and cargo air transport operations; and aircraft accidents.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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Includes cockpit and cabin display devices; and flight instruments.

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Typical Report Citation and Abstract

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

Key

1. Document ID Number; Corporate Source
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9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 363)

DECEMBER 12, 1997

01
AERONAUTICS

19970037587 NASA Lewis Research Center, Cleveland, OH USA
Progress Toward Meeting the Propulsion Technology Challenges for a 21st Century High-Speed Civil Transport
Shaw, Robert J., NASA Lewis Research Center, USA; Koops, Leigh, General Electric Co., USA; Hines, Richard, Pratt and Whitney Aircraft Group, USA; Sep. 1997; 16p; In English; 8th; Air Breathing Engines, 7-12 Sep. 1997, Chattanooga, TN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 537-05-23
Report No.(s): NASA/TM-97-113161; NAS 1.15:113161; ISABE-97-7045; E-10915; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ongoing NASA-funded and privately funded studies continue to indicate that an opportunity exists for a second generation supersonic commercial airliner, or High-Speed Civil Transport (HSCT), to become a key part of the 21st century international air transportation system. Long distance air travel is projected to increase at about 5 percent per annum over the next two decades. This projection suggests that by the year 2015, more than 600,000 passengers per day will be traveling long distances, predominantly over water. These routes would be among the most desirable for an HSCT as part of the international air transportation system. Beyond the year 2000, this portion of the air transportation market is projected to be the fastest growing segment.
Derived from text
Air Transportation; Supersonic Transports; Transport Aircraft; Passengers; High Speed; Civil Aviation

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970036202 NASA Langley Research Center, Hampton, VA USA
Cryogenic Tunnel Pressure Measurements on a Supercritical Airfoil for Several Shock Buffet Conditions
Bartels, Robert E., NASA Langley Research Center, USA; Edwards, John W., NASA Langley Research Center, USA; Sep. 1997; 16p; In English
Contract(s)/Grant(s): RTOP 522-22-21-01
Report No.(s): NASA-TM-110272; NAS 1.15:110272; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Steady and unsteady experimental data are presented for several fixed geometry conditions from a test in the NASA Langley 0.3-Meter Transonic Cryogenic Tunnel. The purpose of this test was to obtain unsteady data for transonic conditions on a fixed and pitching supercritical airfoil at high Reynolds numbers. Data and brief analyses for several of the fixed geometry test conditions will be presented here. These are at Reynolds numbers from 6 x 10(exp 6) to 35 x 10(exp 6) bases on chord length, and span a limited range of Mach numbers and angles of attack just below and at the onset of shock buffet. Reynolds scaling effects appear in both the steady pressure data and in the onset of shock buffet at Reynolds numbers of 15 x 10(exp 6) and 3O x 10(exp 6) per chord length.
Author
Airfoils; Cryogenics; Transonic Wind Tunnels; Buffeting; Reynolds Number; High Reynolds Number; Pressure Measurement; Angle of Attack

19970037291 California Univ., Dept. of Mechanical Engineering, Berkeley, CA USA
Experimental Study of Complex Vortex Interactions in the Wake of High Aspect Ratio Wings ***Final Report***
Savas, Omer, California Univ., USA; Aug. 06, 1997; 32p; In English
Contract(s)/Grant(s): NAG1-1816
Report No.(s): NASA/CR-112556; NAS 1.26:112556; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dynamics of trailing vortex wakes from flapped airfoils are investigated in a towing tank and a wind tunnel. In this work, parallel experiments are conducted in a wind tunnel with a five-hole probe for near wake measurements and in a tow tank with particle image velocimetry (PIV) for mid- and far-wake measurements. The wind tunnel allows detailed time-averaged measurements of the near-wake in a plane fixed relative to the wing while the tow tank allows measurements of the entire evolving wake in a plane fixed relative to an observer. The wakes from a lifting rectangular circular arc airfoil with an aspect ratio of 6 and flap-spans of 30% and 67% and a NACA 0012 with an aspect ratio of 8 and flap-spans of 40% and 50% are studied as the wake evolves downstream. Chord-based Reynolds number Re(sub c), ranged from 1.5 x 10(exp 4) to 8 x 10(exp 4). A traversing five-hole pitot probe and Lagrangian Parcel Tracking (LPT) are used to measure the velocity field in a cross-stream plane behind the wing in the wind tunnel and the towing tank, respectively. The interaction of the tip and flap vortices are studied. Merger of the flap and tip vortices usually occurs within one orbit, leading to a shorter descent distance to merger for the longer flap-spans. The strut wake significantly effects the vortex strength, hence merger characteristics, by disrupting the vortex sheet.
Author
Wakes; Vortices; Airfoils; Wind Tunnels; Particle Image Velocimetry; Time Measurement; Wings

19970037301 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Measurement of Drag Characteristics of Mk 82 General Purpose Low Drag Bomb using an Aeroballistic Range Facility
Krishnamoorthy, L. V., Defence Science and Technology Organisation, Australia; Glass, R., Defence Science and Technology Organisation, Australia; Kirk, D. R., Defence Science and Technology Organisation, Australia; Jun. 1997; 21p; In English
Report No.(s): DSTO-TR-0545; AR-010-249; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P. O. Box 4331, Melbourne Victoria 3001, Australia), Hardcopy, Microfiche

A method is described to determine the drag characteristics of the Mk 82 low drag bomb. This involves launching half scale models from the DSTO gas gun facilities at Port Wakefield and measuring the trajectories by photogrammetric methods. The drag coefficients were calculated from the measured positional data using a three degrees of freedom parameter estimation method. The estimated drag characteristics of various Mk 82 GPLD store configurations will form the basis of a database for use with the updated F-111C aircraft.
Author
Aerodynamic Drag; Aerodynamic Coefficients; Degrees of Freedom; Bombs (Ordnance); Drag Measurement; Trajectories; Photogrammetry

19970037422 NASA Ames Research Center, Moffett Field, CA USA
Study of Organized Structures in the Post-Stall Flow Over Wings ***Final Report***
Yon, Steven, San Diego State Univ., USA; Katz, Joseph, San Diego State Univ., USA; Ross, James, NASA Ames Research Center, USA; Feb. 1996; 6p; In English
Contract(s)/Grant(s): NCC2-5124
Report No.(s): NASA/CR-97-205789; NAS 1.26:205789; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This study of the separated flow over unswept wings is a result of the cooperation between SDSU and NASA Ames Research Center. The research had elements of wind-tunnel and numerical experimentations which were carried out both at SDSU and at Ames research center. One of the important accomplishments of this study is the measurement of the time-dependent pressures on a stalled airfoil. The three-dimensional, cellular nature of the separation pattern on the wing was documented and the dominant frequencies of the pressure fluctuations were recorded. The lateral instability of this cellular pattern was observed first but this phenomenon seemed to be arbitrary and not periodic. The existence of a frequency, lower than the anticipated wake shedding frequency, was documented (which was reported only once before in the open literature). This finding may prove valuable for the noise reduction efforts of the high-lift systems of landing aircraft. Extensive numerical investigations with the INS2D code indicated that the existence of the above mentioned low-frequency oscillations can be captured by the computations. Prediction of the flow separation point at a given angle of attack is still difficult, but the trends are close to the experimental observations. For example, the onset of stall is similar in both cases, but in the computations the events were delayed to somewhat higher angles

of attack. Past experience indicates that this discrepancy can be cured by increasing grid density in the vicinity of the separation point, by using certain forms of adaptive grids.
Derived from text
Separated Flow; Unswept Wings; Wind Tunnels; Angle of Attack; Boundary Layer Separation; Airfoils; Time Dependence; Pressure Measurement; Pressure Oscillations; Wakes; Frequencies

19970037558 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Aircraft Maneuvering Aerodynamics with an Unsteady, Higher-Order Panel Method, Theory and Application
Weber, E. A. C., Technische Univ., Netherlands; Dec. 1996; 109p; In English; Figures in this document may not be legible in microfiche
Report No.(s): PB97-193940; M-751; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A method to predict unsteady aerodynamic loads by solving the Linearized Potential Equation is developed. The steady panel Method FASD, developed at the Department of Theoretical Aerodynamics is extended to include the unsteady capabilities. The resulting program, FASDU, is capable of analyzing arbitrary maneuvers at constant speed, with small amplitudes, at realistic frequencies for aircraft maneuvers. The method is validated against analytical results.
NTIS
Aircraft Maneuvers; Aerodynamic Loads; Unsteady Aerodynamics; Panel Method (Fluid Dynamics)

19970037581 NASA Dryden Flight Research Center, Edwards, CA USA
F-16XL Wing Pressure Distributions and Shock Fence Results from Mach 1.4 to Mach 2.0
Landers, Stephen F., Planning Research Corp., USA; Saltzman, John A., Planning Research Corp., USA; Bjarke, Lisa J., NASA Dryden Flight Research Center, USA; Oct. 1997; 44p; In English
Contract(s)/Grant(s): RTOP 529-31-24
Report No.(s): NASA/TM-97-206219; NAS 1.15:206219; H-2055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chordwise pressure distributions were obtained in-flight on the upper and lower surfaces of the F-16XL ship 2 aircraft wing between Mach 1.4 and Mach 2.0. This experiment was conducted to determine the location of shock waves which could compromise or invalidate a follow-on test of a large chord laminar flow control suction panel. On the upper surface, the canopy closure shock crossed an area which would be covered by a proposed laminar flow suction panel. At the laminar flow experiment design Mach number of 1.9, 91 percent of the suction panel area would be forward of the shock. At Mach 1.4, that value reduces to 65 percent. On the lower surface, a shock from the inlet diverter would impinge on the proposed suction panel leading edge. A chordwise plate mounted vertically to deflect shock waves, called a shock fence, was installed between the inlet diverter and the leading edge. This plate was effective in reducing the pressure gradients caused by the inlet shock system.
Author
F-16 Aircraft; Pressure Distribution; Control Surfaces; Supersonic Transports

19970037758 Defence Science and Technology Organisation, Melbourne, Australia
An Aerodynamic Database for the Mk 82 General Purpose Low Drag Bomb
Krishnamoorthy, L. V., Defence Science and Technology Organisation, Australia; Kirk, D. R., Defence Science and Technology Organisation, Australia; Glass, R., Defence Science and Technology Organisation, Australia; Jul. 1997; 33p; In English
Report No.(s): DSTO-TR-0554; AR-010-269; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The drag database of the Mk 82 General Purpose Low Drag bomb, the primary gravity weapon in the RAAF inventory, has some shortcomings in the quality and traceability of data, and in the variations due to configurational differences. Extensive testing of scaled models in a wind tunnel and an aeroballistic range facility have resulted in establishing estimates of the drag of a dean Mk 82 bomb as well as the incremental drag of add ons such as lugs and fuzes. These results, together with data obtained from full scale bomb drop trials, have been used to produce drag estimates for a full range of bomb configurations and release conditions. It is recommended that these data be incorporated into the mission computer of the weapon delivery system of the updated F111C aircraft. Furthermore it is recommended that the accuracy of these data be validated when the updated aircraft undergoes Ballistic Accuracy Verification flight trials.
Author
Bombs; Aerodynamics; Data Bases; Wind Tunnel Models; Ballistics; Gravitation

19970040120 NASA Ames Research Center, Moffett Field, CA USA

Aerothermal Performance Constraints for Small Radius Leading Edges Operating at Hypervelocity

Kolodziej, Paul, NASA Ames Research Center, USA; Bull, Jeffrey D., NASA Ames Research Center, USA; Milos, Frank S., NASA Ames Research Center, USA; Squire, Thomas H., Eloret Corp., USA; Proceedings of the Eighth Annual Thermal and Fluids Analysis Workshop: Spacecraft Analysis and Design; Sep. 1997, pp. 9.1-9.8; In English; Also announced as 19970040111 Contract(s)/Grant(s): NAS2-14031; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Small radius leading edges and nosetips were used to minimize wave drag in early hypervelocity vehicle concepts until further analysis demonstrated that extreme aerothermodynamic heating blunted the available thermal protection system materials. Recent studies indicate that ultra-high temperature composite (UHTC) materials are shape stable at temperatures approaching 3033 K and will be available for use as sharp leading edge components in the near future. Steady-state aerothermal performance constraints for UHTC components are presented in this paper to identify their non-ablating operational capability at altitudes from sea level to 90 km. An integrated design tool was developed to estimate these constraints. The tool couples aerothermodynamic heating with material response using commercial finite element analysis software and is capable of both steady-state and transient analysis. Performance during entry is analyzed by transient thermal analysis along the trajectory. The thermal load condition from the transient thermal analysis is used to estimate thermal stress. Applying the tool to UHTC materials shows that steady-state, non-ablating operation of a HfB2/SiC(A-7) (A-7) component is possible at velocities approaching Earth's circular orbital velocity of 7.9 km/s at altitudes approaching 70 km.

