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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

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

Key

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 381)

AUGUST 21, 1998

01
AERONAUTICS

19980202133 Office of the Under Secretary of Defense (Acquisitions), Washington, DC USA

The DOD Tactical Aviation Modernization Program

Kaminski, Paul G., Office of the Under Secretary of Defense (Acquisitions), USA; Mar. 05, 1997; 15p; In English

Report No.(s): AD-A339157; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

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

Security; Integrity

19980202469 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Numerical Unsteady Aerodynamic and Aeroelastic Simulation ***L'Aerodynamique instationnaire numerique et la simulation de l'aeroelasticite***

Numerical Unsteady Aerodynamic and Aeroelastic Simulation; Mar. 1998; 198p; In English; In French; Meeting of the AGARD Structures and Materials Panel, 14-15 Oct. 1997, Aalborg, Denmark; Sponsored by Advisory Group for Aerospace Research and Development, France; Also announced as 19980202470 through 19980202483

Report No.(s): AGARD-R-822; ISBN 92-836-0054-1; Copyright Waived; Avail: CASI; A09, Hardcopy; A03, Microfiche

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

Author

Unsteady Aerodynamics; Mathematical Models; Finite Element Method; Aeroelasticity; Computational Fluid Dynamics; Navier-Stokes Equation; Three Dimensional Flow; Computerized Simulation; Flutter

19980202697 Naval Postgraduate School, Monterey, CA USA

Decision Support Requirements for the Aviation Maintenance Material Control Officer

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

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

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

DTIC

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

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

The Aeronautical Journal, Volume 102, Golden Jubilee Issue

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

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

CASI

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

19980203127 Naval Postgraduate School, Monterey, CA USA

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

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

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

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

DTIC

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

02
AERODYNAMICS

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

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

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

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

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

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

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

19980202472 NASA Langley Research Center, Hampton, VA USA

Application of the ENS3DAE Euler/Navier-Stokes Aeroelastic method

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

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

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

Author

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

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

Aerodynamics for elastically oscillating wings using the virtual grid deformation method

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

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

Author

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

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

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

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

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

Transl. by Schreiber

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

19980202476 Boeing Co., Long Beach, CA USA

CFD based corrections for linear aerodynamic methods

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19980202965 Bristol Univ., Dept. of Aerospace Engineering, UK
Unsteady propeller flows due to turbulence ingestion
Harden, J. M., Bristol Univ., UK; Lowson, M. V., Bristol Univ., UK; The Aeronautical Journal; Feb. 1998; ISSN 0001-9240; Volume 102, No. 1012, pp. 63-70; In English; Also announced as 19980202964
Contract(s)/Grant(s): EPSRC-GR/J/15407
Report No.(s): Paper-2337; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A laser doppler anemometer (LDA) was configured to provide simultaneous 1D velocity readings from two separate points in the contracting flow regime upstream of a 0.63 m diameter model propeller operating under high thrust conditions. Cross-correlations between the velocity signals were used to map the progress of turbulent eddy structures throughout the distortion, even within the highly oscillatory region close to the blades. These measurements were used to provide data on the strength and velocity of the eddies, as well as their average size and shape in two dimensions. The results show both elongation of the turbulent structures in the streamwise direction and distortion along their length, caused by the contracting flow and the high Reynolds stress. Linearized isotropic theory was used to predict the changes in the turbulent kinetic energies, and was found to be accurate for the longitudinal component only.
Author
Propellers; Turbulent Flow; Unsteady Flow; Linearization; Isotropic Turbulence; Isotropic Media; Cross Correlation

19980203040 Iowa State Univ. of Science and Technology, Dept. of Aerospace Engineering and Engineering Mechanics, Ames, IA USA
Atmospheric Probe Model: Construction and Wind Tunnel Tests ***Final Report***
Vogel, Jerald M., Iowa State Univ. of Science and Technology, USA; [1998]; 50p; In English
Contract(s)/Grant(s): NCC2-935
Report No.(s): NASA/CR-1998-208195; NAS 1.26:208195; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The material contained in this document represents a summary of the results of a low speed wind tunnel test program to determine the performance of an atmospheric probe at low speed. The probe configuration tested consists of a 2/3 scale model constructed from a combination of hard maple wood and aluminum stock. The model design includes approximately 130 surface static pressure taps. Additional hardware incorporated in the baseline model provides a mechanism for simulating external and internal trailing edge split flaps for probe flow control. Test matrix parameters include probe side slip angle, external/internal split flap deflection angle, and trip strip applications. Test output database includes surface pressure distributions on both inner and outer annular wings and probe center line velocity distributions from forward probe to aft probe locations.
Author
Wind Tunnel Tests; Probes; Wind Tunnel Models; Scale Models; Pressure Distribution; Velocity Distribution; Ring Wings

