

Nasa Paper Models

NASA Technical Paper

state of the art in aeronautical engineering has been continually accelerated by the development of advanced analysis and design tools. Used in the early design stages for aircraft and spacecraft, these methods have provided a fundamental understanding of physical phenomena and enabled designers to predict and analyze critical characteristics of new vehicles, including the capability to control or modify unsatisfactory behavior. For example, the relatively recent emergence and routine use of extremely powerful digital computer hardware and software has had a major impact on design capabilities and procedures. Sophisticated new airflow measurement and visualization systems permit the analyst to conduct micro- and macro-studies of

properties within flow fields on and off the surfaces of models in advanced wind tunnels. Trade studies of the most efficient geometrical shapes for aircraft can be conducted with blazing speed within a broad scope of integrated technical disciplines, and the use of sophisticated piloted simulators in the vehicle development process permits the most important segment of operations—the human pilot—to make early assessments of the acceptability of the vehicle for its intended mission. Knowledgeable applications of these tools of the trade dramatically reduce risk and redesign, and increase the marketability and safety of new aerospace vehicles.

Modeling Flight NASA Latest Version

The NASA Technical Reports Server (NTRS) houses half a million publications that are a valuable means of information to researchers, teachers, students, and the general public. These documents are all aerospace related with much scientific and technical information created or funded by NASA. Some types of documents include conference papers, research reports, meeting papers, journal articles and more. This is one of those

documents.

Modeling Flight

This special collector's edition of *The Art of NASA* adds 32 pages of new material, a presentation case, a new cover, a paper model of the Lunar Module, four postcards, and a rolled poster.

NASA Space Systems Technology Model

On 29 July 1958, President Dwight D. Eisenhower signed the National Aeronautics and Space Act, creating the National Aeronautics and Space Administration (NASA), which became operational on 1 October of that year. Over the next 50 years, NASA achieved a set of spectacular feats, ranging from advancing the well-established field of aeronautics to pioneering the new fields of Earth and space science and human spaceflight. In the

midst of the geopolitical context of the Cold War, 12 Americans walked on the Moon, arriving in peace “for all mankind.” Humans saw their home planet from a new perspective, with unforgettable Apollo images of Earthrise and the “Blue Marble,” as well as the “pale blue dot” from the edge of the solar system. A flotilla of spacecraft has studied Earth, while other spacecraft have probed the depths of the solar system and the universe beyond. In the 1980s, the evolution of aeronautics gave us the first winged human spacecraft, the Space Shuttle, and the International Space Station stands as a symbol of human cooperation in space as well as a possible way station to the stars. With the Apollo fire and two Space Shuttle accidents, NASA has also seen the depths of tragedy. In this volume, a wide array of scholars turn a critical eye toward NASA’s first 50 years, probing an institution widely seen as the premier agency for exploration in the world, carrying on a long tradition of exploration by the United States and the human species in general. Fifty years after its founding, NASA finds itself at a crossroads that historical perspectives can only help to illuminate.

NASA Technical Paper

Two-volume collection of case studies on aspects of NACA-NASA research by noted engineers, airmen, historians, museum curators, journalists, and independent scholars. Explores various aspects of how NACA-NASA research took aeronautics from the subsonic to the hypersonic era.-publisher description.

NASA Technical Memorandum

This paper details the author experiences with the validation of computer models to predict low gravity fluid behavior. It reviews the literature of low gravity fluid behavior as a starting point for developing a baseline set of test cases. It examines authors attempts to validate their models against these cases and the issues they encountered. The main issues seem to be that: Most of the data is described by empirical correlation rather than fundamental relation; Detailed measurements of the flow field have not been made; Free surface shapes are observed but through thick plastic cylinders, and

therefore subject to a great deal of optical distortion; and Heat transfer process time constants are on the order of minutes to days but the zero-gravity time available has been only seconds. Chato, David J. and Marchetta, Jeffery and Hochstein, John I. and Kassemi, Mohammad Glenn Research Center NASA/TM-2005-213832, E-15202, AIAA Paper 2004-1150