Author

Leading Edges; Aerothermodynamics; Mechanical Properties; Thermal Stresses; Thermal Protection; Thermal Analysis; Nose Tips; Finite Element Method

19970040124 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Stroemungsmechanik, Goettingen, Germany

The Effect of Catalycity on the Heating of the X-38 Shape

Brueck, S., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kordulla, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Eggers, T., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Orlowski, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Longo, J. M. A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Proceedings of the Eighth Annual Thermal and Fluids Analysis Workshop: Spacecraft Analysis and Design; Sep. 1997, pp. 13.1-13.6; In English; Also announced as 19970040111; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The flow past the X-38 vehicle is numerically investigated for the trajectory point at 73 km altitude. At this regime the total temperature and the present length scale allow dissociation and vibrational excitation of the molecules in the air mixture. The equilibrium assumption of these processes is sometimes sufficient for aerodynamic purposes. The heating prediction of this simplified model produces an upper limit of the possible heat loads. The results of nonequilibrium flow simulation point out the influence of catalycity on the heating of the X-38 shape. A significant reduction of the surface heating is found for the finite catalytic behavior in comparison to that one of a fully catalytic wall.

Author

X-38 Crew Return Vehicle; Heating; Trajectories; Simulation; Nonequilibrium Flow

19970040125 Moscow State Univ., Inst. of Mechanics, Russia

Heat Transfer and Shear Stress Prediction in 3D Hypersonic Flows by Approximate Methods

Brykina, Irina, Moscow State Univ., Russia; Sakharov, Vladimir, Moscow State Univ., Russia; Proceedings of the Eighth Annual Thermal and Fluids Analysis Workshop: Spacecraft Analysis and Design; Sep. 1997, pp. 14.1-14.12; In English; Also announced as 19970040111; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The effective method for solving 3D viscous super and hypersonic flows over blunted bodies is proposed. The method is based on combination of numerical algorithms for 2D equations and similarity method, which allows to obtain the solutions of 3D problems by calculating flows for equivalent axisymmetric bodies. Accuracy of the method is estimated by comparing heat flux and shear stress predictions, obtained with his help, with more accurate predictions, obtained from direct calculation of 3D governing equations set. The method is tested for various flow models: full and parabolized Navier-Stokes equations, viscous shock layer and boundary layer equations; for perfect gas and chemically reacting one; for different bodies and angles of attack. The approximate analytical solutions are obtained for heat flux to a surface relative to it's value at a stagnation point. The formulas for distribution of relative heat flux are obtained for infinite yawed wings, axisymmetric and 3D blunted bodies. Such formulas are obtained for various flow regimes. Accuracy of formulas is estimated by comparing with numerical solutions of corresponding 3D equa-

tions for boundary layer, hypersonic viscous shock layer and Navier-Stokes equations. Dependence of relative heat flux distribution on flow regime (altitude of flight), chemical reactions in a shock layer, wall catalytic properties is investigated.
Author
Heat Transfer; Shear Stress; Hypersonic Flow; Approximation; Algorithms; Axisymmetric Bodies; Accuracy; Navier-Stokes Equation; Mathematical Models; Boundary Layer Equations

19970040126 Moscow State Univ., Inst. of Mechanics, Russia
Hypersonic Viscous Gas Mixture Flow Over Blunt Bodies Using Chemical Partial Equilibrium Model
Sakharov, Vladimir, Moscow State Univ., Russia; Fateeva, Elena, Moscow State Univ., Russia; Proceedings of the Eighth Annual Thermal and Fluids Analysis Workshop: Spacecraft Analysis and Design; Sep. 1997, pp. 15.1-15.8; In English; Also announced as 19970040111; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Hypersonic gas mixture flows over blunt bodies are often accompanied by chemical reactions whose rates essentially differ. The model of chemical partial equilibrium has been developed for flow problems under these conditions. In this model the part of differential diffusion equations is degenerated into algebraic relations of detailed chemical equilibrium. The number of such equations is equal to the number of high-rate independent chemical reactions. The component formation sources on the right-hand sides of the remaining diffusion equations of new unknown functions ('slow' combinations of mass fractions) do not contain fast stages. It permits to overcome the stiffness problem. It has been demonstrated that the chemical partial equilibrium model is applicable for determination of the hypersonic flow fields over blunt bodies with a nose radius of approx. 1 m on parts of their reentry trajectories in the Earth's and Martian atmospheres.
Author
Viscous Flow; Blunt Bodies; Chemical Equilibrium; Flow Distribution; Differential Equations; Diffusion; Hypersonic Flow

19970040402 Institute of Sound and Vibration Research, Fluid Dynamics and Acustics Group, Southampton, UK
Shear Layer Refraction Corrections for Off-Axis Sources in Flight Simulation: Theoretical Analysis
Morfey, C. L., Institute of Sound and Vibration Research, UK; Oct. 1997; 35p; In English
Report No.(s): ISVR-TR-270; Copyright; Avail: Issuing Activity (Inst. of Sound and Vibration Research, Univ. of Southampton, Southampton SO17 1BJ, UK), Hardcopy, Microfiche

A set of equations is derived for converting acoustic measurements taken in a free-jet flight simulation facility, such as the UK Noise Test Facility at Pyestock or the French CEPR at Saclay, to equivalent far-field fight conditions. The equations are based on the high-frequency geometrical acoustics approximation, whose application in the present context was justified in detail by Morfey and Tester in 1977 and by Amiet in 1978. However, the present work departs from these earlier studies by allowing the source to be positioned off the jet centerline, anywhere within the flight stream. The flight stream jet is modelled as an axisymmetric parallel shear flow, with a shear layer thickness which is small compared with the jet diameter. The model permits the microphone to be located anywhere outside the flow, arbitrarily close to the open jet. By using the results of this report, shear-layer refraction corrections can be calculated for any combination of measurement point (outside the flow) and source point (inside the flow).
Author
Shear Layers; Flight Simulation; Acoustic Measurement; Geometrical Acoustics; Free Jets; Axisymmetric Flow; Refraction; Shear Flow

19970040458 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands
Evaluation of Elastomechanical and Aerodynamic Data Transfer Methods for Non-Planar Configurations in Computational Aeroelastic Analysis
Hounjet, M. H. L., National Aerospace Lab., Netherlands; Meijer, J. J., National Aerospace Lab., Netherlands; Jun. 14, 1995; 33p; In English; 1995 International Forum on Aeroelasticity and Structural Dynamics, 26-28 Jun. 1995, Manchester, UK; Figures in this document may not be legible in microfiche
Contract(s)/Grant(s): NIVR-01904N
Report No.(s): PB97-194831; NLR-TP-95690-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In aeroelastic (flutter) analyses information has to be exchanged between elastomechanical and unsteady aerodynamic simulation programs. The information concerns the structural deformation connected to the elastomechnical grid and the aerodynamic grid. As the aerodynamic and elastomechanical models are based on grids which have a different structure or have no structure at all, interpolation procedures (interfaces) need to be developed which transfer aerodynamic and elastomechanical data between the elastomechanical and aerodynamic surface grids. For aerodynamic configurations schematized by planar thin surface components, traditional methods like surface splines, isoparametric mappings, bicubic splines and/or polynomial techniques can be

applied in a satisfactory manner. For non-planar aerodynamics configurations being considerd by recent full body-modeling panel methods and CFD methods the need exists to develop new techniques. The present paper will discuss and demonstrate novel planar and non-planar interpolation techniques which have been recently put forward by NLR.
NTIS
Aeroelasticity; Unsteady Aerodynamics; Aerodynamic Configurations; Control Surfaces; Flutter Analysis; Computational Grids; Fighter Aircraft; Transonic Flow

19970040508 Institut Franco-Allemand de Recherches, Saint-Louis, France
Numerical and Experimental Investigations of Unsteady Flows under Deep Dynamic Stall Conditions
Geissler, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kompenhans, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Raffel, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Vollmers, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Wernert, P., Institut Franco-Allemand de Recherches, France; 1994; 22p; In English; 20th; European Rotorcraft Forum, 4-7 Oct. 1994, Amsterdam, Netherlands
Report No.(s): PB96-152939; ISL-PU-346/94; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

With increased advance ratios, the retreating blades of modern helicopters encounter flow environments with severe separation and vortex shedding which are known as deep dynamic stall conditions. For the numerical treatment of the problem, a time-accurate code based on the 2D-Navier-Stokes equations has been applied. The experimental investigation of the instantaneous flowfield was carried out by means of a Particle Image Velocimetry (PIV), in two different wind tunnel facilities: The low-speed wind tunnel of the German-French Institute, St.Louis (ISL) and the High Speed Wind Tunnel (HKG) of the DLR in Goettingen. For each wind tunnel, a test set-up for oscillating models has been constructed and used throughout the measurements. Numerical and experimental data obtained under nearly the same conditions are presented and compared.
NTIS
Aerodynamic Stalling; Navier-Stokes Equation; Particle Image Velocimetry; Wind Tunnel Tests; Computational Fluid Dynamics; Oscillating Flow; Boundary Layer Separation

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970037349 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
International Aviation: DOT's Efforts to Promote U.S. Air Cargo Carriers' Interests
Oct. 1996; 81p; In English
Report No.(s): PB97-199236; GAO/RCED-97-13; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In 1995, the value of U.S. exports and imports moving by air was $355 billion, accounting for 27 percent of all U.S. trade. U.S. all-cargo airlines carried about 60 percent of the freight hauled by U.S. airlines. But all-cargo airlines often face obstacles in operating abroad that lessen their efficiency and competitiveness. Concerned about the international interests of U.S. all-cargo airlines, the Chairman of the Senate Committee on Commerce, Science, and Transportation and the Chairman and Ranking Minority Member of its Subcommittee on Aviation asked GAO to address the following questions: What are the problems that all-cargo airlines face in doing business abroad, and what actions have the affected airlines and the U.S. government taken to resolve these problems; to what extent has the U.S. government addressed air cargo issues in policymaking and during bilateral aviation negotiations, and what are the possibilities for separating negotiations of air cargo services from broader negotiations that include passenger services. For this report, GAO surveyed the 26 U.S. airlines authorized by DOT and operating international all-cargo services as of September 1995. Twenty-two responded, including three major airlines, nine national airlines, and nine regional airlines. These airlines carried about 60 percent of the freight hauled by U.S. airlines in 1994.
NTIS
Congressional Reports; Air Cargo; International Trade; Civil Aviation

19970037539 Technische Univ., Delft, Netherlands
Ice Accretion during Flight
Snellen, M., Technische Univ., Netherlands; Dec. 1996; 100p; In English; Figures in this document may not be legible in microfiche
Report No.(s): PB97-193932; M-749; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A program that calculates ice accretion during flight has been developed. The second-order panel method 2DFOIL is used for the calculation of the flowfield. The method 2DFOIL-ICE calculates the droplet trajectories, needed in order to determine the amount of water impinging at different locations on the airfoil surface. The amount of ice that accretes on the airfoil is calculated by solving the heat- and mass-balances for small control volumes that are located on the airfoil surface. Results of 2DFOIL-ICE are compared with computational results found in the literature and with experimental data.
NTIS
Ice Formation; Airfoils; Panel Method (Fluid Dynamics); Impingement; Boundary Layer Flow; Deposition

19970037565 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
Systems and Techniques for Identifying and Avoiding Ice ***Final Report***
Hansman, R. John, Massachusetts Inst. of Tech., USA; Dec. 1995; 13p; In English
Contract(s)/Grant(s): NAGw-1761
Report No.(s): NASA/CR-97-205871; NAS 1.26:205871; ASL-95-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In-flight icing is one of the most difficult aviation weather hazards facing general aviation. Because most aircraft in the general aviation category are not certified for flight into known icing conditions, techniques for identifying and avoiding in-flight ice are important to maintain safety while increasing the utility and dispatch capability which is part of the AGATE vision. This report summarizes a brief study effort which: (1) Reviewed current ice identification, forecasting, and avoidance techniques; (2) Assessed feasibility of improved forecasting and ice avoidance procedures; and (3) Identified key issues for the development of improved capability with regard to in-flight icing.
Derived from text
Ice Formation; Ice; Identifying; Weather Forecasting; Flight Conditions; General Aviation Aircraft

19970037591 Vigyan Research Associates, Inc., Hampton, VA USA
Observed Changes in Atmospheric Boundary Layer Properties at Memphis International Airport During August 1995
Zak, J. Allen, Vigyan Research Associates, Inc., USA; Rodgers, William G., Jr., Lockheed Martin Engineering and Sciences Co., USA; Sep. 1997; 66p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 538-04-11-11
Report No.(s): NASA-CR-4786; NAS 1.26:4786; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As part of the NASA Terminal Area Productivity Program, Langley Research Center embarked on a series of field measurements of wake vortex characteristics and associated atmospheric boundary layer properties. One measurement period was at the Memphis International Airport in August 1995. Atmospheric temperature, humidity, winds, turbulence, radiation, and soil properties were measured from a variety of sensor systems and platforms including sodars, profilers, aircraft and towers. This research focused on: (1) changes that occurred in tower data during sunrise and sunset transitions, (2) vertical variation of temperature and cross-head winds at selected times utilizing combinations of sensors, and (3) changes measured by an OV-10 aircraft during approaches and level flights. Significant but not unusual changes are documented and discussed in terms of expected boundary layer behavior. Questions on measurement and prediction of these changes from existing and near-term capabilities are discussed in the context of a future Aircraft Vortex Spacing System.
Author
Vortices; Wakes; Atmospheric Boundary Layer; Atmospheric Temperature; Humidity; Wind Direction; Turbulence

