Framework For Multidisciplinary Analysis Design And

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Advanced UAV Aerodynamics, Flight Stability and Control Pascual Marques 2017-07-11 Comprehensively covers emerging aerospace technologies Advanced UAV aerodynamics, flight stability and control: Novel concepts, theory and applications presents emerging aerospace technologies in the rapidly growing field of unmanned aircraft engineering. Leading scientists, researchers and inventors describe the findings and innovations accomplished in current research programs and industry applications throughout the world. Topics included cover a wide range of new aerodynamics concepts and their applications for real world fixed-wing (airplanes), rotary wing (helicopter) and quad-rotor aircraft. The book begins with two introductory chapters that address fundamental principles of aerodynamics and flight stability and form a knowledge base for the student of Aerospace Engineering. The book then covers aerodynamics of fixed wing, rotary wing and hybrid unmanned aircraft, before introducing aspects of aircraft flight stability and control. Key features: Sound technical level and inclusion of high-quality experimental and numerical data. Direct application of the aerodynamic technologies and flight stability and control principles described in the book in the development of real-world novel unmanned aircraft concepts. Written by world-class academics, engineers, researchers and inventors from prestigious institutions and industry. The book provides up-to-date information in the field of Aerospace Engineering for university students and lecturers, aerodynamics researchers, aerospace engineers, aircraft designers and manufacturers.
A Relative Adequacy Framework for Multi-model Management in Single- and Multidisciplinary Design Optimization Ahmed Bayoumy 2020 "We present a novel multi-model management method for numerical design optimization. The goal is to determine whether any of the analysis models associated with lower computational cost (that are typically expected to have inferior predictive capability relative to models associated with higher computational cost) can be used in certain areas of the design space as the latter is being explored during the optimization process. The framework quantifies and utilizes relative errors among available models regardless of their expected fidelity to enhance the predictive capability of inexpensive models and reduce the use of expensive ones. We implement our strategy by means of a trust-region management framework that utilizes the mesh adaptive direct search derivative-free optimization algorithm. We first present the methodology for single-disciplinary design optimization problems and demonstrate it using a cantilevered flexible beam example. Results show significant reduction in the computational cost of the optimization process. We also investigate the scalability of the proposed method using an airfoil shape optimization problem.We then proceed to extend our method to solve multidisciplinary design optimization problems with particular emphasis on strongly-coupled fluid-structure interaction. We illustrate that interactions can have a significant impact on multi-model management as models that could have been selected in a single-disciplinary analysis environment can be inadequate in a multidisciplinary analysis context. We implement our method for two multidisciplinary design optimization architectures: the monolithic multidisciplinary feasible formulation (also known as all-at-once) and a penalty-based distributed interdisciplinary feasible formulation.Finally, we extend the method to allow the consideration of time-dependent multidisciplinary design optimization problems. The algorithms are modified to automate the search for adequate modeling parameters during the time-dependent multidisciplinary analysis. We demonstrate the proposed time-invariant and time-dependent multidisciplinary design optimization methods by means of three problems: a flexible plate fluid-structure interaction problem, a flexible beam fluid-structure interaction problem, and a transonic fan flow problem. Results show that both methods are accurate and efficient and result in significant cost savings, especially in the presence of strongly-coupled disciplines"--
Metaheuristic Applications in Structures and Infrastructures Amir Hossein Gandomi 2013-01-31 Due to an ever-decreasing supply in raw materials and stringent constraints on conventional energy sources, demand for lightweight, efficient and low-cost structures has become crucially important in modern engineering design. This requires engineers to search for optimal and robust design options to address design problems that are commonly large in scale and highly nonlinear, making finding solutions challenging. In the past two decades, metaheuristic algorithms have shown promising power, efficiency and versatility in solving these difficult optimization problems. This book examines the latest developments of metaheuristics and their applications in structural engineering, construction engineering and earthquake engineering, offering practical case studies as examples to demonstrate real-world applications. Topics cover a range of areas within engineering, including big bang-big crunch approach, genetic algorithms, genetic programming, harmony search, swarm intelligence and some other metaheuristic methods. Case studies include structural identification, vibration analysis and control, topology optimization, transport infrastructure design, design of reinforced concrete, performance-based design of structures and smart pavement management. With its wide range of everyday problems and solutions, Metaheursitic Applications in Structures and Infrastructures can serve as a supplementary text for design courses and computation in engineering as well as a reference for researchers and engineers in metaheuristics, optimization in civil engineering and computational intelligence. Review of the latest development of

metaheuristics in engineering. Detailed algorithm descriptions with focus on practical implementation. Uses practical case studies as examples and applications.

Numerical Methods for Reliability and Safety Assessment Seifedine Kadry 2014-09-30 This book offers unique insight on structural safety and reliability by combining computational methods that address multiphysics problems, involving multiple equations describing different physical phenomena and multiscale problems, involving discrete sub-problems that together describe important aspects of a system at multiple scales. The book examines a range of engineering domains and problems using dynamic analysis, nonlinear methods, error estimation, finite element analysis and other computational techniques. This book also: · Introduces novel numerical methods · Illustrates new practical applications · Examines recent engineering applications · Presents up-to-date theoretical results · Offers perspective relevant to a wide audience, including teaching faculty/graduate students, researchers and practicing engineers.