The Art of NASA

Steady-state and transient computer models of the RL10A-3-3A rocket engine have been created using the Rocket Engine Transient Simulation (ROCETS) code. These models were created for several purposes. The RL10 engine is a critical component of past, present, and future space missions; the model will give NASA an in-house capability to simulate the performance of the engine under various operating conditions and mission profiles. The RL10 simulation activity is also an opportunity to further validate the ROCETS program. The ROCETS code is an important tool for modeling rocket engine systems at NASA Lewis. ROCETS provides a modular and general framework for

simulating the steady-state and transient behavior of any desired propulsion system. Although the ROCETS code is being used in a number of different analysis and design projects within NASA, it has not been extensively validated for any system using actual test data. The RL10A-3-3A has a ten year history of test and flight applications; it should provide sufficient data to validate the ROCETS program capability. The ROCETS models of the RL10 system were created using design information provided by Pratt & Whitney, the engine manufacturer. These models are in the process of being validated using test-stand and flight data. This paper includes a brief description of the models and comparison of preliminary simulation output against flight and test-stand data. Binder, Michael Unspecified Center NASA-CR-190786, E-9585, NAS 1.26:190786 NAS3-25266; RTOP 593-12-00...

Models of the Trapped Radiation Environment

The current status of combustor-noise prediction in the NASA Aircraft Noise Prediction Program (ANOPP) for current-generation (N) turbofan engines is summarized. Best

methods for near-term updates are reviewed. Long-term needs and challenges for the N+1 through N+3 timeframe are discussed. This work was carried out under the NASA Fundamental Aeronautics Program, Subsonic Fixed Wing Project, Quiet Aircraft Subproject. Hultgren, Lennart, S. Glenn Research Center NASA/TM-2012-217671, AIAA Paper- 2012-2087, E-18346

Space-based Astronomy

An approach is introduced to automated model derivation for knowledge based systems. The approach, model compilation, involves procedurally generating the set of domain models used by a knowledge based system. With an implemented example, how this approach can be used to derive models of different precision and abstraction is illustrated, and models are tailored to different tasks, from a given set of base domain models. In particular, two implemented model compilers are described, each of which takes as input a base model that describes the structure and behavior of a simple electromechanical device, the Reaction Wheel Assembly of NASA's Hubble Space

Telescope. The compilers transform this relatively general base model into simple task specific models for troubleshooting and redesign, respectively, by applying a sequence of model transformations. Each transformation in this sequence produces an increasingly more specialized model. The compilation approach lessens the burden of updating and maintaining consistency among models by enabling their automatic regeneration. Keller, Richard M. and Baudin, Catherine and Iwasaki, Yumi and Nayak, Pandurang and Tanaka, Kazuo Ames Research Center NASA-TM-107895, FIA-90-04-06-01, NAS 1.15:107895 NAS2-11555; NAS2-12952...

NASA Space Systems Technology Model

Control research for a Turbine Based Combined Cycle (TBCC) propulsion system is the current focus of the Hypersonic Guidance, Navigation, and Control (GN&C) discipline team. The ongoing work at the NASA Glenn Research Center (GRC) supports the Hypersonic GN&C effort in developing tools to aid the design of control algorithms to manage a TBCC airbreathing propulsion system during a critical operating period. The