19980203116 Dynamic Engineering, Inc., Newport News, VA USA
Flutter Model Technology ***Final Report, 1 Jun. 1996 - 1 Jun 1997***
Busan, Ron, Dynamic Engineering, Inc., USA; Jan. 1998; 62p; In English
Contract(s)/Grant(s): F33601-94-D-4016; AF Proj. 2401
Report No.(s): AD-A340820; WL-TR-97-3074; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Wind tunnel testing of dynamically scaled models plays a key role in assuring that new or modified aircraft will be free of flutter within their flight envelopes. Dynamically scaled models are also widely used in research studies such as active control of aeroelastic response, buffet alleviation, and validation of theoretical or computational methods. This paper summarizes many of the critical design consideration involved with designing and fabricating flutter model hardware once the basic requirements

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

03
AIR TRANSPORTATION AND SAFETY

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

19980201889 Failure Analysis Associates, Inc., Alexandria, VA USA
Metallurgical Evaluation of a DOT-E6498-2216 Cylinder ***Final Report***
Smith, T. R., Failure Analysis Associates, Inc., USA; Jan. 1997; 64p; In English
Report No.(s): PB98-140692; FAA-DC-FR-97-01-01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents a metallurgical examination of a failed aluminum cylinder authorized for the transportation in commerce of specified liquified and nonliquefied compressed gases. The DOT-3AL cylinder, manufactured under exemption DOT-E 6498, was in breathing air service for fire-fighting use. The evaluation included photodocumentation and non-destructive examinations, chemical and mechanical property determination, metallographic sectioning, and fractography.
NTIS
Failure Analysis; Cracking (Fracturing); Mechanical Properties; Compressed Gas; Cylindrical Shells; Metallography

19980201892 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Nuisance Alarms in Aircraft Cargo Areas and Critical Telecommunications Systems: Proceedings of the Third NIST Fire Detector Workshop
Grosshandler, W. L., Editor, National Inst. of Standards and Technology, USA; Mar. 1998; 46p; In English; Nuisance Alarms in Aircraft Cargo Areas and Critical Telecommunications Systems, Mar. 1998, Gaithersburg, MD, USA
Report No.(s): PB98-144538; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The need for faster and more intelligent decision making regarding the presence or absence of a fire threat has become acute in the commercial aircraft and telecommunications industries, both of which have been particularly hard-hit be the cessation of halon production. The drive earlier detection has as a consequence the possibility of increased rate of nuisance alarms; however, there are no accepted standards against which a fire detection system can be operated to assess its immunity to false alarm. A workshop was held at NIST with the main objective to identify physical sources of nuisance alarms that may plague current and emerging fire detection technologies for telecommunications applications and for aircraft cargo areas, to reach consensus on what test methods are appropriate to evaluate a detection system's immunity to false alarm in the presence of physical nuisance sources, and to recommend actions to develop and/or implement these new test methods. The workshop consisted of a number of invited background talks from representatives of the aircraft and telecommunications industries and government agencies. The current state of detector evaluation methodologies was reviewed, along with what has been documented in the open literature regarding the number and sources of nuisance/false alarms in these two applications. This report summarizes the discussions and presents the major findings for each application.
NTIS
Commercial Aircraft; False Alarms; Fires; Air Cargo; Decision Making; Telecommunication; Warning Systems; Detection

19980202332 Federal Aviation Administration, Airport and Aircraft Safety Research and Development, Atlantic City, NJ USA
Fire-Resistant Materials: Research Overview ***Final Report***
Lyon, Richard E., Federal Aviation Administration, USA; Dec. 1997; 23p; In English
Report No.(s): AD-A340649; DOT/FAA/AR-97/99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides an overview of the research being conducted by the Federal Aviation Administration (FAA) to develop fire safe cabin materials for commercial aircraft. The objective of the Fire-Resistant Materials program is to eliminate burning cabin materials as a cause of death in aircraft accidents. Long-term activities include the synthesis of new, thermally stable, low fuel value organic and inorganic polymer systems. The synthesis effort is supported by fundamental research to understand poly-

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

19980202334 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Briefing Report to the Honorable Ike Skelton, Ranking Minority Member, Committee on National Security, House of Representatives. Military Aircraft Safety: Serious Accidents Remain at Historically Low Levels
Mar. 1998; 13p; In English
Report No.(s): AD-A340751; GAO/NSIAD-98-95BR; B-279205; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight mishaps involve an y reportable damage to an aircraft that is preparing to fly, in flight, or completing a landing. Flight mishaps are classified by DOD according to the severity of resulting injury or property damage. Class A mishaps involve damage of $1 million or more, a destroyed aircraft, or a fatality or permanent total disability. The remaining classes of mishaps are distinguished primarily by their loss value and severity of injury: Class B accidents involve damage ranging from $200,000 to less than $1 million, permanent partial disability, or inpatient hospitalization of five or more people; Class C accidents involve damage ranging from $10,000 to less than $200,000 or a lost time injury; and Class D accidents involve damage of less than $10,000. Our review focused on Class A flight mishaps only. DOD requires that all mishaps be investigated so that causes can be identified and corrective actions taken to prevent future occurrences. Service safety centers play a key role in * maintaining aviation mishap statistics, establishing safety policies, disseminating safety information, reviewing mishap investigation reports, tracking recommendations, and performing safety studies. In addition, the safety centers analyze trends to identify potential safety hazards.
DTIC
Congressional Reports; Aircraft Safety; Military Aircraft; Aircraft Accidents