Advances in Multidisciplinary Analysis and Optimization Raviprakash R. Salagame 2020-08-10 This volume contains select papers presented during the 2nd National Conference on Multidisciplinary Analysis and Optimization. It discusses new developments at the core of optimization methods and its application in multiple applications. The papers showcase fundamental problems and applications which include domains such as aerospace, automotive and industrial sectors. The variety of topics and diversity of insights presented in the general field of optimization and its use in design for different applications will be of interest to researchers in academia or industry.

The Art of Differentiating Computer Programs Uwe Naumann 2012-01-01 This is the first entry-level book on algorithmic (also known as automatic) differentiation (AD), providing fundamental rules for the generation of first- and higher-order tangent-linear and adjoint code. The author covers the mathematical underpinnings as well as how to apply these observations to real-world numerical simulation programs. Readers will find: examples and exercises, including hints to solutions; the prototype AD tools dco and dcc for use with the examples and exercises; first- and higher-order tangent-linear and adjoint modes for a limited subset of C/C++, provided by the derivative code compiler dcc; a supplementary website containing sources of all software discussed in the book, additional exercises and comments on their solutions (growing over the coming years), links to other sites on AD, and errata.

International Aerospace Abstracts 1998

Parallel Numerical Computation with Applications Laurence Tianruo Yang 2012-12-06 Parallel Numerical Computations with Applications contains selected edited papers presented at the 1998 Frontiers of Parallel Numerical Computations and Applications Workshop, along with invited papers from leading researchers around the world. These papers cover a broad spectrum of topics on parallel numerical computation with applications; such as advanced parallel numerical and computational optimization methods, novel parallel computing techniques, numerical fluid mechanics, and other applications related to material sciences, signal and image processing, semiconductor technology, and electronic circuits and systems design. This state-of-the-art volume will be an up-to-date resource for researchers in the areas of parallel and distributed computing.

Progress in Systems Engineering Henry Selvaraj 2014-08-12 This collection of proceedings from the International Conference on Systems Engineering, Las Vegas, 2014 is orientated toward systems engineering, including topics like aero-space, power systems, industrial automation and robotics, systems theory, control theory, artificial intelligence, signal processing, decision support, pattern recognition and machine learning, information and communication technologies, image processing, and computer vision as well as its applications. The volume's main focus is on models, algorithms, and software tools that facilitate efficient and convenient utilization of modern achievements in systems engineering.

Multidisciplinary Design Optimization Natalia M. Alexandrov 1997-01-01 Multidisciplinary design optimization (MDO) has recently emerged as a field of research and practice that brings together many previously disjointed disciplines and tools of engineering and mathematics. MDO can be described as a technology, environment, or methodology for the design of complex, coupled engineering systems, such as aircraft, automobiles, and other mechanisms, the behavior of which is determined by interacting subsystems.

Variational Analysis and Aerospace Engineering Giuseppe Buttazzo 2009-08-21 The Variational Analysis and Aerospace Engineering conference held in Erice, Italy in September 2007 at International School of Mathematics, Guido Stampacchia provided a platform for aerospace engineers and mathematicians to discuss the problems requiring an extensive application of mathematics. This work contains papers presented at the workshop.

Aerospace System Analysis and Optimization in Uncertainty Loïc Brevault 2020-08-26 Spotlighting the field of Multidisciplinary Design Optimization (MDO), this book illustrates and implements state-of-the-art methodologies within the complex process of aerospace system design under uncertainties. The book provides approaches to integrating a multitude of components and constraints with the ultimate goal of reducing design cycles. Insights on a vast assortment of problems are provided, including discipline modeling, sensitivity analysis, uncertainty propagation, reliability analysis, and global multidisciplinary optimization. The extensive range of topics covered include areas of current open research. This Work is destined to become a fundamental reference for aerospace systems engineers, researchers, as well as for practitioners and engineers working in areas of optimization and uncertainty. Part I is largely comprised of fundamentals. Part II presents methodologies for single discipline problems with a review of existing uncertainty propagation, reliability analysis, and optimization techniques. Part III is dedicated to the uncertainty-based MDO and related issues. Part IV deals with three MDO related issues: the multifidelity, the multi-objective optimization and the mixed continuous/discrete optimization and Part V is devoted to test cases for aerospace vehicle design.