critical operating period being addressed in this paper is the span when the propulsion system transitions from one cycle to another, referred to as mode transition. One such tool, that is a basic need for control system design activities, is computational models (hereto forth referred to as models) of the propulsion system. The models of interest for designing and testing controllers are Control Development Models (CDMs) and Control Validation Models (CVMs). CDMs and CVMs are needed for each of the following propulsion system elements: inlet, turbine engine, ram/scram dual-mode combustor, and nozzle. This paper presents an overall architecture for a TBCC propulsion system model that includes all of the propulsion system elements. Efforts are under way, focusing on one of the propulsion system elements, to develop CDMs and CVMs for a TBCC propulsion system inlet. The TBCC inlet aerodynamic design being modeled is that of the Combined-Cycle Engine (CCE) Testbed. The CCE Testbed is a large-scale model of an aerodynamic design that was verified in a small-scale screening experiment. The modeling approach includes employing existing state-of-the-art simulation codes, developing new dynamic simulations, and performing system identification experiments on the hardware in the NASA GRC 10 by 10-Foot Supersonic Wind Tunnel. The developed CDMs and CVMs will be available for control studies prior to hardware buildup. The system identification experiments on the CCE Testbed will characterize the

necessary dynamics to be represented in CDMs for control design. Thes

NASA 50th Anniversary Proceedings: NASA's First 50 Years: Historical Perspectives

This paper determines the information required about system recovery to compute the reliability of a class of reconfigurable systems. Upper and lower bounds are derived for these systems. The class consists of those systems that satisfy five assumptions: the components fail independently at a low constant rate, fault occurrence and system reconfiguration are independent processes, the reliability model is semi-Markov, the recovery functions which describe system configuration have small means and variances, and the system is well designed. The bounds are easy to compute, and examples are included. White, A. L. Unspecified Center NASA-CR-172340, NAS 1.26:172340 NAS1-16000...

NASA's Contributions to Aeronautics: Flight environment, operations, flight testing, and research

The aircraft industry jointly with NASA is studying enabling technologies for higher speed, longer range aircraft configurations. Higher speeds, higher temperatures, and aerodynamics are driving these newer aircraft configurations towards long, slender, flexible fuselages. Aircraft response during ground operations, although often overlooked, is a concern due to the increased fuselage flexibility. This paper discusses modeling and simulation of the High Speed Civil Transport aircraft during taxiing, take-off, and landing. Finite element models of the airframe for various configurations are used and combined with nonlinear landing gear models to provide a simulation tool to study responses to different ground input conditions. A commercial computer simulation program is used to numerically integrate the equations of motion and to compute estimates of the responses using an existing runway profile. Results show aircraft responses exceeding safe acceptable human response levels. Reaves, Mercedes C. and Horta, Lucas G. Langley Research Center AIRCRAFT PERFORMANCE; COMPUTERIZED SIMULATION; FINITE ELEMENT METHOD; LANDING SIMULATION; SUPERSONIC TRANSPORTS; TAKEOFF; TAXIING; AIRFIELD SURFACE MOVEMENTS; DYNAMIC

RESPONSE; MATHEMATICAL MODELS; FLIGHT CHARACTERISTICS; TRANSPORT AIRCRAFT; EQUATIONS OF MOTION; AIRCRAFT LANDING; COMMERCIAL AIRCRAFT; LANDING GEAR; NUMERICAL INTEGRATION; VIBRATION MODE

**NASA's Contributions to Aeronautics, Volume 2, Flight Environment
..., NASA/SP-2010-570-Vol 2, 2010, ***

This compilation of abstracts describes and indexes over 780 technical reports resulting from the scientific and engineering work performed and managed by the Lewis Research Center in 1977. All the publications were announced in the 1977 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace Abstracts). Documents cited include research reports, journal articles, conference presentations, patents and patent applications, and theses.

Approaches to Validation of Models for Low Gravity Fluid Behavior

This paper describes a modeling effort used to develop an improved type of magnetic bearing controller, called a modal controller, for use on high speed flywheel systems. The controller design is based on models of the flywheel system, is designed to directly control the natural dynamics of the spinning rotor, and is generic enough to be readily adapted to future flywheel systems. Modeling and development are described for two key controller subsystems: the modal controller subsystem, which allows direct control over the rotor rigid body modes, and the bending mode compensation subsystem, which tracks, and prevents interference from, the rotor bending modes during flywheel operation. Integration of modeling results into the final controller is described and data taken on the NASA Glenn D1 flywheel module during high speed operation are presented and discussed. The improved modal controller described in this paper has been successfully developed and implemented and has been used for regular hands-free operation of the D1 flywheel module up to its maximum operating speed of 60,000 RPM. Dever, Timothy P. and Brown, Gerald V. and Duffy, Kirsten P. and Jansen, Ralph H. Glenn Research Center NASA/TM-2005-213877, E-15248, AIAA Paper 2004-5626