19970040173 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Report to the Chairman, Subcommittee on Transportation and Related Agencies, Committee on Appropriations, House of Representatives. Aviation Acquisition: A Comprehensive Strategy Is Needed for Cultural Change at FAA
Aug. 1996; 70p; In English
Report No.(s): PB97-196216; GAO/RCED-96-159; B-265985; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the light of the steady growth in air traffic operations and the failures of aging equipment in the Air Traffic Control (ATC) system, the Federal Aviation Administration's (FAA) timely acquisition of new ATC equipment has become increasingly critical for aviation safety and efficiency. FAA estimates that it will need $13 billion over the next 7 years to continue its modernization program. However, persistent acquisitions problems raise questions about the agency's ability to field new equipment within cost, schedule, and performance parameters.
NTIS
Flight Safety; Management; Procurement Management; Congressional Reports

19970040219 Federal Aviation Administration, Washington, DC USA
Flight Management System: Air Traffic Management Next Generation (FANG) Operational Concept. FMS-ATM Next Generation (FANG) Team
Jul. 1997; 75p; In English
Report No.(s): PB97-199871; DOT/FAA/AND-97/7; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The document, a product of a Cooperative Research and Development Agreement (CRDA) between the Federal Aviation Administration (FAA) and The Boeing Company, presents the initial operational concept of an integrated Flight Management System (FMS) - Air Traffic Management (ATM) automation system. The concept envisions the next generation of FMS and ATM automation, and so is referred to as FMS-ATM Next Generation (FANG). Functional descriptions, potential benefits and the high-level functional capabilities required to implement 23 integrated services are described herein. All phases of flight and ground movement are evaluated. The FANG Operational Concept outlines a systems level approach to achieve gains in operating efficiency and overall system productivity while maintaining and enhancing flight safety and system integrity.
NTIS
Air Traffic Control; Flight Management Systems; Flight Safety

19970040531 Federal Aviation Administration, Aviation Security Human Factors, Atlantic City, NJ USA
Test and Evaluation Plan for X-ray 'Screener Assist Technologies' ***Final Report***
Barrientos, J. M., Federal Aviation Administration, USA; Fobes, J. L., Federal Aviation Administration, USA; Koo, L. Y., Federal Aviation Administration, USA; Jun. 1997; 41p; In English
Report No.(s): PB97-176465; DOT/FAA/AR-97/5; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Federal Aviation Regulations (FAR) Section 108 requires air carriers in the USA to provide for the safety and security of passengers and their property. to comply, air carriers procure equipment and trained personnel to screen passengers and their carry-on baggage before they board the aircraft. The evaluation will include the collection and analysis of empirical data on the automatic exposive detection capabilities of the X-ray equipment as well as the human factors issues involved in alarm resolution. Systems to be evaluated include the SAT developed by EG&G Astrophysics, Rapiscan Security Products, Vivid Technologies, Inc., and Heimann Systems.
NTIS
Airport Security; Explosives; X Ray Inspection; Baggage; Evaluation; Checkout

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970037322 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Video Landing Parameter Survey: John F. Kennedy International Airport ***Final Report***
Barnes, Terence, Naval Air Warfare Center, USA; Defore, Thomas, Federal Aviation Administration, USA; Micklos, Richard, Federal Aviation Administration, USA; Jul. 1997; 64p; In English
Report No.(s): PB97-201669; DOT/FAA/AR-96/125; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Federal Aviation Administration William J. Hughes Technical Center is conducting a series of video landing parameter surveys at high-capacity commercial airports to acquire a better understanding of typical contact conditions for a wide variety of aircraft and airports as they relate to current aircraft design criteria and practices. The initial parameter landing survey was conducted at John F. Kennedy (JFK) International Airport in June 1994. Four video cameras were temporarily installed along the north apron of runway 13L. Video images of 614 transport (242 wide-body, 264 narrow-body, and 108 commuter aircraft) were captured, analyzed, and the results presented. Landing parameters presented include sink rate; approach speed; touchdown pitch, roll, and yaw angles and rates; off-center distance; and the distance from the runway to the threshold. Wind and weather conditions were also recorded and land weights were available for most landings.
NTIS
Aircraft Landing; Approach; Runways; Video Data; Touchdown

19970037325 Corps of Engineers, Washington, DC USA
GPS for GIS Data Collection. USACE/NOAA Surveying, Mapping and Remote Sensing Conference, August 1997
Aug. 1997; 55p; In English; USACE/NOAA Surveying, Mapping and Remote Sensing Conference, Aug. 1997, Rockville, MD, USA
Report No.(s): PB97-202444; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Topics considered include: GPS for GIS Data Collection Workshop Slides; GPS Background; GIS Workflow; GPS/GIS Discussions (PLGR + 96 Federal Version; PLGR Field Evaluation; and Future Trends); GPS Evaluation - West Coast Test Site; Comparison of handheld receivers; A Field Evaluation of Precise Lightweight GPS Receiver (PLGR) Accuracy; and EC 1110-1-86 Use, Acquisition, and Security of Precise Positioning Service (PPS) GPS Receivers for Civil Applications.
NTIS
Geographic Information Systems; Global Positioning System; Surveys; Conferences

19970037473 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA
Evolution Toward a Decentralized Air Traffic Flow Management System ***Final Report, 28 Aug. 1995 - 30 Nov. 1996***
Kolitz, Stephan, Draper (Charles Stark) Lab., Inc., USA; Adams, Milton, Draper (Charles Stark) Lab., Inc., USA; Abramson, Mark, Draper (Charles Stark) Lab., Inc., USA; Nelson, Steven, Draper (Charles Stark) Lab., Inc., USA; Hall, William, Draper (Charles Stark) Lab., Inc., USA; Rifkin, Ryan, Draper (Charles Stark) Lab., Inc., USA; Nov. 30, 1996; 174p; In English
Contract(s)/Grant(s): NAS2-14283
Report No.(s): NASA/CR-97-205943; NAS 1.26:205943; CSDL-R-2767; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

There are three major components of the work reported here. The first is the development of alternative Air Traffic Flow Management (ATFM) concepts ranging from centralized to decentralized. The second is the development of metrics and tools to be employed in the analysis of alternative ATFM concepts that are in this range. The third is the application of these tools and metrics in the analysis of three ATFM operational concepts: passive, current, and collaborative. Passive refers to no ATFM and is used as a baseline; current is the currently employed approach to ATFM; and collaborative refers to a hypothesized ATFM concept that is more decentralized than current ATFM and is a concept in which the FAA allocates a set of arrival slots for each airline and each airline individually determines the assignment of each of its particular aircraft to each slot in its allocated set of slots. Two classes of capacity scenarios are used. The first is a case for which there is VMC throughout the system. The second represents the case of a weather front moving up the east coast, causing IMC for several hours (with uncertain start times) at key airports. Cases with and without en route free flight (User Preferred Routing) and CTAS are modeled. Appropriate metrics (e.g., delay, tardiness) for each of the operational and capacity scenarios have been calculated and are presented.
Author
Air Traffic Control; Airline Operations; Management Planning; Management Systems; Flow Distribution; Airports

19970037550 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
International GPS (Global Positioning System) Service for Geodynamics ***Annual Report, 1994***
Zumberge, J. F., Editor, Jet Propulsion Lab., California Inst. of Tech., USA; Liu, R., Editor, Jet Propulsion Lab., California Inst. of Tech., USA; Neilan, R. E., Editor, Jet Propulsion Lab., California Inst. of Tech., USA; Sep. 01, 1995; 340p; In English
Contract(s)/Grant(s): NAS7-1260; RTOP 465-23-03-21
Report No.(s): NASA/CR-97-112582; JPL-Publ-95-18; NAS 1.26:112582; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The International GPS (Global Positioning System) Service for Geodynamics (IGS) began formal operation on January 1, 1994. This first annual report is divided into sections, which mirror different aspects of the service. Section (1) contains general information, including the history of the IGS, its organization, and the global network of GPS tracking sites; (2) contains information on the Central Bureau Information System; (3) describes the International Earth Rotation Service (IERS); (4) details collecting and distributing IGS data in Data Center reports; (6) describes how the IGS Analysis Centers generate their products; (7) contains miscellaneous contributions from other organizations that share common interests with the IGS.
Author
Data Acquisition; Geodynamics; Global Positioning System; Information Systems; Information Transfer

19970040191 Army Research Lab., Information Science and Technology Directorate, Aberdeen Proving Ground, MD USA
A Modular System for Situational Awareness ***Final Report, 1 Oct. 1995 - 1 Apr. 1997***
Brundick, Frederick S., Army Research Lab., USA; Jul. 1997; 31p; In English
Report No.(s): AD-A328766; ARL-TR-1415; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a modular collection of applications that provide situational awareness using standard combat net radios. Communications bandwidth is limited, while computers continue to become more powerful. Global Positioning System (GPS) devices allow a unit to pinpoint its location and get the current time. In order to integrate this equipment, model-based battle command must be employed instead of traditional message-based techniques. A fully automated system is described that uses preplanned sequential objectives with information distribution technology (IDT) to determine the locations of friendly units.
DTIC
Global Positioning System; Information Systems; Bandwidth

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970036324 NASA Dryden Flight Research Center, Edwards, CA USA
In-Flight Transport Performance Optimization: An Experimental Flight Research Program and an Operational Scenario
Gilyard, Glenn, NASA Dryden Flight Research Center, USA; Oct. 1997; 20p; In English; 16th; AIAA Digital Avionics Systems Conference, 26-30 Oct. 1997, Irvine, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 522-15-34
Report No.(s): NASA/TM-97-206229; NAS 1.15:206229; H-2192; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A flight research program exploring the practical application of real-time performance optimization based on aircraft measurements and calculation of incremental drag from forced-response maneuvers is presented. The outboard ailerons of the L-1011 test bed aircraft were modified to provide for symmetric deflections to permit a recambering of the wing in that localized area, which in turn modifies the entire wing load distribution. The National Aeronautics and Space Administration developed an onboard research engineering test station from which the flight experiments are conducted and all analyses, both qualitative and quantitative, are performed in a real-time or near real-time manner. Initial flight test results are presented that indicate real-time drag minimization is attainable. An approach to an operational implementation of adaptive performance optimization on current and future commercial and military transports is discussed with the goal of keeping the required modifications simple and the pilot interface minimal and user friendly.
Author
L-1011 Aircraft; Flight Tests; Transport Vehicles; Wing Loading; Optimization; Ailerons; Real Time Operation; Aerodynamic Drag; Cambered Wings

19970037333 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Stress Analysis of an Interference Fit Life Extension Option for a Cold Expanded Elongated Fuel Flow Vent Hole on the F-111C Aircraft
Allan, R. B., Defence Science and Technology Organisation, Australia; Heller, M., Defence Science and Technology Organisation, Australia; Jun. 1997; 40p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-0549; AR-010-256; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P. O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This investigation has been undertaken as part of a program of work having the aim of determining a suitable fatigue life enhancement option for the non-circular fuel flow vent hole number 13 in the wing pivot fitting of the F-111C aircraft. Two types of stress analysis have been undertaken for a finite width rectangular plate of D6ac steel containing an elongated hole. Firstly, plate stress distributions due to interference fitting obtained from elastic two dimensional finite element analyses were compared to those measured experimentally using strain gauges and thermoelasticity. Secondly, two-dimensional elastic-plastic finite element analyses were undertaken to quantify the effect on critical plate stresses due to enhancement by combined cold expansion with interference fitting, in the presence of subsequent representative cold proof test loading and a sample spectrum loading. The predicted stresses for the elastic analysis cases agreed well with the experimental results, which also demonstrated the suitability of a proposed tapered plug/sleeve design to achieve effective interference fitting of an elongated hole. Overall, enhancement through combined cold expansion and interference fitting was considered to be significantly better than interference fitting alone. For example, the combined enhancement case, as compared to interference fitting only, led to a change in the critical hoop stress from 603 MPa, to -87 MPa. These favourable results indicate that such an enhancement procedure would potentially be suitable for

extending the fatigue life of the fuel flow vent hole number 13 region of the F-111C aircraft, pending the results of appropriate static and fatigue tests.
Author
Stress Analysis; Fuel Flow; Thermoelasticity; Stress Distribution; Vents; Interference Fit; Dimensional Analysis; Finite Element Method; Fatigue Tests; Holes (Mechanics); F-111 Aircraft