19980203117 Marine Aviation Weapons and Tactics Squadron 1, Yuma, AZ USA
Qualitative Assessment Report. Portable Flight Planning Software (PFPS), *Sep. 1997 - Feb. 1998*
Barr, Robert S., Marine Aviation Weapons and Tactics Squadron 1, USA; Sampson, Matthew T., Marine Aviation Weapons and Tactics Squadron 1, USA; Feb. 25, 1998; 65p; In English
Report No.(s): AD-A340821; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

With the exponential increase in computer capabilities in the last ten years, the Department of Defense and the Department of the Navy (DoN) has sought to equip Navy and Marine forces with more capable and compact Automated Mission Planning Systems (AMPS). Despite these efforts, there currently is no single AMPS which satisfies the AMPS requirements for all DoN aircraft. There are, however, numerous AMPS's being employed to fill the shortfall. One interim fix being explored by DoN is Portable Flight Planning Software (PFPS). PFPS is a PC based AMPS, developed by the Air Force and Georgia Tech Research Institute, which presents the Combat Flight Planning Software (CFPS) interactive time, distance, heading, and fuel card and the Falcon View mapping toolkit simultaneously. Other capabilities include the ability to interface with digital maps, imagery, terrain elevation data and aeronautical flight information files. Upon request from PMA 233, a Qualitative Assessment (QA) of PFPS was conducted by Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) during Weapons and Tactics Instructor (WTI) Course 1-98. Approximately forty experienced aviators from the Marine Corps and Air Force participated in the assessment. The assessment consisted of classroom training, computer lab, and self-paced study. Respondent opinions were captured in a single survey administered three times during the course. Respondents were surveyed on their background information, their computer and AMPS experience, the adequacy of PFPS training received, the difficulty of using PFPS Human Machine Interfaces (HMI), the adequacy of PFPS documentation, the compatability of PFPS with various mission planning requirements, the reliability of PFPS, the maintainability of PFPS, and the tactical impact and time savings realized while using PFPS.
DTIC
Computer Programs; Flight Plans; Mission Planning

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

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

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

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

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

19980202414 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Improved Mathematical Modeling for GPS Based Navigation
Nardi, Salvatore, Air Force Inst. of Tech., USA; Mar. 1998; 144p; In English
Report No.(s): AD-A342014; AFIT/GE/ENG/98M-01; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This thesis is concerned with the development of new closed form GPS position determination algorithms that work in the presence of pseudorange measurement noise. The mathematical derivation of two closed form algorithms, based on stochastic modeling and estimation techniques, is presented. The algorithms provide an estimate of the GPS solution parameters (viz., the user position and the user clock bias) as well as the estimation error covariance. The experimental results are analyzed by comparison to the baseline results from the conventional Iterative Least Squares (ILS) algorithm. In typical GPS scenarios, the closed form

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

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

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

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

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

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

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

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

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

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

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

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

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

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

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

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

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

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

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

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

19980202508 Naval Postgraduate School, Monterey, CA USA

Measurement of Synchronous Forces and Flow Non-Uniformity in an Axial Compressor

Cuellar, Alvaro A., Naval Postgraduate School, USA; Dec. 1997; 89p; In English

Report No.(s): AD-A342761; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

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

DTIC

Gas Turbines; Axial Flow Turbines; Mass Flow; Static Pressure; Turbocompressors

08
AIRCRAFT STABILITY AND CONTROL

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

19980202477 Air Force Research Lab., Wright-Patterson AFB, OH USA

Investigation of buffet load alleviation on a scaled F-15 twin tail model

Huttsell, L. J., Air Force Research Lab., USA; Tinapple, J. A., Air Force Research Lab., USA; Weyer, R. M., Aeronautical Systems Div., USA; Mar. 1998; 8p; In English; Also announced as 19980202469; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

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

Author

F-15 Aircraft; Computational Fluid Dynamics; Buffeting; Tangential Blowing; Unsteady Aerodynamics; Aerodynamic Loads; Scale Models; Vortices; Wind Tunnel Tests; Computerized Simulation; Aircraft Models; Unstructured Grids (Mathematics)

19980202480 British Aerospace Defence Ltd., Military Aircraft and Aerostructures, Brough, UK

Flutter prediction for complex configurations

Henshaw, M. J. deC., British Aerospace Defence Ltd., UK; McKiernan, D. D., British Aerospace Defence Ltd., UK; Mairs, C., British Aerospace Defence Ltd., UK; Mar. 1998; 8p; In English; Also announced as 19980202469; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Flutter analysis requires the linking of structural deformation modeling with unsteady fluid dynamics; at British Aerospace, Aerospace Military Aircraft and Aerostructures (MA&A) a series of computational methods are used to model the various aspects of flutter to provide clearance data for aircraft. The various methodologies will be briefly described and the manner in which the parts of the process interface outlined. Future aircraft require the tools to be capable of modelling complex configurations including novel planforms and aircraft with stores; these must also include the difficult transonic flow regime. The requirements of the unsteady methods needed to provide this capability and the manner in which they must be inserted into the existing process will be discussed. Initial results obtained using an unsteady Multiblock Euler method will be presented and the development of this method within the overall process will be detailed. These results will be used to illustrate the ways that sophisticated unsteady CFD methods must be developed, in terms of interface with structural components of the process, to meet project requirements for complex configurations. The post-processing requirements will also be presented.