NASA Tech Briefs

The paper provides details on the structure and implementation of the Computational Materials program at the NASA Langley Research Center. Examples are given that illustrate the suggested approaches to predicting the behavior and influencing the design of nanostructured materials such as high-performance polymers, composites, and nanotube-reinforced polymers. Primary simulation and measurement methods applicable to multi-scale modeling are outlined. Key challenges including verification and validation of models are highlighted and discussed within the context of NASA's broad mission objectives. Gates, Thomas S. and Hinkley, Jeffrey A. Langley Research Center
NASA/TM-2003-212163, L-18267, NAS 1.15:212163

An RL10a-3-3a Rocket Engine Model Using the Rocket Engine Transient Simulator (Rocets) Software

This paper describes two results from a continuing effort to provide accurate cost-

benefit analyses of the NASA Terminal Area Productivity (TAP) program technologies. Previous tasks have developed airport capacity and delay models and completed preliminary cost benefit estimates for TAP technologies at 10 U.S. airports. This task covers two improvements to the capacity and delay models. The first improvement is the completion of a detailed model set for the Chicago O'Hare (ORD) airport. Previous analyses used a more general model to estimate the benefits for ORD. This paper contains a description of the model details with results corresponding to current conditions. The second improvement is the development of specific wind speed and direction criteria for use in the delay models to predict when the Aircraft Vortex Spacing System (AVOSS) will allow use of reduced landing separations. This paper includes a description of the criteria and an estimate of AVOSS utility for 10 airports based on analysis of 35 years of weather data. Hemm, Robert and Shapiro, Gerald Langley Research Center NAS2-14361; RTOP 538-04-14-02

A Comparison of Combustor-Noise Models

This paper presents a step-by-step tutorial of the methods and the tools that were used for the reliability analysis of fault-tolerant systems. The approach used in this paper is the Markov (or semi-Markov) state-space method. The paper is intended for design engineers with a basic understanding of computer architecture and fault tolerance, but little knowledge of reliability modeling. The representation of architectural features in mathematical models is emphasized. This paper does not present details of the mathematical solution of complex reliability models. Instead, it describes the use of several recently developed computer programs SURE, ASSIST, STEM, and PAWS that automate the generation and the solution of these models. Butler, Ricky W. and Johnson, Sally C. Langley Research Center COMPUTER SYSTEMS DESIGN; COMPUTER SYSTEMS PERFORMANCE; FAULT TOLERANCE; MARKOV PROCESSES; MATHEMATICAL MODELS; RELIABILITY ANALYSIS; RELIABILITY ENGINEERING; APPLICATIONS PROGRAMS (COMPUTERS); ARCHITECTURE (COMPUTERS); FAILURE ANALYSIS; SYSTEM FAILURES...

Monthly Catalog of United States Government Publications

This paper at first describes the fluid network approach recently implemented into the National Combustion Code (NCC) for the simulation of transport of aerosols (volatile particles and soot) in the particulate sampling systems. This network-based approach complements the other two approaches already in the NCC, namely, the lower-order temporal approach and the CFD-based approach. The accuracy and the computational costs of these three approaches are then investigated in terms of their application to the prediction of particle losses through sample transmission and distribution lines. Their predictive capabilities are assessed by comparing the computed results with the experimental data. The present work will help establish standard methodologies for measuring the size and concentration of particles in high-temperature, high-velocity jet engine exhaust. Furthermore, the present work also represents the first step of a long term effort of validating physics-based tools for the prediction of aircraft particulate emissions. Wey, Thomas and Liu, Nan-Suey Glenn Research Center
NASA/TM-2008-215304, AIAA Paper-2009-0257, E-16575