19970037562 Illinois Univ. at Urbana-Champaign, Dept. of Aeronautical and Astronautical Engineering, Urbana, IL USA
On-Line Modal State Monitoring of Slowly Time-Varying Structures
Johnson, Erik A., Illinois Univ. at Urbana-Champaign, USA; Bergman, Lawrence A., Illinois Univ. at Urbana-Champaign, USA; Voulgaris, Petros G., Illinois Univ. at Urbana-Champaign, USA; Oct. 1997; 186p; In English
Contract(s)/Grant(s): NAG2-4001; RTOP 529-50-04
Report No.(s): NASA-CR-198057; NAS 1.26:198057; H-2202; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Monitoring the dynamic response of structures is often performed for a variety of reasons. These reasons include condition-based maintenance, health monitoring, performance improvements, and control. In many cases the data analysis that is performed is part of a repetitive decision-making process, and in these cases the development of effective on-line monitoring schemes help to speed the decision-making process and reduce the risk of erroneous decisions. This report investigates the use of spatial modal filters for tracking the dynamics of slowly time-varying linear structures. The report includes an overview of modal filter theory followed by an overview of several structural system identification methods. Included in this discussion and comparison are H-infinity, eigensystem realization, and several time-domain least squares approaches. Finally, a two-stage adaptive on-line monitoring scheme is developed and evaluated.
Author
Dynamic Response; Monitors; Examination; Evaluation; Tracking Filters; Spatial Filtering

19970037651 National Aerospace Lab., Flight Div., Amsterdam, Netherlands
Historical Review of Two Helicopters Designed in the Netherlands
Vodegel, H. J. G. C., National Aerospace Lab., Netherlands; Jessurun, K. P., National Aerospace Lab., Netherlands; Sep. 27, 1995; 23p; In English; 21st; 21st European rotorcraft Forum, 30 Aug. - 1 Sep. 1995, St. Petersburg, Russia
Report No.(s): PB97-194526; NLR-TP-95455-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper gives a review of the two helicopters designed in the Netherlands. The Von Baumhauer helicopter from the 1920's featured for the first time in history a single main rotor for lift, a tail rotor for countering the main rotor torque and collective and cyclic blade pitch for height, pitch and roll control of the helicopter. These principles had been patented in various European countries. It seemed that da la Cierva had adopted this rotor control principle for his autogiros, and from thereon it was applied in almost all modern helicopters. Also, the now commonly used main-rotor/tail-rotor concepts stems from von Baumhauer's patent. The 2-seat 'Kolibrie' (Hummingbird) from the 1950's was a tip-driven ramjet helicopter with a maximum all-up weight of 700 kg. The helicopter featured a 9.95 m diameter 2-bladed main rotor and a 0.92 m diameter single bladed tail rotor. The machine application of this small helicopter was spraying and crop dusting. About 20 machines had been produced, of which about 12 ones have flown in 8 countries merely for agricultural purposes; the last one in Israel until the 1980's. Unfortunately, both projects ended due to financial reasons. In the Kolibrie case, the sales were lacking far behind the expectations.
NTIS
Helicopter Design; Case Histories; Helicopters

19970037663 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands
Adaption of 3D Single-Block Structured Grids Around Wings
Hagmeijer, R., National Aerospace Lab., Netherlands; Kok, J. C., National Aerospace Lab., Netherlands; Oskam, B., National Aerospace Lab., Netherlands; ECARP in the Vieweg series "Notes on Numerical Fluid Mechanics; Aug. 17, 1995; 29p; In English
Report No.(s): PB97-194427; NLR-TP-95402-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An extension of the 2D grid adaptation algorithm developed earlier is described. The two-dimensional modified anisotropic diffusion equations formulated in the parametric domain are extended into three dimensions. These uncoupled second order linear PDEs are solved for the new computational coordinates as functions of the parametric coordinates. This inverse adaption map is then numerically re-inverted. to account for the trailing edge alignment and grid continuity at face-to-face connections of a CO-

topology grid around a wing or wing-body configuration correction maps are defined. realistic applications to transonic wings are presented where the flow is described by the compressible Reynolds-averaged Navier-Stokes equations.
NTIS
Structured Grids (Mathematics); Body-Wing Configurations; Three Dimensional Models; Reynolds Averaging; Computational Fluid Dynamics; Navier-Stokes Equation

19970037686 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Use of Bonded Rubber Pads for the Application of Loads for Structural Testing of the P-3 Orion Leading Edge
VanBlaricum, T. J., Defence Science and Technology Organisation, Australia; Luke, G., Defence Science and Technology Organisation, Australia; Jan. 1997; 27p; In English
Report No.(s): DSTO-TR-0433; AR-009-912; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., P. O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Aerodynamic loads on aircraft lifting surfaces are often due to negative pressures acting on the outer skin of the structure. to simulate this type of loading, rubber pads bonded to the skin and loaded in tension can be used. This report describes the development of a contact adhesive based bonded rubber tension pad system for testing of an Orion P-3 wing leading edge.
Author
Aerodynamic Loads; Structural Analysis; Leading Edges; Loads (Forces)

19970037693 National Aerospace Lab., Amsterdam, Netherlands
Recent Experiences in Modelling the NLR Metro 2 Research Aircraft
Kannemans, H., National Aerospace Lab., Netherlands; Jan. 10, 1995; 25p; In English; CEAS Symposium on Simulation Technology ”Making it Real”, 30 Oct. - 1 Nov. 1995, Delft, Netherlands
Report No.(s): PB97-194534; NLR-TP-95457-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

To obtain a mathematical model of a turbo-prop aircraft, a number of flight test campaigns with the NLR Metro 2 research aircraft have been executed. During the flight tests, dynamic flight test techniques were intensively used. The analysis of the test data was done applying the NSM (Nonstationary Measurement) technique. Nowadays, there is an increasing demand to guarantee specified qualification standards for flight simulators.
NTIS
Mathematical Models; Turboprop Aircraft; Research Aircraft; Flight Tests

19970037713 Office National d’Etudes et de Recherches Aeronautiques, Paris, France
ONERA, Matra Develop Fast Low-Flying Air-to-Sea Missile
1997; 16p; In French; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This 15-page document presents a missile project carried out by engineers from ONERA (National Office for Aerospace Studies and Research) and Matra Defense between November 1995 and April 1996 aimed at developing a very-high speed low-altitude air-to-sea missile capable of replacing the French Exocet and Otomat tactical missiles. The document elaborates on the missile’s specifications, air-breathing propulsion system, size, ram-jet engine, its aerodynamic properties and trajectory performance, and guidance and control functions.
Derived from text
Aerodynamic Characteristics; Missiles; Air Breathing Engines; Trajectory Control; Jet Engines; Antiship Missiles

19970037714 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA
Design of a Vehicle Based Intervention System to Prevent Ozone Loss ***Final Report, 16 Aug. 1994 - 15 Aug. 1995***
Cole, Robin, Virginia Polytechnic Inst. and State Univ., USA; Fisher, Daniel, Virginia Polytechnic Inst. and State Univ., USA; Meade, Matt, Virginia Polytechnic Inst. and State Univ., USA; Neel, James, Virginia Polytechnic Inst. and State Univ., USA; Olson, Kristin, Virginia Polytechnic Inst. and State Univ., USA; Pittman, Andrew, Virginia Polytechnic Inst. and State Univ., USA; Valdivia, Anne, Virginia Polytechnic Inst. and State Univ., USA; Wibisono, Aria, Virginia Polytechnic Inst. and State Univ., USA; Mason, William H., Virginia Polytechnic Inst. and State Univ., USA; Kirschbaum, Nathan, Virginia Polytechnic Inst. and State Univ., USA; May 03, 1995; 111p; In English
Contract(s)/Grant(s): NAGw-4289
Report No.(s): NASA-CR-205553; NAS 1.26:205553; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This project was designed to be completed over a period of three years. Overall project goals were: (1) to understand the processes that contribute to stratospheric ozone loss; (2) to determine the best prevention scheme for loss; (3) to design a delivery

vehicle to accomplish the prevention scheme. The 1994-1995 design objectives included: (1) to review the results of the 1993-1994 design team, including a reevaluation of the major assumptions and criteria selected to choose a vehicle; (2) to evaluate preliminary vehicle concepts and perform quantitative trade studies to select the optimal vehicle concept.
Derived from text
Atmospheric Composition; Stratosphere; Ozone

19970040165 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Limited Sensitivity Study on Side-Thruster Guidance for an Extended Range MLRS-Type Vehicle
Maree, A. G. M., Prins Maurits Lab. TNO, Netherlands; Keus, L. J., Prins Maurits Lab. TNO, Netherlands; Gadiot, G. M. H. J. L., Prins Maurits Lab. TNO, Netherlands; Aug. 1997; 15p; In English; Original contains color illustrations
Contract(s)/Grant(s): A95/KL/410
Report No.(s): TD97-0036; PML-1997-A36; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., PO Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

The 30 km range of an MLRS-type vehicle has been improved to 60 km, by increasing the velocity at burn-out. to keep the accuracy at impact at the same level as for the 30 km range, the upgraded missile is guided with side thrusters. to prevent jamming of the signal, guidance takes place only up to the time of apogee for it is assumed that jamming will occur when the missile is approaching the target. to obtain a first impression of the required total impulse of side thruster firings, a disturbance case with errors in the burn-out state is used as a reference. For this case a missile with a range of 30 km has an impact just inside an assumed accuracy range of +/- 50 m in cross- and down-range around the nominal ballistic point of impact. The upgraded MLRS-like missile could be guided such that the accuracy at impact was similar to that of the 30 km range reference vehicle. For achieving this, a total impulse of 300 - 500 Ns was required. Since these values are realistic for small side thrusters, it is recommended to do more in-depth studies on this topic in the near future.
Author
Missiles; Terminal Ballistics; Point Impact; Downrange; Jamming; Burnout; Apogees

19970040446 Sikorsky Aircraft, Stratford, CT USA
Test Results of the RAH-66 Main Rotor Ballistically Damaged Flexbeam
McCann, M., Sikorsky Aircraft, USA; Aug. 04, 1997; 32p; In English
Contract(s)/Grant(s): DAAJ02-97-M-0001
Report No.(s): AD-A329229; ETR-924; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The AATD supplied, ballistically damaged, RAH-66 main rotor blade flexbeam was tested in fatigue to demonstrate fly home capability. The testing was conducted in the Bearingless Main Rotor test facility, and consisted of loads representative of 45 degree AOB turns at vibratory test loads including flatwise, chordwise and torsional moments, centrifugal load and snubber/damper loads. The requirement was to demonstrate 30 minutes capability. The results demonstrated a total of 90 minute flight capability of the ballistically damaged flexbeam, thus exceeding the 30 minute fly home capability requirement.
DTIC
Rotary Wings; Fatigue Tests; Vibratory Loads; Rotor Blades; Flight Tests; Helicopter Performance

19970040469 National Aerospace Lab., Amsterdam, Netherlands
Outline and Applications of a Semi-Empirical Method for Predicting Transonic Limit Cycle Oscillation Characteristics of Fighter Aircraft
Meijer, J. J., National Aerospace Lab., Netherlands; Cunningham, A. M., National Aerospace Lab., Netherlands; Jun. 14, 1995; 24p; In English; International Forum on Aeroelasticity and Structural Dynamics, 26-28 Jun. 1995, Manchester, UK
Report No.(s): PB97-191936; NLR-TP-95308-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An analysis of steady wind tunnel data, obtained for a fighter type aircraft, has indicated that shock-induced and trailing-edge separation play a dominant role in the development of Limit Cycle Oscillations (LCO) at transonic speeds. On the basis of these data a semi-empirical LCO prediction method was developed. Its preliminary version has been applied to several configurations and has correctly identified those which have encountered LCO. It has already shown the potential for application early in the design process of new aircraft to determine and understand the non-linear aeroelastic characteristics. In the present paper this method is upgraded on the basis of results of unsteady wind tunnel force and pressure measurements obtained from on oscillating fighter type wings.
NTIS
Fighter Aircraft; Aeroelasticity; Wind Tunnel Tests; Pressure Measurement

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19970036457 NERAC, Inc., Tolland, CT USA
Head Up Displays: Latest citations from the NTIS Bibliographic Database
Jun. 1997; 6p; In English; Supersedes PB96-867031
Report No.(s): PB97-861645; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning the design, fabrication, and applications of head up displays (HUDs). Applications include military aircraft, helicopters, space shuttle, and commercial aircraft. Functions of the display include instrument approach, target tracking, and navigation. The head up display provides for an integrated avionics system with the pilot in the loop.
NTIS
Display Devices; Navigation; Instrument Approach; Commercial Aircraft