Author

Computational Fluid Dynamics; Transonic Flutter; Flutter Analysis; Transonic Flow; Prediction Analysis Techniques; Aerodynamic Configurations; Mathematical Models; Euler Equations of Motion; Unsteady Aerodynamics

19980202870 Royal Melbourne Inst. of Tech., Sir Lawrence Wackett Centre for Aerospace Design Technology, Australia
MATLAB(registered trademark) m Files for Flutter Analysis Using pk Method
Ariyaka, Soma, Royal Melbourne Inst. of Tech., Australia; Feb. 1996; 42p; In English
Report No.(s): TM-96/01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A flutter analysis computer program using the pk method was written in Matlab(registered trademark) m files. Three different systems were examined including two dimensional and two degrees of freedom (2d 2dof), two dimensional and three degrees of freedom (2d 3dof), and three dimensional and three degrees of freedom (3d 3dof). The results of these pk analyses were then compared with the k method of analysis using the flutter parameters which were representative of the Seagull aircraft. Very brief derivations of the flutter equations leading to the form needed by the pk method are given in this report as well. The uncoupled modes formulation given by Scanlan and Rosenbaum was followed. The preliminary flutter analysis of WAC-8 was conducted, and the results are also shown.
Author
Applications Programs (Computers); Flutter Analysis; Uncoupled Modes; Mathematical Models; Aeroelasticity

19980203156 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
An Evaluation of Frequency Domain Ensemble Averaging to Improve Aircraft Stability Derivative Estimation
Hoffman, Lawrence M., Air Force Inst. of Tech., USA; Mar. 1998; 184p; In English
Report No.(s): AD-A341812; AFIT/GAE/ENY/98M-02; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This research evaluated a process to improve aircraft stability derivative estimation results. The Have Derivatives process used overlap ensemble averaging in the frequency domain to minimize noise on the original time domain signals. The process estimated average complex frequency response functions that were then transformed back into the time domain as a set of discrete pulse responses with far less noise than the original signals. These clean signals were used in a parameter estimation program to estimate better stability derivatives than were estimated with the original noisy signals. Both simulation and flight test data were used to study the effects of various noise levels on stability derivative estimation results and to evaluate the Have Derivatives process to improve those results. The simulations demonstrated dramatic improvement using the Have Derivatives process. The flight test results were not as conclusive. The ensemble averaging step of the Have Derivatives process was not effective enough at reducing noise on the flight test data due to non-uniform frequency content of the flight test input. The overall recommendation was to further evaluate the Have Derivatives process using a broadband flight test input, similar to the input that worked well in simulation.
DTIC
Stability; Evaluation; Stability Derivatives; Derivation; Estimating; Aircraft Stability; Frequency Assignment

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

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

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

19980203107 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development and Validation of an Experimental Test Rig for Electrohydrodynamic Enhancement of Forced Convective Heat Transfer

Caldwell, William T., Air Force Inst. of Tech., USA; Dec. 1997; 107p; In English

Report No.(s): AD-A341802; AFIT/GA/ENY/97D-05; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report details the development of a facility for the experimental investigation of electrohydrodynamic (EHD) enhancement of forced convection heat transfer. The test facility was developed for the Thermal and Transparencies Laboratory (TATLAB), Air Force Research Laboratory (AFRL), for use in future research into the applicability of EHD for the miniaturization of Air Force heat exchangers. During this research, a closed loop, medium scale electrohydrodynamic test rig was developed and brought online. The test fluid loop was integrated with a data acquisition and parameter control system. Basic loop and fluid performance testing was accomplished through the use of a 3 mm hydraulic diameter, square channel test section using Flourinert FC-72, a dielectric electronics coolant, as the working fluid. Due to the design of the test section, no heat transfer data was generated in this initial study. However, this study greatly expanded the experimental and practical understanding of the EHD phenomenon within AFRL, by providing a working knowledge of the basics of effective EHD test section design, contamination control procedures, and loop design and operation. Deficiencies in the design of the loop, data acquisition system, and test section were identified and recommendations for improvements in future work were delivered. The Air Force Research Laboratory is now poised to generate useful EHD heat transfer data with this test facility.