Model Compilation: An Approach to Automated Model Derivation

Real-time piloted aircraft simulations with digital computers have been performed at Ames Research Center (ARC) for over two decades. For the simulation of conventional aircraft models, the establishment of initial vehicle and control orientations at various operational flight regimes has been adequately handled by either analog techniques or simple inversion processes. However, exotic helicopter configurations have been introduced recently that require more sophisticated techniques because of their expanded degrees of freedom and environmental vibration levels. At ARC, these techniques are used for the backward solutions to real-time simulation models as required for the generation of trim points. These techniques are presented in this paper with examples from a blade-element helicopter simulation model. Mcfarland, Richard E. Ames Research Center NASA-TM-89466, A-87238, NAS 1.15:89466 RTOP 505-67-51...

Control Activity in Support of NASA Turbine Based Combined Cycle (Tbcc) Research

This paper describes the methodology, model, input data, and analysis results of a reusable launch vehicle engine operability study conducted with the goal of supporting design from an operations perspective. Paralleling performance analyses in schedule and method, this requires the use of metrics in a validated operations model useful for design, sensitivity, and trade studies. Operations analysis in this view is one of several design functions. An operations concept was developed given an engine concept and the predicted operations and maintenance processes incorporated into simulation models. Historical operations data at a level of detail suitable to model objectives were collected, analyzed, and formatted for use with the models, the simulations were run, and results collected and presented. The input data used included scheduled and unscheduled timeline and resource information collected into a Space Transportation System (STS) Space Shuttle Main Engine (SSME) historical launch operations database. Results reflect upon the importance not only of reliable hardware but upon operations and corrective maintenance process improvements. Christenson, R. L. and Komar, D. R.

Marshall Space Flight Center...

NASA's First A

This paper reports on accomplishments in 2004 in (1) development of Stirling-converto CFD models at NASA Glenn and via a NASA grant, (2) a Stirling regenerator-research effort being conducted via a NASA grant (a follow-on effort to an earlier DOE contract), and (3) a regenerator-microfabrication contract for development of a \"next-generation Stirling regenerator.\" Cleveland State University is the lead organization for all three grant/contractual efforts, with the University of Minnesota and Gedeon Associates as subcontractors. Also, the Stirling Technology Company and Sunpower, Inc. are both involved in all three efforts, either as funded or unfunded participants. International Mezzo Technologies of Baton Rouge, Louisiana is the regenerator fabricator for the regenerator-microfabrication contract. Results of the efforts in these three areas are summarized. Tew, Roy C. and Dyson, Rodger W. and Wilson, Scott D. and Demko,

Rikako Glenn Research Center NASA/TM-2004-213404, E-14912

Upper and Lower Bounds for Semi-Markov Reliability Models of Reconfigurable Systems

This paper presents a rational approach to modelling the triple velocity correlations that appear in the transport equations for the Reynolds stresses. All existing models of these correlations have largely been formulated on phenomenological grounds and are defective in one important aspect: they all neglect to allow for the dependence of these correlations on the local gradients of mean velocity. The mathematical necessity for this dependence will be demonstrated in the paper. The present contribution lies in the novel use of Group Representation Theory to determine the most general tensorial form of these correlations in terms of all the second- and third-order tensor quantities that appear in the exact equations that govern their evolution. The requisite representation did not exist in the literature and therefore had to be developed specifically for this purpose by Professor G. F. Smith. The outcome of this work is a mathematical

framework for the construction of algebraic, explicit, and rational models for the triple velocity correlations that are theoretically consistent and include all the correct dependencies. Previous models are reviewed, and all are shown to be an incomplete subset of this new representation, even to lowest order. Younis, B. A. and Gatski, T. B. and Speziale, C. G. Langley Research Center NASA/TM-1999-209134, L-17847, NAS 1.15:209134