19970037430 McDonnell-Douglas Aerospace, Saint Louis, MO USA
Optical Closed-Loop Flight Control Demonstration. Fly-by-Light Aircraft Closed Loop Test (FACT) Program and Fly-by-Light Installation and Test (FIT) Program ***Final Report***
Kessler, Bradley L., McDonnell-Douglas Aerospace, USA; Wanamaker, Michael F., McDonnell-Douglas Aerospace, USA; Aug. 1997; 92p; In English
Contract(s)/Grant(s): NAS3-25965; RTOP 538-01-15
Report No.(s): NASA-CR-204139; NAS 1.26:204139; E-10860; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The optical closed-loop flight control demonstration consists of two independent programs. The objective of the Fly-By-Light Aircraft Closed-Loop Test (FACT) program is to demonstrate in-flight optical closed-loop control equivalent to a production Fly-By-Wire system for a rudder control surface. The FACT system has been designed, developed, and tested and is a robust system ready for flight tests on NASA-Dryden's F/A-18 Systems Research Aircraft. The FACT program was sponsored by NASA-Lewis Research Center and developed by McDonnell Douglas. The FACT architecture inserts electro-optic avionics between the flight control computer and a rudder actuator modified with an optic sensor. Tbc avionics transmits optic command signals for the actuator, determines actuator position by decoding the optic sensor, and provides error monitoring. Several tests verified the system's readiness for flight test. Component tests verified proper operation of each low-level function. Vibration, temperature and altitude, and electromagnetic compatibility tests verified the system can survive the military aircraft environment. System tests verified FACT system performance was equivalent to production system performance. This final report describes the FACT system architecture, development, and test up to delivery to NASA-Dryden. Also described is the Fly-By-Light Installation and Test (FIT) program that investigated optic fiber installation, repair, and signal quality.
Author
Flight Control; Fly by Light Control; Fly by Wire Control; Optical Control; Electro-Optics; Flight Tests

19970037436 Norwegian Defence Research Establishment, Kjeller, Norway
System for Helicopter Based Image Recording ***System for Helikopterbaserte Bildeopptak: Systembeskrivelse og Brukerveiledning***
Hoimyr, Tor, Norwegian Defence Research Establishment, Norway; Ostevold, Einar, Norwegian Defence Research Establishment, Norway; Stromman, Eivind, Norwegian Defence Research Establishment, Norway; Jul. 12, 1997; 38p; In Norwegian
Report No.(s): FFI/RAPPORT-97/03369; ISBN-82-464-0193-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a system for airborne video recordings of ground targets in the thermal and visual spectral band. The system is constructed for use in a Bell 412 helicopter. The components of the system and the mounting/dismounting of the cameras in the helicopter are described in detail. A user guide is included. Comments on the performance of the system and its operation are given.
Author
Helicopters; Video Equipment; Cameras; Infrared Imagery; Mounting; Bell Aircraft

19970037668 Brookhaven National Lab., Upton, NY USA
Polyplanar optical display electronics
DeSanto, L., Brookhaven National Lab., USA; Biscardi, C., Brookhaven National Lab., USA; [1997]; 12p; In English; SPIE International Conference, 21-25 Apr. 1997, Orlando, FL, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64332; CONF-970465-20; DE97-006737; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Polyplanar Optical Display (POD) is a unique display screen which can be used with any projection source. The prototype ten inch display is two inches thick and has a matte black face which allows for high contrast images. The prototype being developed is a form, fit and functional replacement display for the B-52 aircraft which uses a monochrome ten-inch display. In order to achieve a long lifetime, the new display uses a 100 milliwatt green solid-state laser (10,000 hr. life) at 532 nm as its light source. to produce real-time video, the laser light is being modulated by a Digital Light Processing (DLP(trademark)) chip manufactured by Texas Instruments. In order to use the solid-state laser as the light source and also fit within the constraints of the B-52 display, the Digital Micromirror Device (DMD(trademark)) circuit board is removed from the Texas Instruments DLP light engine assembly. Due to the compact architecture of the projection system within the display chassis, the DMD(trademark) chip is operated remotely from the Texas Instruments circuit board. The authors discuss the operation of the DMD(trademark) divorced from the light engine and the interfacing of the DMD(trademark) board with various video formats (CVBS, Y/C or S-video and RGB) including the format specific to the B-52 aircraft. A brief discussion of the electronics required to drive the laser is also presented. DOE

Solid State Lasers; Pods (External Stores); Light Beams; Image Contrast; Display Devices

19970040195 Brookhaven National Lab., Upton, NY USA
Polyplanar optic display
Veligdan, J., Brookhaven National Lab., USA; Biscardi, C., Brookhaven National Lab., USA; Brewster, C., Brookhaven National Lab., USA; DeSanto, L., Brookhaven National Lab., USA; Beiser, L., Beiser (Leo), Inc., USA; [1997]; 12p; In English; SPIE International Conference, 21-25 Apr. 1997, Orlando, FL, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64357; CONF-970465-21; DE97-006736; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Polyplanar Optical Display (POD) is a unique display screen which can be used with any projection source. This display screen is 2 inches thick and has a matte black face which allows for high contrast images. The prototype being developed is a form, fit and functional replacement display for the B-52 aircraft which uses a monochrome ten-inch display. The new display uses a 100 milliwatt green solid state laser (532 nm) as its optical source. In order to produce real-time video, the laser light is being modulated by a Digital Light Processing (DLP(trademark)) chip manufactured by Texas Instruments, Inc. A variable astigmatic focusing system is used to produce a stigmatic image on the viewing face of the POD. In addition to the optical design, the authors discuss the electronic interfacing to the DLP(trademark) chip, the opto-mechanical design and viewing angle characteristics. DOE

Pods (External Stores); Real Time Operation; Solid State Lasers; Mechanical Devices; Design Analysis

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.

19970036307 NASA Lewis Research Center, Cleveland, OH USA
Blockage Development in a Transonic, Axial Compressor Rotor
Suder, Kenneth L., NASA Lewis Research Center, USA; Aug. 1997; 18p; In English; Turbo-Expo 1997, 2-5 Jun. 1997, Orlando, FL, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 523-26-33
Report No.(s): NASA-TM-113115; NAS 1.15:113115; E-10873; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A detailed experimental investigation to understand and quantify the development of blockage in the flow field of a transonic, axial flow compressor rotor (NASA Rotor 37) has been undertaken. Detailed laser anemometer measurements were acquired upstream, within, and downstream of a transonic, axial compressor rotor operating at 100%, 85%, 80% and 60% of design speed which provided inlet relative Mach numbers at the blade tip of 1.48, 1.26, 1.18, and 0.89 respectively. The impact of the shock on the blockage development, pertaining to both the shock/boundary layer interactions and the shock/tip clearance flow interactions, is discussed. The results indicate that for this rotor the blockage in the endwall region is 2-3 times that of the core flow region,

and the blockage in the core flow region more than doubles when the shock strength is sufficient to separate the suction surface boundary layer.
Author
Transonic Compressors; Compressor Rotors; Flow Characteristics; Laser Anemometers; Transonic Flow; Blocking; Shock Wave Interaction

19970037477 NERAC, Inc., Tolland, CT USA
Helicopter Engines. (Latest citations from the NTIS Bibliographic Database)
May 1997; In English; Page count unavailable; Supersedes PB96-860366
Report No.(s): PB97-859706; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
The bibliography contains citations concerning gas turbine engine design and performance in helicopter airframes. Citations discuss engine performance evaluations, engine vibrational fatigue, climatic influence, engine innovations, models and safety design, and engine-airframe compatibility. Military flight tests are included. (Contains 50-250 citations and includes a subject term index and title list.)
NTIS
Gas Turbine Engines; Helicopters; Engine Design; Bibliographies

19970037598 NASA Lewis Research Center, Cleveland, OH USA
Effects of Stator Indexing on Performance in a Low Speed Multistage Axial Compressor
Barankiewicz, Wendy S., NASA Lewis Research Center, USA; Hathaway, Michael D., Army Research Lab., USA; Aug. 1997; 14p; In English; Turbo-Expo 1997, 2-5 Jun. 1997, Orlando, FL, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 523-22-13; DA Proj. 1L1-61102-AH-45
Report No.(s): NASA-TM-113113; NAS 1.15:113113; E-10870; ARL-MR-370; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The results of an experimental investigation to determine the impact of stator row indexing or clocking on multistage axial compressor performance are presented. Testing was conducted in the NASA Lewis Research Center's Four-Stage Axial Compressor Facility. The impact of stator row indexing on both the overall and stator 3 blade element performance is presented for both the peak efficiency and peak pressure operating conditions. The change in overall performance due to stator indexing is 0.2% for both operating conditions. Indexing resulted in a 5% change in stator 3 mass averaged loss coefficient at the peak efficiency condition and a 10% change at the peak pressure condition. Since the mass-averaged stator 3 loss coefficient is on the order of 7%, the changes in loss coefficient due to indexing are on the order of O.35-0.7%. These changes are considered to be small and are of the same order of magnitude as the passage-to-passage differences in loss coefficient due to manufacturing and assembly tolerances in the test compressor. The effects of stator-stator wake interactions are also shown and indicate that for rows with unequal blade counts it may be necessary to survey across more than one blade row pitch for accurate blade row performance measurements.
Derived from text
Stators; Turbocompressors; Low Speed; Losses; Stator Blades

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19970036153 Lockheed Martin Engineering and Sciences Co., Langley Program Office, Hampton, VA USA
Pilot Evaluation Comments During Selected Maneuvers from Flight Tests of the HARV NASA-1A Control Law
Yeager, Jessie C., Lockheed Martin Engineering and Sciences Co., USA; Aug. 1997; 66p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 522-21-31-01
Report No.(s): NASA-CR-201743; NAS 1.26:201743; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Under the NASA High-Alpha Technology Program the High-Alpha Research Vehicle (HARV) was used to conduct flight tests of advanced control effectors, advanced control laws, and high-alpha design guidelines for future super-maneuverable fighters. The HARV is a pre-production F/A-18 airplane modified with a multi-axis thrust-vectoring system for augmented pitch and yaw control power. Handling-Qualities flight testing at the Dryden Flight Research Center (DFRC) for the NASA-1A Control Law was conducted in the spring of 1994. Pilot comments during actual flight test maneuvers and following the maneuvers will

be useful in evaluation of control law performance. Audio files containing pilot comments were retrieved from the DFRC data system and stored on the Dynamics and Control Branch (DCB) computer complex at NASA Langley Research Center (LaRC), and pilot comments were transcribed for use as a control law evaluation tool. This report briefly describes the multi-step task used to transcribe these comments and presents transcriptions of actual pilot communications for selected maneuvers using the NASA-1A control law. Documentation includes flight information, maneuver information, time intervals for which comments were retrieved, pilot comments, and pilot Cooper-Harper ratings.
Author
Flight Control; Maneuverability; Flight Tests; Aircraft Control; Controllability

19970036304 NASA Ames Research Center, Moffett Field, CA USA
Revised Simulation Model of the Control System, Displays, and Propulsion System for a ASTOVL Lift Fan Aircraft
Franklin, James A., NASA Ames Research Center, USA; Oct. 1997; 70p; In English
Contract(s)/Grant(s): RTOP 581-50-22
Report No.(s): NASA-TM-112208; NAS 1.15:112208; A-977189; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report describes revisions to a simulation model that was developed for use in piloted evaluations of takeoff, transition, hover, and landing characteristics of an advanced short takeoff and vertical landing lift fan fighter aircraft. These revisions have been made to the flight/propulsion control system, head-up display, and propulsion system to reflect recent flight and simulation experience with short takeoff and vertical landing operations. They include nonlinear inverse control laws in all axes (eliminating earlier versions with state rate feedback), throttle scaling laws for flightpath and thrust command, control selector commands apportioned based on relative effectiveness of the individual controls, lateral guidance algorithms that provide more flexibility for terminal area operations, and a simpler representation of the propulsion system. The model includes modes tailored to the phases of the aircraft's operation, with several response types which are coupled to the aircraft's aerodynamic and propulsion system effectors through a control selector tailored to the propulsion system. Head-up display modes for approach and hover are integrated with the corresponding control modes. Propulsion system components modeled include a remote lift fan and a lift-cruise engine. Their static performance and dynamic responses are represented by the model. A separate report describes the subsonic, power-off aerodynamics and jet induced aerodynamics in hover and forward flight, including ground effects.
Author
Flight Characteristics; Flight Simulation; Command and Control; Propulsion; Control Theory; Aerodynamic Characteristics; Lift Fans; Fighter Aircraft; Head-Up Displays; Vertical Landing; Takeoff; Hovering; Control Equipment; Display Devices

19970037518 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands
Parametric Identification of Transonic Unsteady Flow Characteristics for Predicting Flutter of Fighter Aircraft with External Stores
Meijer, J. J., National Aerospace Lab., Netherlands; Cunningham, A. M., National Aerospace Lab., Netherlands; May 18, 1995; 23p; In English; FDP Symposium on Aerodynamics of Store Integration and Separation, 24-27 Apr. 1995, Ankara, Turkey; Figures in this document may not be legible in microfiche
Report No.(s): PB97-193254; NLR-TP-95245-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
An analysis of steady wind tunnel data, obtained for a fighter type aircraft, has indicated that shock-induced and trailing-edge separation play a dominant role in the development of Limit Cycle Oscillations (LCO) at transonic speeds. On the basis of these data a semi-empirical LCO prediction method was developed. Its preliminary version has been applied to several configurations and has correctly identified those which have encountered LCO. It has already shown the potential for application early in the design process of new aircraft to determine and understand the nonlinear aeroelastic characteristics. In the present paper the method is upgraded on the basis of results of unsteady wind tunnel force and pressure measurements obtained from on oscillating fighter type wings.
NTIS
Unsteady Flow; Transonic Flow; Flutter; Aeroelasticity; Oscillating Flow; Transonic Speed