DTIC

Performance Tests; Test Facilities; Fabrication; Research Facilities; Heat Transfer; Coolants; Convective Heat Transfer; Proving; Experiment Design

19980203118 Federal Aviation Administration, Civil Aeromedical Inst., Oklahoma City, OK USA

Differential Training Needs and Abilities at Air Traffic Control Towers: Should All Controllers Be Trained Equally? ***Final Report***

Thompson, Richard C., Federal Aviation Administration, USA; Agen, Rebecca A., Federal Aviation Administration, USA; Broach, Dana M., Federal Aviation Administration, USA; Mar. 1998; 17p; In English

Report No.(s): AD-A340829; DOT/FAA/AM-98/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present study uses job elements identified by subject-matter experts to assess the perceived training needs of air traffic control specialists (ATCSs) who are assigned to towers after successful completion of FAA Academy training. The Director of Air Traffic Services tasked The Air Traffic Resource Management Program (ATX) with conducting a training needs assessment. to measure the needed skills and knowledge of new controllers, a survey was developed by ATX and distributed by the Civil Aeromedical Institute to 172 tower level III, IV, and V facility managers and nine regional Air Traffic Division managers. The survey was used to assess the performance-based skills standards needed by new controllers at the time of entry into a field facility. The training capability of individual towers was also examined. The results indicated that there are some differences in the required training of ATCSs assigned to level IV and V towers. Therefore, the tower assignment of new hires should be identified upon entry into the Academy to better focus on the specific training needs of prospective towers.

DTIC

Air Traffic; Air Traffic Control; Air Traffic Controllers (Personnel)

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.

19980202357 Tether Applications, Chula Vista, CA USA

A Station Tethered Express Payload System (STEPS)

Carroll, Joseph A., Tether Applications, USA; Tether Technology Interchange Meeting; Jan. 1998, pp. 187-190; In English; Also announced as 19980202346

Contract(s)/Grant(s): NAS8-40544; NAS8-40645; NASA Order H-2592D; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Most capsules designed to return payloads from earth orbit use rockets for deorbit. They have modest payload mass & volume fractions. Active attitude control raises costs, and the deorbit rocket imposes risks which increase development and operational

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

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.

19980202457 Honeywell Technology Center, Minneapolis, MN USA
Avionics/Electronics Quick Reliability Assessment ***Final Report, Sep. 1991 - Feb. 1994***
Havey, G., Honeywell Technology Center, USA; Lewis, S., Honeywell Technology Center, USA; Seifert, G., Honeywell Technology Center, USA; Mar. 1998; 78p; In English
Contract(s)/Grant(s): F30602-91-C-0083; AF Proj. 2338
Report No.(s): AD-A342681; C950805; AFRL-IF-WP-TR-1998-5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

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

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

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

19980203012 Naval Postgraduate School, Monterey, CA USA

Testing and Analysis of a Transonic Axial Compressor

Grossman, Bart L., Naval Postgraduate School, USA; Sep. 1997; 119p; In English

Report No.(s): AD-A341113; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A test program to evaluate a new transonic axial compressor stage was conducted. The stage was designed (by Nelson Sanger of NASA Lewis) relying heavily on Computational Fluid Dynamics (CFD) techniques while minimizing conventional empirical design methods. The stage was installed in the NPS Transonic Compressor Test Rig and instrumented with fixed temperature and pressure probes. A new PC-based data acquisition system was commissioned and programmed for stage performance measurements. These were obtained at 50, 60, 65, 70, and 80% of the design speed before failure of the spinner retaining bolt led to the loss of the stage. The flow through the rotor was analyzed and the rotor performance predicted using a 3-dimensional viscous code (RVC3D). The predicted rotor performance agreed qualitatively and was numerically consistent with the measured stage performance.

DTIC

Transonic Flow; Computational Fluid Dynamics; Transonic Compressors; Turbocompressors

13
GEOSCIENCES

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

19980203119 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Forecasting Wet Microbursts Associated with Summertime Airmass Thunderstorms Over the Southeastern USA

Mackey, James B., Air Force Inst. of Tech., USA; Mar. 1998; 142p; In English

Report No.(s): AD-A340856; AFIT/GM/ENP/98M-06; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Microbursts are intense downbursts from thunderstorms that affect an area less than 4 km and have a lifespan less than 10 minutes. Wet microbursts are associated with heavy precipitation and are common in the eastern and southeastern part of the country. The greatest threat from microbursts is to low flying aircraft, where the rapid fluctuations in horizontal and vertical airflow create tremendous shear zones. Microbursts have been determined to be the causal factor behind at least three major aircraft accidents resulting in numerous fatalities. Due to the short lifespan of microbursts, they often strike without warning and pose a serious challenge to operational forecasters trying to protect Air Force assets. This thesis seeks to develop a technique to forecast wet microbursts using currently operational technology, including upper air soundings and WSR-88D products. The technique developed is comprised of three distinct phases. First, recognize the potential threat for given environmental conditions. Second, predict the maximum outflow velocities from microbursts using predictive equations. Third, highlight key NEXRAD radar products that demonstrate a strong potential to serve as precursors to microburst formation. Using the technique developed, warning leadtimes on the order of 10 to 20 minutes appear to be reasonable in operational applications.