Taxiing, Take-Off, and Landing Simulation of the High Speed Civil Transport Aircraft

Structure detection is a procedure for selecting a subset of candidate terms, from a full model description, that best describes the observed output. This is a necessary procedure to compute an efficient system description which may afford greater insight into the functionality of the system or a simpler controller design. Structure computation as a tool for black-box modeling may be of critical importance in the development of robust, parsimonious models for the flight-test community. Moreover, this approach may

lead to efficient strategies for rapid envelope expansion that may save significant development time and costs. In this study, a least absolute shrinkage and selection operator (LASSO) technique is investigated for computing efficient model descriptions of non-linear aeroelastic systems. The LASSO minimises the residual sum of squares with the addition of an l_1 penalty term on the parameter vector of the traditional l_2 minimisation problem. Its use for structure detection is a natural extension of this constrained minimisation approach to pseudo-linear regression problems which produces some model parameters that are exactly zero and, therefore, yields a parsimonious system description. Applicability of this technique for model structure computation for the F/A-18 (McDonnell Douglas, now The Boeing Company, Chicago, Illinois) Active Aeroelastic Wing project using flight test data is shown for several flight conditions (Mach numbers) by identifying a parsimonious system description with a high percent fit for cross-validated data. Kukreja, Sunil L. Armstrong Flight Research Center NASA/TM-2007-214623, H-2736, AIAA Paper 2007-2317

Resources in Education

In aerospace power systems, mass and volume are key considerations to produce a viable design. The utilization of fuel cells is being studied for a commercial aircraft electrical power unit. Based on preliminary analyses, a SOFC/gas turbine system may be a potential solution. This paper describes the parametric mass and volume models that are used to assess an aerospace hybrid system design. The design tool utilizes input from the thermodynamic system model and produces component sizing, performance, and mass estimates. The software is designed such that the thermodynamic model is linked to the mass and volume model to provide immediate feedback during the design process. It allows for automating an optimization process that accounts for mass and volume in its figure of merit. Each component in the system is modeled with a combination of theoretical and empirical approaches. A description of the assumptions and design analyses is presented. Tornabene, Robert and Wang, Xiao-yen and Steffen, Christopher J., Jr. and Freeh, Joshua E. Glenn Research Center NASA/TM-2005-213819, GT2005-68334, E-15177

Bibliography of Lewis Research Center Technical Publications Announced in 1977

Modeling and Development of a Magnetic Bearing Controller for a High Speed Flywheel System

http://development.digicelgroup.com/TEXT/290926/378496L1Q1/clinical__pharmacy_and__therapeutics-roger-walker.pdf

http://development.digicelgroup.com/TEXT/3WM3833087/8WM3083/disputed-moral__issues_a_reader.pdf

http://development.digicelgroup.com/PLAY/111637/Q9H1903/harley_davidson__service__manuals__fxst.pdf

http://development.digicelgroup.com/TEXT/111637/35335ZA/yamaha-ttr50e__ttr50ew-full_service__repair-manual_2006-2014.pdf

http://development.digicelgroup.com/EPDF/Q67490Q614/Q57948Q/modern-operating_systems-solution__manual_3rd__edition.pdf

http://development.digicelgroup.com/BOOK/35889HP/111637290926/audi_tfsi_engine.pdf

http://development.digicelgroup.com/RTF/5855C8Z/111637290926/the_mcgraw_hill_illustrated_encyclopedia-of-robotics_artificial_intelligence.pdf

http://development.digicelgroup.com/KINDLE/an292609/743N184A48111637/mtd_thor_x-35_ohv-manual.pdf

http://development.digicelgroup.com/RTF/290926/5P8K852211/god-faith-identity_from_the_ashes-reflections_of-children_and-grandchildren_of_holocaust_survivors_2014_11_24.pdf

http://development.digicelgroup.com/PDF/111637/L7791Y2220/honda_vt750c_owners_manual.pdf