19970037547 NASA Dryden Flight Research Center, Edwards, CA USA
A Presentation on Robust Flutter Margin Analysis and a Flutterometer
Lind, Rick C., NASA Dryden Flight Research Center, USA; Oct. 1997; 64p; In English, 9 Sep. 1997, Seattle, WA, USA
Contract(s)/Grant(s): RTOP 529-31-14
Report No.(s): NASA/TM-97-206220; NAS 1.15:206220; H-2208; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper documents an invited presentation given to The Boeing Company, Seattle, Washington, on September 9, 1997. The audience consisted of structural dynamic and flight test engineers from the Boeing Commercial Airplane Group who were interested in discussing research which may be applied to future flight flutter test programs. A method to compute robust flutter margins is described which is a significant departure from traditional methods. This method uses the structured singular value, mu, to compute a flutter margin which directly accounts for modeling errors such that a worst-case flutter margin is computed with respect to those errors. This method may be applied in several ways. A post-flight application uses data sets from multiple test points to compute worst-case flutter margins and a worst-case flight envelope. An on-line implementation computes flutter margins at each test point to track the flutter margins during a flight test. This on-line implementation is the basis for a flutterometer flight test tool that displays the distance to flutter at a given test point. Such a tool was not previously possible using traditional flutter flight test analysis methods. The F/A-18 System Research Aircraft was used to demonstrate these applications using flight data recorded from test points throughout the flight envelope.
Derived from text
Flutter Analysis; Flight Tests; Dynamic Tests; Error Analysis; Flight Envelopes; Flutter; Commercial Aircraft

19970037798 NERAC, Inc., Tolland, CT USA
Autopilots: Marine Applications. (Latest citations from the INSPEC Database)
May 1997; In English; Page count unavailable; Supersedes PB96-860218
Report No.(s): PB97-859458; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
The bibliography contains citations concerning autopilots used on marine vessels. The citations explore a variety of autopilot systems including noise adaptive, digital, linear quadratic Gaussian, self tuning regulators, and those that incorporate automatic guidance and collision avoidance capabilities. Autopilots that provide rudder roll stabilization, yaw, and fuel savings are also described. Cost considerations of autopilot systems are briefly considered. (Contains 50-250 citations and includes a subject term index and title list.)
NTIS
Bibliographies; Marine Technology; Automatic Pilots; Navigation Aids

19970040278 Wright Lab., Flight Dynamics Directorate, Wright-Patterson AFB, OH USA
Tailless Aircraft Control Allocation *Final Report, 1-31 May 1997*
Buffington, James M., Wright Lab., USA; May 1997; 12p; In English
Report No.(s): AD-A327799; WL-TM-97-3060; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents a fight controller for tail-less aircraft with large suite of conventional and unconventional control effector. The controller structure module to take advantages of individual technologies from the no of plant parameter estimation, control, and robust feedback. Line models generated off-line provide plant parameter estimates for control.
DTIC
Tailless Aircraft; Feedback Control; Aircraft Control

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970037649 National Aerospace Lab., Flight Div., Amsterdam, Netherlands
Initial Results of a Piloted Simulator Investigation of Modern Windshear Detection Systems
Haverdings, H., National Aerospace Lab., Netherlands; Rouwhorst, W. F. J. A., National Aerospace Lab., Netherlands; Oct. 25, 1995; 21p; In English; ICAS 1994 Congress/AIAA System Conference, 18-23 Sep. 1994, Anaheim, CA, USA
Report No.(s): PB97-194575; NLR-TP-95519-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
A preliminary investigation has been carried out on the NLR Research Flight Simulator (RFS) concerning several aspects involving the use of modern windshear detection systems during landing approaches. Three windshear detection systems were evaluated together with three flight procedures. The systems evaluated were a reactive windshear detection system, a LIght Detec-

tion And Ranging (LIDAR) forward-looking windshear detection system, and a ground-based Terminal Doppler Weather Radar (TDWR) system. With the latter a simulated data-uplink connection to the aircraft cockpit was used.
NTIS
Airborne Radar; Warning Systems; Wind Shear; Flight Simulators; Radar Detection

19970037834 Defence Science and Technology Organisation, Weapons Systems Div., Melbourne, Australia
A User Manual for the Harpoon Shipboard Simulator
McFarlane, Jason, Defence Science and Technology Organisation, Australia; Nov. 1996; 42p; In English
Report No.(s): AD-A327797; DODA-AR-010-144; DSTO-GD-0128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper includes the the topic of harpoon shipboard simulations.
Derived from text
Simulation; Simulators

19970040180 National Aerospace Lab., Aerodynamics Div., Amsterdam, Netherlands
Flow Reference System: An Air Data System for Windtunnels
Juanarena, D. B., National Aerospace Lab., Netherlands; Klaser, H. N., National Aerospace Lab., Netherlands; Fuykschot, P. H., National Aerospace Lab., Netherlands; Aug. 12, 1995; 18p; In English; International Congress on Instrumentation in Aerospace Simulation Facilities, 18-21 Jul. 1995, Wright-Patterson AFB, OH, USA
Report No.(s): PB97-194484; NLR-TP-95414-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The paper describes an integrated system specifically developed for establishing the elementary flow quantities Total Pressure (P2), Static Pressure (Ps), and Total Temperature (Tt) in a wind-tunnel environment with the highest presently attainable accuracy. These quantities are required for calculating quintessential aerodynamic parameters like Mach number (MA), Dynamic Pressure (Q), Reynolds number (Re), and Flow Velocity (V). Up to four extremely accurate (0.015% Full Scale) absolute or differential Pressure Sensing Units can be accommodated on a plug-in basis in this 'Flow Reference System.' Temperature measurement is based on the use of a Platinum 100 ohm RTD sensor; accuracy of signal conditioning and linearization are better than 0.05 over a range of -200 to +100 deg C. Data output for pressures and temperature is in fully corrected Engineering Units over two independent output links at high sampling rate of 10 Hz. A status word output alloys an effective monitoring of system integrity.
NTIS
Wind Tunnel Apparatus; Cryogenic Wind Tunnels; Measuring Instruments; Air Data Systems

19970040418 Institute for Human Factors TNO, Soesterberg, Netherlands
Considerations to the Acquisition of a Training Device for a New EOV-Installation for the Walrus Class of Submarines *Interim Report Overwegingen bij aanschaf van een trainingsmiddel ten behoeve van nieuw EOV systeem voor de Walrus klasse*
Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; Aug. 06, 1997; 12p; In Dutch
Contract(s)/Grant(s): A97/KM/318
Report No.(s): TD97-0232; TM-97-A053; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands), Hardcopy, Microfiche

The Royal Netherlands Navy is in the process of acquiring a new EOV-installation for the Walrus-class of submarines. For the training of both operators and maintainers, a training device has to be acquired as well. The main research question is whether such a training device should be physically and functionally identical to the real system, or that an alternative configuration may be sufficient to meet the training needs. If so, what are the advantages and disadvantages of this alternative configuration, as well as technological and financial risks involved. The TNO Human Factors Research Institute has been asked to carry out this research, as an example of a broader research study carried out by TNO HFRI into the specification of training devices. On the basis of a global task analysis, a comparison between the existing system and the system to be acquired, different configurations of training devices are compared. It is concluded that a training device which is physically and functionally identical to the real system will meet the training needs well. A specific simulator will possibly satisfy, but this is dependent upon the degree in which an adequate simulation, including built-in-test equipment can be developed in a controlled manner.
Author
Training Devices; Human Factors Engineering; Education; Simulators; Risk

19970040480 Galaxy Scientific Corp., Egg Harbor Township, NJ USA

Evaluation of Airfield Lighting Circuit Performance

Lean, Shay, Galaxy Scientific Corp., USA; Jul. 1997; 78p; In English

Report No.(s): AD-A328992; DOT/FAA/AR-96/120; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

New requirements for airfield guidance signs have necessitated replacement and purchase of a large number of airfield signs. In the process manufacturers have developed new designs for airfield signs using current technology for the illumination and control. However, as the new signs are placed into service, airports are experiencing problems with the performance of the signs. In order to determine the scope and to investigate these problems, the Federal Aviation Administration (FAA) conducted an evaluation at six different airports. The evaluations showed that the source of the electrical problems was the incompatibility between the signs and the constant current regulators. The report provides recommendations to improve the operation of airfield lighting circuits.

DTIC

Lighting Equipment; Current Regulators; Landing Sites; Airports

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19970037712 NASA Marshall Space Flight Center, Huntsville, AL USA

Design of Launch Vehicle Flight Control Augmentors and Resulting Flight Stability and Control (Center Director's Discretionary Fund Project 93-05, Part III)

Barret, C., NASA Marshall Space Flight Center, USA; Aug. 1997; 76p; In English

Report No.(s): NASA-TP-3704; NAS 1.60:3704; M-839; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This publication presents the control requirements, the details of the designed Flight Control Augmentor's (FCA's), the static stability and dynamic stability wind tunnel test programs, the static stability and control analyses, the dynamic stability characteristics of the experimental Launch Vehicle (LV) with the designed FCA's, and a consideration of the elastic vehicle. Dramatic improvements in flight stability have been realized with all the FCA designs; these ranged from 41 percent to 72 percent achieved by the blunt TE design. The control analysis showed that control increased 110 percent with only 3 degrees of FCA deflection. The dynamic stability results showed improvements with all FCA designs tested at all Mach numbers tested. The blunt TE FCA's had the best overall dynamic stability results. Since the lowest elastic vehicle frequency must be well separated from that of the control system, the significant frequencies and modes of vibration have been identified, and the response spectra compared for the experimental LV in both the conventional and the aft cg configuration. Although the dynamic response was 150 percent greater in the aft cg configuration, the lowest bending mode frequency decreased by only 2.8 percent.

Author

Design Analysis; Launch Vehicles; Augmentation; Flight Control; Stability Tests

19970039325

Launching tactically configured solid armature projectiles from large and medium calibre railguns - results from the DRA test programme

Kirkpatrick, Doug, Guns Dep, UK; Haugh, David; IEEE Transactions on Magnetics; January 1997; ISSN 0018-9464; vol. 33, no. 1, pt. 1, pp. 109-114; In English; Copyright; Avail: Issuing Activity

One of the main thrusts of the UK EM gun programme is to prove the feasibility of accurate hypervelocity flight of projectiles launched from an EM gun. Several notable successes have been achieved in pursuit of this goal. to date DRA has carried out almost 70 large and medium calibre solid armature experiments using 40 mm and 90 mm round bore railguns. With one or two exceptions all firings have employed monolithic aluminum alloy armatures, the majority in base-push configuration. So far, approximately half of the shots have been full tactical packages with discarding sabots and long rod sub-projectiles flown over range. This paper presents results from these tactical package firings and observations on armature performance based on analysis of shot data and recovered specimens. Other gun issues that may be important to any future implementation of EML technology in a weapons system are also discussed.

Author (EI)

Hypersonic Flight; Launching; Projectiles; Rails

19970040121 NASA Johnson Space Center, Houston, TX USA

Spacecraft Orbital Debris Reentry: Aerothermal Analysis

Rochelle, Wm. C., Lockheed Martin Corp., USA; Kinsey, Robin E., Lockheed Martin Corp., USA; Reid, Ethan A., Lockheed Martin Corp., USA; Reynolds, Robert C., Lockheed Martin Corp., USA; Johnson, Nicholas L., NASA Johnson Space Center, USA; Proceedings of the Eighth Annual Thermal and Fluids Analysis Workshop: Spacecraft Analysis and Design; Sep. 1997, pp. 10.1-10.14; In English; Also announced as 19970040111; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

In the past 40 years, thousands of objects have been placed in Earth orbit and are being tracked. Space hardware reentry survivability must be evaluated to assess risks to human life and property on the ground. The objective of this paper is to present results of a study to determine altitude of demise (burn-up) or survivability of reentering objects. Two NASA/JSC computer codes - Object Reentry Survival Analysis Tool (ORSAT) and Miniature ORSAT (MORSAT) were used to determine trajectories, aerodynamic aerothermal environment, and thermal response of selected spacecraft components. The methodology of the two codes is presented, along with results of a parametric study of reentering objects modeled as spheres and cylinders. Parameters varied included mass, diameter, wall thickness, ballistic coefficient, length, type of material, and mode of tumbling/spinning. Two fragments of a spent Delta second stage undergoing orbital decay, stainless steel cylindrical propellant tank and titanium pressurization sphere, were evaluated with ORSAT and found to survive entry, as did the actual objects. Also, orbital decay reentry predictions of the Japanese Advanced Earth Observing Satellite (ADEOS) aluminum and nickel box-type components and the Russian COSMOS 954 satellite beryllium cylinders were made with MORSAT. These objects were also shown to survive reentry.
Author

Aerothermodynamics; Earth Orbits; Spacecraft Reentry; Space Debris; Risk; Spacecraft Components; Temperature Effects; Thermal Analysis; Computer Programs

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19970037359 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Active Combustion Control for Propulsion Systems ***Le Controle Actif de la Combustion Pour les Systemes de Propulsion***