DTIC

Meteorological Radar; Aircraft Accidents

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19980202599 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Human Factors Evaluation of Vocoders for Air Traffic Control Environments, Phase 2, ATC Simulation

Sollenberger, Randy L., Federal Aviation Administration, USA; LaDue, James, Federal Aviation Administration, USA; Carver, Brian, Federal Aviation Administration, USA; Heinze, Annmarie, Federal Aviation Administration, USA; Dec. 1997; 48p; In English

Contract(s)/Grant(s): DTFA03-94-C-00042

Report No.(s): AD-A341106; DOT/FAA/CT-TN97/25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vocoders offer a potential solution to radio congestion by digitizing human speech and compressing the signal to achieve low bandwidth voice transmissions. A reduction in bandwidth will allow the addition of more communication channels to the system and reduce radio congestion. This air traffic control simulation study is the second phase of a research effort to compare the effec-

tiveness of two 4.8 kbps vocoders (designated as A and B for test purposes) with the current analog radio communication system. Sixteen air traffic controllers from Level 5 Terminal Radar Approach Controls participated in the study and performed 12 one hour traffic scenarios over 3 days of testing. Scenarios consisted of medium and high traffic volumes designed to produce different levels of controller tasidoad. The communications configuration allowed each simulation pilot to transmit with jet, propeller, or helicopter background noises. The results indicated that the vocoders did not affect controller workload or performance. In general, intelligibility and acceptability ratings were highest for analog radio, slightly lower for vocoder B, and lowest for vocoder A. In addition, intelligibility and acceptability ratings were highest for jet background noise, slightly lower for propeller background noise, and lowest for helicopter background noise. Controller taskload had no effect on intelligibility and acceptability. This human factors evaluation indicated that both vocoders were highly intelligible and acceptable for air traffic control environments. Even the least preferred vocoder did not substantially interfere with controller performance. This study suggests that vocoder technology could replace the current analog radio system in the future.
DTIC
Environments; Human Factors Engineering; Vocoders; Air Traffic Control; Air Traffic Controllers (Personnel); Control Simulation; Radio Communication; Jet Aircraft Noise; Voice Communication

19980202744 Institute for Human Factors TNO, Soesterberg, Netherlands
The Influence of Expectation on the Perception of Linear Horizontal Motion ***Interim Report De Invloed van Verwachting op de Waarneming van Lineaire Horizontale Beweging***
Mesland, B. S., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Groen, E. L., Institute for Human Factors TNO, Netherlands; Mar. 23, 1998; 23p; In English
Contract(s)/Grant(s): A92/KLu/331; Proj. 789.3
Report No.(s): TD98-0016; TM-98-A010; Copyright; Avail: Issuing Activity (TNO Human Factors Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

In normal situations the judgment of linear horizontal self-motion largely depends on visual information. In the absence of adequate visual feedback, however, the information provided the otolith organs and non-vestibular proprioceptors (together called linear proprioceptiva sensors) becomes more important. The peculiar thing about these sensors is that they respond to linear accelerations, which may arise from transiatory motion as well as from the gravitational acceleration. As a consequence it is difficult for these sensors to differentiate between linear translations and tilt with respect to gravity. This ambiguity may lead to the false perception of tilt during pure linear accelerations along a horizontal path. Still, it was our experience that these illusory perceptions only seldomly occur when we oscillate subjects to and fro on a linear track (the ESA-sled). It was hypothesized that prior knowledge of subjects, who had seen the linear motion device before the experiment, may have biased the perception towards a veridical sensation of linear self-motion as opposed to an illusory sensation of self-tilt. In other words, their expectation may have influenced their perception of the stimulus. Therefore, two experiments were carried out in which this cognitive factor was controlled as an independent variable. In the first experiment, blindfolded subjects who were completely naive regarding the characteristics of the motion device were exposed to oscillatory linear motion at frequencies of 0.159 and 0.252 Hz. In the second experiment similar linear motion was applied, but this time in combination with various angles of actual tilt of the subject's seat. The subjects in this experiment were informed beforehand that they would be exposed to various combinations of linear motion and tilt, so that they-although not completely naive-could not have any expectation about whether to perceive tilt or translation. In both experiments the dependent variable was the report about experienced self-motion or self-tilt. The results of both experiments unambiguously confirm that illusory self-tilt is sensed much more frequently when the subject has no precise expectation about the linear motion. Expressed in another way, the expectation of subjects who have seen the sled beforehand seems to enhance the threshold for perceiving self-tilt. It is concluded that expectation from prior knowledge and previous experience should be taken into account when modelling the perception of self-motion. The experiments described in this report clearly demonstrate that the expectation, or mental state, of a subject has significant bearing on the judgment of linear horizontal self-motion. Clearly, the interpretation of sensory information about self-motion depends on more than the transfer characteristics of the peripheral senses alone. As a consequence, one has to take cognitive factors, such as prior knowledge or previous experience, into account when investigating or modelling the perception of self-motion. From this point of view it will be difficult to exactly predict or reconstruct the sensations of an aviator on the basis of the physical characteristics of a flight path. Seen from the positive side, the expectation of an experienced pilot is likely to be advantageous for the appreciation of simulated motion in a flight simulator.
Author
Motion Simulators; Horizontal Orientation; Cognition; Expectation; Flight Simulators; Visual Perception

19980202913 Army Construction Engineering Research Lab., Champaign, IL USA

A Comparative Study of Indoor Human Response to Blast Noise and Sonic Booms ***Final Report***

Schomer, Paul D., Army Construction Engineering Research Lab., USA; Sias, John W., Army Construction Engineering Research Lab., USA; Maglieri, Domenic, Army Construction Engineering Research Lab., USA; Mar. 1998; 79p; In English

Report No.(s): AD-A341404; CERL-TR-98/25; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

For the past two decades in the USA, blast sounds and sonic booms both have been assessed using C weighted day and night average sound level. Based almost exclusively on blast sound research, a new method which replaces the C weighted day and night average sound level recently has been recommended, reviewed, and incorporated into a new American National Standard. As in the previous method, the new method includes and assesses sonic boom sounds in a like manner to blast sounds. However, while available evidence suggested that in an indoor setting sonic boom could be treated in a similar fashion to blast sounds, experimental evidence was lacking. to provide the lacking comparison data, this study tested the responses of subjects to sonic booms to determine if they were consistent with the previous blast response data presented by Schomer in 1994, since these data formed the basis for the new method. A key factor in the design of this study was the presentation of real blasts and booms to subjects situated in real structures in the field. The new data resulting from this study show good general agreement with the previous data.

DTIC

Noise; Noise Tolerance; Sonic Booms; Blasts; Human Tolerances

19980203133 Metrica, Inc., San Antonio, TX USA

Evaluating the Decision Making Skills of General Aviation Pilots

Driskill, Walter E., Metrica, Inc., USA; Weissmuller, Johnny J., Metrica, Inc., USA; Quebe, John C., Metrica, Inc., USA; Hand, Darryl K., Metrica, Inc., USA; Feb. 1998; 43p; In English

Report No.(s): AD-A341118; DOT/FAA/AM-98/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An instrument consisting of 51 items was developed to assess pilot decision-making skill. Each item consisted of a stem, a short description of an aviation scenario requiring a decision on the part of the pilot. Four alternatives were provided, and subjects were instructed to rank order the alternatives from best to worst solution to the scenario presented. Rank-ordered judgments of a sample of 246 general aviation (GA) pilots (with an average of about 500 hours of total flying experience) were compared with the recommended solutions provided by an expert panel. Results indicated that, overall, GA pilots and an expert panel of pilots agreed in their judgments of the appropriate course of action in situations critical to flight safety. However, the degree of agreement of individual general aviation pilots with the recommended solutions varied widely. An index of agreement (Safety Deviation Index) was calculated that expressed the degree of agreement of individual GA pilots with the recommended solutions. Initial evaluation of this index indicates that it demonstrates adequate psychometric properties and that, as other research would suggest, it has little relationship with common demographic or flight experience measures.

DTIC

Decision Making; Aircraft Pilots; Pilot Performance

19980203141 Army Aeromedical Research Lab., Fort Rucker, AL USA

Heat Stress Effects of a Navy/USMC vs. Army Aviator Ensemble in a UH-6O Helicopter Simulator ***Final Report***

Reardon, Matthew J., Army Aeromedical Research Lab., USA; Fraser, E. B., Army Aeromedical Research Lab., USA; Katz, Lawrence, Army Aeromedical Research Lab., USA; LeDuc, Patricia, Army Aeromedical Research Lab., USA; Morovati, Pooria, Army Aeromedical Research Lab., USA; Feb. 1998; 73p; In English

Contract(s)/Grant(s): Proj-3M162787A879

Report No.(s): AD-A341281; USAARL-98-21; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This aviator heat stress study used a between test subjects design with one environmental condition (hot) and two current (U.S. Navy/U.S. Marine Corps vs. U.S. Army) rotary wing MOPP4 ensembles encumbered with additional ballistic protective and overwater survival components. Four U.S. Marine Corps (USMC) aviators (2 UH-60 crews) were tested in the hot condition and their physiological, subjective, and flight performance responses compared to those of 14 Army aviators (9 crews) who tested in the same condition in a previous related study. The environmental condition consisted of 100 F (dry bulb) and 20 percent relative humidity (RH) in an environmental chamber where test subjects walked on a treadmill for 20 minutes to simulate preflight outdoor activities, and 100 F and 50 percent RH (90 F wet bulb globe temperature WBGT) in the UH-60 simulator. Every 30 minutes the right seat pilot encountered instrument meteorological conditions and ascended to 2000 feet to perform a 10 minute set of standard maneuvers. These maneuvers included straight and level (SL), right standard rate turn (RSRT), left climbing turn (LCT), and left descending turn (LDT). After each iteration of the set of standard maneuvers, the pilot returned to nap of the earth (NOE) and

contour flight between control points. The right seat pilot also performed up to four 1 minute hovers (HOVs) and hover turns (HOVTs) in the 2 hour sortie and three in the second 2 hour sortie.
DTIC
Aircraft Pilots; Heat Tolerance; Flight Simulators; Physiological Effects; UH-60A Helicopter

15
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.