Schadow, K., Naval Air Warfare Center, USA; Yang, V., Pennsylvania State Univ., USA; Culick, F., California Inst. of Tech., USA; Rosfjord, T., United Technologies Corp., USA; Sturgess, G., Innovative Scientific Solutions, Inc., USA; Zinn, B., Georgia Inst. of Tech., USA; Sep. 1997; 52p; In English; In French; Propulsion and Energetics Panel, 6-9 May 1996, Athens, Greece
Report No.(s): AGARD-R-820; ISBN-92-836-1060-1; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

Active combustion control is one of the most promising approaches to further optimize the size/weight/power relationship in rockets, ramjets, afterburners, aero-engines, and marine propulsion. A workshop was organized in Athens in spring 1996 under the sponsorship of the AGARD Propulsion and Energetics Panel. It covered the existing knowledge, and further possible strategies for military equipment were discussed within the NATO nations. Further activities are planned.
AIAA

Combustion Control; Active Control; Propulsion System Performance; Propulsion System Configurations; Afterburning; Aircraft Engines; Marine Propulsion; Ramjet Engines

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970036178 NASA Lewis Research Center, Cleveland, OH USA

Machine Dynamics Branch Research and Accomplishments for FY 1996

Stefko, George L., NASA Lewis Research Center, USA; Aug. 1997; 26p; In English
Contract(s)/Grant(s): RTOP 538-03-11
Report No.(s): NASA-TM-107519; NAS 1.15:107519; E-10825; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This publication contains a collection of fiscal year 1996 research highlights from the Machine Dynamics Branch at NASA Lewis Research Center. Highlights from the branch's major work areas - Turbomachinery Aeroelasticity, Vibration Control and Magnetic Suspension Systems, Dynamic Systems Response and Analysis, and Computational Structural Methods - are included in the report as well as a listing of the fiscal year 1996 branch publications.
Author
Aeroelasticity; Vibration Damping; Turbomachinery; Rotor Dynamics; Magnetic Suspension; Dynamic Structural Analysis

19970036181 NASA Lewis Research Center, Cleveland, OH USA
PIV for Turbomachinery Applications
Wernet, Mark P., NASA Lewis Research Center, USA; Jul. 1997; 16p; In English; Optical Technology in Fluid, Thermal and Combustion Flow 3, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): RTOP 519-20-53
Report No.(s): NASA-TM-107525; NAS 1.15:107525; E-10839; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Particle Imaging Velocimetry (PIV) is emerging as a powerful measurement technique which can be used as an alternative or complementary approach to Laser Doppler Velocimetry (LDV) in a wide range of research applications. The instantaneous planar velocity measurements obtained with PIV make it an attractive technique for use in the study of the complex flow fields encountered in turbomachinery. The data acquired offer several advantages over traditional LDV data: higher accuracy; multiple measurement points and the ability to study both transient and steady state flow phenomena. Many of the same issues encountered in the application of LDV techniques to rotating machinery apply in the application of PIV. Techniques for optical access, light sheet delivery and particulate seeding are discussed. Preliminary results from the successful application of the PIV technique to a transonic axial compressor are presented.
Author
Particle Image Velocimetry; Turbomachinery; Velocity Measurement; Laser Doppler Velocimeters; Transonic Compressors; Unsteady Flow; Turbocompressors; Equilibrium Flow

19970036321 NASA Ames Research Center, Moffett Field, CA USA
Dynamic Forms, Part 2, Application to Aircraft Guidance
Meyer, George, NASA Ames Research Center, USA; Smith, G. Allan, NASA Ames Research Center, USA; Oct. 1997; 84p; In English
Contract(s)/Grant(s): RTOP 548-40-12
Report No.(s): NASA-TP-3695; NAS 1.60:3695; A-976688; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The paper describes a method for guiding a dynamic system through a given set of points. The paradigm is a fully automatic aircraft subject to air traffic control (ATC). The ATC provides a sequence of waypoints through which the aircraft trajectory must pass. The waypoints typically specify time, position, and velocity. The guidance problem is to synthesize a system state trajectory that satisfies both the ATC and aircraft constraints. Complications arise because the controlled process is multidimensional, multiaxis, nonlinear, highly coupled, and the state space is not flat. In addition, there is a multitude of operating modes, which may number in the hundreds. Each such mode defines a distinct state space model of the process by specifying the state space coordinatization, the partition of the controls into active controls and configuration controls, and the output map. Furthermore, mode transitions are required to be smooth. The proposed guidance algorithm is based on the inversion of the pure feedback approximation, followed by correction for the effects of zero dynamics. The paper describes the structure and major modules of the algorithm, and the performance is illustrated by several example aircraft maneuvers.
Author
Active Control; Algorithms; Air Traffic Control; Nonlinearity; Trajectories; Aircraft Maneuvers

19970037303 NASA Dryden Flight Research Center, Edwards, CA USA
Stress Analysis of B-52 Pylon Hooks for Carrying the X-38 Drop Test Vehicle
Ko, William L., NASA Dryden Flight Research Center, USA; Oct. 1997; 34p; In English
Contract(s)/Grant(s): RTOP 250-88-00
Report No.(s): NASA/TM-97-206218; NAS 1.15:206218; H-2187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The finite-element structural analysis method was used in a two-dimensional stress concentration analysis of a new pylon hook for carrying the X-38 lifting body atmospheric drop test vehicle on the B-52 carrier aircraft. The stress distributions in the hook were obtained, and the critical stress points were identified. The functional relationships between the applied hook load and the induced maximum tangential and shear stresses were established for setting the limit hook load for test flights. by properly

representing the X-38 hook with an equivalent curved beam, the conventional curved beam theory predicted the values of the maximum tangential and shear stresses quite close to those calculated from the finite-element analysis. The equivalent curved beam method may be of practical value during the initial stage of the hook design in estimating the critical stresses and failure loads with reasonable accuracy.
Author
Stress Analysis; Pylons; Hooks; Drop Tests; B-52 Aircraft; Curved Beams; Finite Element Method; Flight Tests; Stress Concentration

19970037497 National Aerospace Lab., Amsterdam, Netherlands
Hexahedron Based Grid Adaptation for Future Large Eddy Simulation
vanderVegt, J. J. W., National Aerospace Lab., Netherlands; vanderVen, H., National Aerospace Lab., Netherlands; Dec. 10, 1995; 37p; In English; AGARD Symposium Progress and Challenges in CFD Methods, 2-5 Oct. 1995, Seville, USA
Report No.(s): PB97-194567; NLR-TP-95514-U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The paper discusses a new numerical method which enables the future application of Large Eddy Simulation to high Reynolds number aerodynamic flow. The new numerical method uses local grid refinement of hexahedral cells and the discontinuous Galerkin finite element method. The method offers maximum flexibility in grid adaption and maintains accuracy on highly irregular grids. The method is demonstrated with calculations of inviscid transonic flow on a generic delta wing. The calculations are done on two parallel shared memory computers and the performance results are used to give estimates of the computing time and memory requirements for Large Eddy Simulation of a clean wing on a NEC SX-4 supercomputer.
NTIS
Computational Grids; Upwind Schemes (Mathematics); Numerical Analysis; High Reynolds Number; Aerodynamic Characteristics; Large Eddy Simulation; Hexahedrite

19970037698 NASA Dryden Flight Research Center, Edwards, CA USA
Passive Vibration Control of Airborne Equipment using a Circular Steel Ring *Final Report*
Ellison, Joseph, Clarkson Univ., USA; Ahmadi, Goodarz, Clarkson Univ., USA; Kehoe, Mike, NASA Dryden Flight Research Center, USA; Oct. 1997; 33p; In English
Contract(s)/Grant(s): NGT-51314
Report No.(s): NASA/CR-97-205868; NAS 1.26:205868; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vibration isolation is needed to protect avionics equipment from adverse aircraft vibration environments. Passive isolation is the simplest means to achieve this goal. The system used here consists of a circular steel ring with a lump mass on top and exposed to base excitation. Sinusoidal and filtered zero-mean Gaussian white noise are used to excite the structure and the acceleration response spectra at the top of the ring are computed. An experiment is performed to identify the natural frequencies and modal damping of the circular ring. Comparison is made between the analytical and experimental results and good agreement is observed. The ring response is also evaluated with a concentrated mass attached to the top of the ring. The effectiveness of the ring in isolating the equipment from base excitation is studied. The acceleration response spectra of a single degree of freedom system attached to the top of the ring are evaluated and the results are compared with those exposed directly to the base excitation. It is shown that a properly designed ring could effectively protect the avionics from possible damaging excitation levels.
Author
Control Equipment; Vibration Isolators; Airborne Equipment; Aircraft Wakes

19970037773 NASA Lewis Research Center, Cleveland, OH USA
Current Lewis Turbomachinery Research: Building on our Legacy of Excellence
Povinelli, Louis A., NASA Lewis Research Center, USA; Sep. 1997; 26p; In English; 13th; International Symposium on Air Breathing Engines, 7-12 Sep. 1997, Chattanooga, TN, USA; Sponsored by International Society on Air Breathing Engines
Contract(s)/Grant(s): RTOP 522-31-23
Report No.(s): NASA-TM-107499; NAS 1.15:107499; E-10799; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Wu Chang-Hua lecture is concerned with the development of analysis and computational capability for turbomachinery flows which is based on detailed flow field physics. A brief review of the work of Professor Wu is presented as well as a summary of the current NASA aeropropulsion programs. Two major areas of research are described in order to determine our predictive capabilities using modern day computational tools evolved from the work of Professor Wu. In one of these areas, namely transonic rotor flow, it is demonstrated that a high level of accuracy is obtainable provided sufficient geometric detail is simulated. In the second case, namely turbine heat transfer, our capability is lacking for rotating blade rows and experimental correlations will pro-

vide needed information in the near term. It is believed that continuing progress will allow us to realize the full computational potential and its impact on design time and cost.
Author
Turbomachinery; NASA Programs; Aircraft Engines; Transonic Flow; Turbines; Heat Transfer; Flow Distribution; Rotors; Lectures

19970039832
Comparative overview of strain actuated surfaces' design
Santini, Paolo, Dipartimento Aerospaziale, Italy; Gasbarri, Paolo; Altobelli, Matteo; Rossi, Anna; Journal of Reinforced Plastics and Composites; 1997; ISSN 0731-6844; vol. 16, no. 6, pp. 519-536; In English; Copyright; Avail: Issuing Activity

In this paper two different approaches to design of strain actuated lifting surfaces are compared with each other and with a classical aeroelastic tailoring method. Piezoelectric actuation is accomplished by piezo-patches embedded in the wing's composite lay-up and piezoelectric ribs (piezo-ribs) placed spanwise. If the piezoelectric patches are isotropic in their plane they can not directly induce any twist effect in the wing. Thus, in this case, the wing can undergo twisting only as an effect of the coupling (due to tailoring and wing sweep angle) between bending and twisting torques. When piezoelectric patches are used, this configuration is not yet the most effective one. In fact, the largest electromechanical coupling coefficient, which is the one in the direction of the applied electric field, is not thoroughly exploited. On the other hand, piezo-ribs are able to induce not only bending but also pure twisting deformation and exploit the largest electromechanic coupling effect so they may provide the designer with a higher control authority. However, this kind of control involves larger weight. In this paper, aeroelastic wing performance for these different configurations is analyzed. Moreover, the comparison is also made in terms of energy consumption. Numerical examples complete the work.
Author (EI)
Aerodynamics; Composite Structures; Strain Distribution; Wings

19970039087
Design of experiments for the controller of rotor systems with a magnetic bearing
Sheu, G. J., Natl Cheng Kung Univ, USA; Yang, S. M.; Yang, C. D.; Journal of Vibration and Acoustics, Transactions of the ASME; April 1997; ISSN 1048-9002; vol. 119, no. 2, pp. 200-207; In English; Copyright; Avail: Issuing Activity

A new design methodology for the vibration control of rotor systems with a magnetic bearing is developed in this paper. The methodology combines the experimental design method in quality control engineering and the conventional PD control technique such that their advantages in implementation feasibility and performance-robustness can be integrated together. A quality loss index defined by the summation of the infinity norm of unbalanced vibration is used to characterize the system dynamics. by using the location of the magnetic bearing and PD feedback gains as design parameters, the controller can be determined by a small number of matrix experiments to achieve the best system performance. In addition, it is robust to the vibration modes within a desired speed range. A rotor system consisting of 4 rigid disks, 3 isotropic bearings, and 1 magnetic bearing is applied to illustrate the feasibility and effectiveness of the experiment-aided controller design.
Author (EI)
Control Systems Design; Magnetic Bearings; Proportional Control; Rotors; Vibration Damping; Vibration Mode

19970039374
Viscoelastic behavior of composite rotors at elevated temperatures
Tzeng, Jerome T., U.S. Army Research Lab, USA; IEEE Transactions on Magnetics; January 1997; ISSN 0018-9464; vol. 33, no. 1, pt. 1, pp. 413-418; In English; Copyright; Avail: Issuing Activity

The composite rotor of a pulsed-power machine is built with radial precompression to enhance mechanical performance; however, the preload might decrease due to the viscoelastic behavior of materials at elevated temperatures. In this investigation, an analytical solution is developed to study the viscoelastic problem of thick-walled cylinders. The analysis accounts for ply-by-ply variations of rotor structural properties, ply orientations, and temperature gradients through the thickness of rotors. Fiber-reinforced composite materials generally illustrate extreme anisotropy in viscoelastic behavior. The viscoelasticity exists mainly in matrix dominant properties, such as transverse and shear, while the fiber dominant properties behave more like elastic mediums. Accordingly, the viscoelastic characteristics of composite cylinders is quite different from those of isotropic cylinders. Currently, finite element packages such as ABAQUS, ANSYS, and DYNA3D are not very suitable for the viscoelastic analysis of composite cylinder because of the lack of anisotropic viscoelastic elements. The prestress in the hoop-wound fiber, which generates radial compression in the rotor, might decrease due to Poisson's effect alone from the creep behavior in the transverse properties of com-

posite. The result also shows the effects of layup construction and fiber orientations on the anisotropic behavior of composite rotors.
Author (EI)
Anisotropy; Applications Programs (Computers); Fiber Composites; Rotors; Viscoelasticity

19970039619
Optimum design of switched reluctance motors using dynamic finite element analysis
Ohdachi, Yasuharu, R&D Cent Toyoda Automatic Loom Works, Ltd, Japan; Kawase, Yoshihiro; Miura, Yutaka; Hayashi, Yoji; IEEE Transactions on Magnetics; March 1997; ISSN 0018-9464; vol. 33, no. 2, pt. 2, pp. 2033-2036; In English; Copyright; Avail: Issuing Activity

Switched reluctance motors have the advantages of a high torque/weight ratio, as the large reluctance torque is made by salient poles of both stator and rotor, and a high reliability. On the other hand, the switched reluctance motors have the disadvantage of a large ripple torque, which is made by salient poles. So the application for the industrial fields have been limited to special cases. For the optimum design of switched reluctance motors, this paper presents the methods and results, which are calculated by the dynamic finite element analysis. The method are the pole shape optimization, the compensated current and so on. In case of the calculated model, the ripple torque can be reduced to almost zero.
Author (EI)
Finite Element Method; Optimization; Reluctance; Rotors; Torque; Winding

19970040183 Centre National de la Recherche Scientifique, Toulouse, France
Diagnosis of dynamic systems based on explicit and implicit behavioural models: an application to gas turbines in Esprit Project Tiger
Trave-Massuyes, L., Centre National de la Recherche Scientifique, France; Milne, R., Centre National de la Recherche Scientifique, France; 1995; 14p; In English
Report No.(s): CNRS-LAAS-95301; DE97-749189; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

We are interested in the monitoring and diagnosis of dynamic systems. In our work, we are combining explicit temporal models of the behaviour of a dynamic system with implicit behavioural models supporting model based approaches. This work is drive by the needs of and applied to, two gas turbines of very different size and power. In this paper we describe the problems of building systems for these domains and illustrate how we have developed a system where these two approaches complement each other to provide a comprehensive fault detection and diagnosis system. We also explore the strengths and weaknesses of each approach. The work described here is currently working continuously, on line to a gas turbine in a major chemical plant.
DOE
Gas Turbines; Fault Detection; Gas Turbine Engines

19970040225 Electricite de France, Clamart, France
Large eddy simulation with unstructured grids and finite elements
Miet, P., Electricite de France, France; Laurence, D., Electricite de France, France; Nitrosso, B., Electricite de France, France; Dec. 1995; 10p; In English
Report No.(s): EDF-96-NB-00124; DE97-620572; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

A large Eddy simulation was conducted with a general purpose Finite Element code (N3S). The flow around a square cylinder, a typical case for Bluff Body Aerodynamics and with well documented experiments (Lyn and Durao), was used as a test case. The simple mixing length model of Smagorinsky was applied together with wall functions and yielded reasonable agreement with experiment for mean, and pseudo periodic velocities. Filtering difficulties associated with LES in finite elements and possible improvements are considered.
DOE
Fluid Dynamics; Computerized Simulation; Turbulent Flow; Aerodynamics; Large Eddy Simulation

19970040406 Institute for Human Factors TNO, Soesterberg, Netherlands
Speech Transmission Quality and Sound Attenuation of the Gentex HGU-56/P and the Alpha 200 Helmet ***Interim Report Spraaktransmissiekwaliteit en geluidsverzwakking van de Gentex HGU-56/P en Alpha 200 helm***
vanWijngaarden, S. J., Institute for Human Factors TNO, Netherlands; Jul. 22, 1997; 14p; In English
Contract(s)/Grant(s): A97/KLu/328

Report No.(s): TD97-0230; TNO-TM-97-A052; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands), Hardcopy, Microfiche

Upon request of the Royal Netherlands Airforce, speech transmission and hearing protection of the Gentex HGU-56/P and the Alpha 200 helmet have been investigated. The sound attenuation properties of the helmet 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 calculated. For the tested version of Alpha 200 helmet, which is equipped with ANR (Active Noise Reduction), the active attenuation was also determined. Additionally, two types of microphones (M-87/AIC and M-1 62/AIC) were evaluated. The results show, that the HGU-56/P leads to predicted A-weighted noise levels at the ear of 85 dBA (cockpit) to 92 dBA (cargo compartment); these levels are, respectively, 84 and 92 dBA for the Alpha helmet with ANR switched on, and 89 and 95 dBA with ANR switched off. Hence, when used passively, the HGU-56/P performs better than the Alpha 200 helmet. However, neither of the systems gives an improvement on the currently used modified SPH-5 helmet. The M-87/AIC microphone gives adequate speech transmission quality. The results for the M-162/AIC, nevertheless, are better. Author

Helmets; Noise Intensity; Noise Reduction; Acoustic Attenuation; Active Control; Aircraft Noise; Microphones

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970037678 National Renewable Energy Lab., Golden, CO USA

An evaluation of an empirical model for stall delay due to rotation for HAWTS

Tangler, J. L., National Renewable Energy Lab., USA; Selig, M. S., Illinois Univ., USA; Jul. 1997; 12p; In English; Windpower1997: Annual Conference and Exhibition of the American Wind Energy Association, 15-18 Jun. 1997, Austin, TX, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-440-23258; CONF-970608-2; DE97-007947; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The objective of this study was to evaluate the Corrigan and Schillings stall delay model for predicting rotor performance for horizontal axis wind turbines. Two-dimensional (2D) wind tunnel characteristics with and without stall delay were used in the computer program PROP93 to predict performance for the NREL Combined Experiment Rotor (CER) and a lower solidity commercial machine. For the CER, predictions were made with a constant-chord/twisted blade and a hypothetical tapered/twisted blade. Results for the constant-chord/twisted blade were compared with CER data. Predicted performance using this empirical stall-delay method provided significant increases in peak power over 2D post-stall airfoil characteristics. The predicted peak power increase due to stall delay for the CER was found to be quite large (20% to 30%) as a result of its high blade solidity. For a more typical, lower-solidity commercial blade the predicted peak power increase was 15% to 20%. As described in the paper, correlation with test data was problematic due to factors not related to the stall-delay model.
DOE

Evaluation; Rotors; Performance Prediction; Computerized Simulation

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970036380 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Aerospace 2020, Volume 2 ***Aeronautique et Espace a l'Horizon 2020, Volume 2***

Sep. 1997; 196p; In English; Original contains color illustrations
Report No.(s): AGARD-AR-360-Vol-2; ISBN-92-836-1058-X; Copyright Waived; Avail: CASI; A09, Hardcopy; A03, Microfiche

Volume 2, the main volume, of the report of the NATO Advisory Group for Aerospace Research and Development (AGARD) study: 'Aerospace 2020'. This study explored the most advanced technologies, relevant to aerospace, being researched and developed in laboratories today. The study focused on the most promising current technologies and the organizational and tactical con-

sequences they will have at the field and system levels, over the course of the next 25 years. Topics include: a discussion of the impact of proliferation, human-machine interaction, synthetic environments, directed-energy weapons, information technologies, unmanned tactical aircraft, suborbital launchers, hypersonic missiles, and a discussion of affordability issues. Technologies are assessed from the viewpoints of both potential capabilities and threats. Observations and recommendations are presented.
Author
Aerospace Engineering; Forecasting; Weapon Systems; Hypersonics; Human Factors Engineering; Man Machine Systems; Pilotless Aircraft

19970036412 Boeing Commercial Airplane Co., Seattle, WA USA
Use of CAD/CAM Digital Data on 737 and 777 programs
Lynn, Steven G., Boeing Commercial Airplane Co., USA; Kanemoto, Harvey, Boeing Commercial Airplane Co., USA; Next Generation CAD/CAM/CAE Systems; Sep. 1997, pp. 213-244; In English; Also announced as 19970036402; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper has two parts. The first is a review of the digital processes implemented at Boeing on the 777 and 737 Next Generation airplane programs. The second part is a description of how we would like the Define processes to be. The existing processes are built on the infrastructure of Spatial Integration and Build Integration. The future processes include the idea of functional integration. These are explained. The purpose of this paper is to show that Boeing is successfully implementing CAD/CAM/CAE technology that benefits the business and helps CAD/CAM/CAE suppliers understand our business processes at an overview level so that they can better support us with products and technology.
Derived from text
Computer Aided Design; Computer Aided Manufacturing; Functional Integration; Commercial Aircraft; Human-Computer Interface

19970037336 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands
ADAS Structures Module Evaluation Report
Arendsen, P., National Aerospace Lab., Netherlands; Vandelen, F., Technische Univ., Netherlands; Bil, C., Technische Univ., Netherlands; Rothwell, A., Technische Univ., Netherlands; Sep. 06, 1995; 42p; In English
Contract(s)/Grant(s): 01905N
Report No.(s): PB97-194500; NLR-TP-95442-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a joint research project between the National Aerospace Laboratory (NLR) and the Faculty of Aerospace Engineering of Delft University of Technology (TUD) a multi-level system for the preliminary design of aircraft structures has been developed. The present system is essentially an extension of the existing Aircraft Design and Analysis System (ADAS). ADAS has been modified to allow the definition of major structural components like ribs, spars, frames, bulkheads, floor structures, and semi-automatically to generate models for air load calculations (panel methods, doublet lattice) and finite element structural optimization. The models can be automatically modified with changes in general design parameters such as wing area, sweepback angle, aspect ratio. In a study to evaluate the system, ADAS has been used to (re)design the principal structure of the Fokker 50.
NTIS
Structural Design; Aircraft Structures; Computer Aided Design; Finite Element Method

19970037590 National Aerospace Lab., Informatics Div., Amsterdam, Netherlands
Need for Super Computers in Aerospace Research and Industry
Vogels, M. E. S., National Aerospace Lab., Netherlands; vanderVen, H., National Aerospace Lab., Netherlands; Hameetman, G. J., National Aerospace Lab., Netherlands; Mar. 03, 1995; 17p; In English; HPCN EUROPE 1995, 2-5 May 1995, Milan, Italy; Also announced as N96-33607
Report No.(s): PB97-193320; NLR-TP-95114 U; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this paper the need for super computer in aerospace research and industry is motivated by describing the computational needs of three aerospace applications. The computational needs are described in terms of performance, memory resources and portability. It is discussed to what extent next generation super computers satisfy these needs. The conclusion of this discussion is that shared memory vector machines satisfy the present requirements, but in the near future distributed memory machines can no longer be avoided.
NTIS
Aircraft Design; Architecture (Computers); Supercomputers; Aerospace Industry; Research and Development

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics. (General)

19970037302 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Highly Accurate Measurement of Projectile Trajectories
Leathem, J., Defence Science and Technology Organisation, Australia; Apr. 1997; 40p; In English
Report No.(s): DSTO-TN-0077; AR-010-182; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P. O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

A method has been developed for making very accurate position and angular attitude measurements over the trajectory of gun launched, fin stabilized weapons. The method has been extensively used for free flight testing of weapon models. This report describes the on board instrumentation, the range instrumentation and the experimental procedure used to carry out the trajectory measurements. The post trials processing of the camera records is also described and a brief account given of the analysis used to derive vehicle aerodynamics.
Author
Trajectories; Projectiles; Aerodynamics; Fins; Attitude (Inclination); Flight Tests; Free Flight

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19970037622 NASA Washington, Washington, DC USA
Achieving Aeronautics Leadership: Aeronautics Strategic Enterprise Plan
Apr. 1995; 36p; In English
Report No.(s): NASA/TM-97-112610; NAS 1.15:112610; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Today, more than ever, aggressive leadership is required to ensure that our national investments in aeronautical research, technology, and facilities are shaped into a coordinated, and high-impact, strategy. Under the auspices of the National Science and Technology Council, and in conjunction with the domestic industry, universities, the Department of Defense, and the Federal Aviation Administration - our partners in aeronautics - we propose to provide that leadership, and this document is our plan.
Derived from text
Defense Program; Research and Development; Leadership; Aeronautics

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