19980202236 Short Bros. Public Ltd. Co., Engineering Centre, Belfast, UK
Use of Virtual Prototyping in Design and Manufacturing
Kingsbury, Alan, Short Bros. Public Ltd. Co., UK; Virtual Manufacturing; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

In 1989, Shorts first looked at the potential of replacing physical wooden mock-ups with electronic solid model assemblies. They took existing drawings of the F100 wing and translated these into a solid mock-up. Although these early solid modellers were not user friendly, the resulting demonstrator was impressive and proved that large assemblies could be produced. This gave Shorts the confidence to embark on a small production contract - Trent Nacelle. This had 10 designers working concurrently generating structures, hydraulic and electrical systems all as solid models. Initially there was concern because the project planners who traditionally measure drawing output were getting very little drawings released during the first half of the program as the solid models and assemblies were being created. However, the drawing output increased dramatically near the end because of the fast production of assembly drawings giving a resulting overall reduction in leadtime of 20%. This result set the scene for the technology strategy on the Lear 45 when the decision was made to solid model the complete aircraft including all structures, hydraulic and electrical systems.
Author
Manufacturing; Design Analysis; Prototypes; Concurrent Engineering; Systems Integration; Lear Jet Aircraft; Aircraft Models

19980202240 Wright Lab., Simulation Assessment Validation Environment Program, Wright-Patterson AFB, OH USA
Simulation Assessment Validation Environment (SAVE) Reducing Cost and Risk Through Virtual Manufacturing
Poindexter, James W., Wright Lab., USA; Cole, Paul E., Lockheed Aeronautical Systems Co., USA; May 1998; 10p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The 1994 Lean Aircraft Initiative industry forum, identified the application of Virtual Manufacturing (VM), in the form of integrated simulation technologies, as a key technology in reducing cost and increasing quality. The Joint Strike Fighter Program initiated the Simulation Assessment Validation Environment (SAVE) Program to integrate a set of VM tools and to validate the potential savings through a series of demonstrations. This paper describes the SAVE program and its potential for a $3 Billion (US) savings on the Joint Strike Fighter program.
Author
Virtual Reality; Manufacturing; Cost Reduction; Aircraft Industry; Systems Integration; Functional Design Specifications

19980202243 Daimler-Benz Aerospace A.G., Munich, Germany
Virtual Manufacturing for Composites
Berchtold, G., Daimler-Benz Aerospace A.G., Germany; May 1998; 12p; In English; Also announced as 19980202235; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The geometry based aircraft design to manufacturing process is described, highlighting the extensive use of simulation activities along its phases to verify the geometry. It is shown that the manufacturing simulation has an exceptional role in minimizing or even avoiding global iteration loops. In addition, some wording is defined in the world of virtual manufacturing to be able to position the different software developments. Based on this information two examples are shown - the composite stiffener technology and the composite skin technology - both based on prepreg tape targeting for high performance aircraft structures. Due to the full usage of all necessary material-, manufacturing-, and machine data right from the beginning of the design it is demonstrated that a fully automatic NC-code generation can be achieved at the end of the engineer's design process producing verified manufacturable data without any additional human interaction based on the designed geometry. By means of this, time consuming iteration loops coming back from the manufacturing phases and creating local iteration loops to the structural analysis are avoided. Real examples of this "virtual manufacturing" process are indicating 10 to 50 times faster processes compared to existing methods.

Finally, for both manufacturing technologies the integration with the corresponding optimization code is explained, outlining the important issues in this field.
Author
Structural Analysis; Aircraft Design; Aircraft Structures; Prepregs; Manufacturing; Virtual Reality; Computerized Simulation; Composite Materials; Optimization

19980202475 Colorado Univ., Dept. of Aerospace Engineering and Sciences, Boulder, CO USA
Fast staggered algorithms for the solution of three-dimensional nonlinear aeroelastic problems
Farhat, Charbel, Colorado Univ., USA; Lesoinne, Michel, Colorado Univ., USA; Mar. 1998; 12p; In English; Also announced as 19980202469
Contract(s)/Grant(s): F49620-97-1-0059; NAG2-827; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

We overview two sequential and parallel partitioned procedures that are popular in computational nonlinear aeroelasticity, and address their limitation in terms of accuracy and numerical stability. We propose two alternative serial and parallel staggered algorithms for the solution of coupled transient aeroelastic problems, and demonstrate their superior accuracy and computational efficiency with the flutter analysis of the AGARD Wing 445.6. We contrast our results with those computed by other investigators and validate them with experimental data.
Author
Flutter Analysis; Aeroelasticity; Numerical Stability; Parallel Processing (Computers); Staggering; Parsing Algorithms; Three Dimensional Models; Mathematical Models; Conservation Laws; Nonlinearity

Subject Term Index

U

V

W

X

Personal Author Index

Report Documentation Page

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