Multidisciplinary Optimization Branch Experience Using ISIGHT Software S. L. Padula 1999 The Multidisciplinary Optimization (MDO) Branch at NASA Langley is investigating frameworks for supporting multidisciplinary analysis and optimization research. A framework provides software and system services to integrate computational tasks and allows the researcher to concentrate more on the application and less on the programming details. A framework also provides a common working environment and a full range of optimization tools, and so increases the productivity of multidisciplinary research teams. Finally, a framework enables staff members to develop applications for use by disciplinary experts in other organizations. This year, the MDO Branch has gained experience with the iSIGHT framework. This paper describes experiences with four aerospace applications, including (1) reusable launch vehicle sizing, (2) aerospike nozzle design, (3) low-noise rotorcraft trajectories, and (4) acoustic liner design. Brief overviews of each problem are provided, including the number and type of

disciplinary codes and computation time estimates. In addition, the optimization methods, objective functions, design variables, and constraints are described for each problem. For each case, discussions on the advantages and disadvantages of using the iSIGHT framework are provided as well as notes on the ease of use of various advanced features and suggestions for areas of improvement.
Aircraft Aerodynamic Design with Computational Software Arthur Rizzi 2021-05-20 This modern text presents aerodynamic design of aircraft with realistic applications, using CFD software and guidance on its use. Tutorials, exercises, and mini-projects provided involve design of real aircraft, ranging from straight to swept to slender wings, from low speed to supersonic. Supported by online resources and supplements, this toolkit covers topics such as shape optimization to minimize drag and collaborative designing. Prepares seniors and first-year graduate students for design and analysis tasks in aerospace companies. In addition, it is a valuable resource for practicing engineers, aircraft designers, and entrepreneurial consultants.
Discretization Methods and Structural Optimization — Procedures and Applications Hans A. Eschenauer 2012-12-06 In recent years, the Finite Element Methods FEM were more and more employed in development and design departments as very fast working tools in order to determine stresses, deformations, eigenfrequencies etc. for all kinds of constructions under complex loading conditions. Meanwhile. very effective software systems have been developed by various research teams although some mathematical problems (e. g. convergence) have not been solved satisfac torily yet. In order to make further advances and to find a common language between mathe maticians and mechanicians the "Society for Applied Mathematics and Mechanics" (GAMM) agreed on the foundation of a special Committee: "Discretization Methods in Solid Mechanics" focussing on the following problems: - Structuring of various methods (displacement functions, hybrid and mixed approaches, etc. >, - Survey of approach functions (Lagrange-/Hermite-polynominals, Spline-functions), - Description of singularities, - Convergence and stability, - Practical and theoretical optimality to all mentioned issues (single and interacting). One of the basic aims of the GAMM-Committee is the interdisciplinary cooperation between mechanicians, mathematicians, and users which shall be intensified. Thus, on September 22, 1985 the committee decided to hold a seminar on "Structural Optimization" in order to allow an exchange of experiences and thoughts between the experts of finite element methods and those of structural optimization. A GAMM-seminar entitled "Discretization Methods and Structural Optimization - Procedures and Applications" was hold on October 5-7, 1988 at the Unversity of Siegen.
AeroStruct: Enable and Learn How to Integrate Flexibility in Design Ralf Heinrich 2018-01-30 This book reports on the German research initiative AeroStruct, a three-year collaborative project between universities and the aircraft industry. It describes the development of an integrated multidisciplinary simulation environment for aircraft analysis and optimization using high-fidelity methods. This system is able to run at a high level of automatism, thus representing a step forward with respect to previous ones. Its special features are: a CAD description that is independent from the disciplines involved, an automated CFD mesh generation and an automated structure model generation including a sizing process. The book also reports on test cases by both industrial partners and DLR demonstrating the advantages of the new environment and its suitability for the industry. These results were also discussed during the AeroStruct closing Symposium, which took place on 13-14 October 2015 at the DLR in Braunschweig, Germany. The book provides expert readers with a timely report on multidisciplinary aircraft design and optimization. Thanks to a good balance between theory and practice, it is expected to address an audience of both academics and professional, and to offer them new ideas for future research and development.
Collaborative Multidisciplinary Design Optimization for Conceptual Design of Complex Products Edris Safavi 2016-10-06 MULTIDESCIPLINARY design optimization (MDO) has developed in theory andpractice during the last three decades with the aim of optimizing complexproducts as well as cutting costs and product development time. Despite thisdevelopment, the implementation of such a method in industry is still a challenge andmany complex products suffer time and cost overruns. Employing higher fidelity models (HFMs) in conceptual design, one of the early and most important phases in the design process, can play an important role in increasing the knowledge base regarding the concept under evaluation. However, design space in the presence of HFMs could significantly be expanded. MDO has proven to be an important tool for searching the design space and finding optimal solutions. This leads to a reduction in the number of design iterations later in the design process, with wiser and more robust decisions made early in the design process to rely on. In complex products, different systems from a multitude of engineering disciplines have to work tightly together. This stresses the importance of evolving various domain experts in the design process to improve the design from diverse engineering perspectives. Involving more engineers in the design process early on raises the challenges of collaboration, known to be an important barrier to MDO implementation in industry. Another barrier is the unavailability and lack of MDO experts in industry; those who understand the MDO process and know the implementation tasks involved. In an endeavor to address the mentioned implementation challenges, a novel collaborative multidisciplinary design optimization (CMDO) framework is defined in order to be applied in the conceptual design phase. CMDO provides a platform where many engineers team up to increase the likelihood of more accurate decisions being taken early on. The structured way to define the engineering responsibilities and tasks involved in MDO helps to facilitate the implementation process. It will be further elaborated that educating active engineers with MDO knowledge is an expensive and time-consuming process for industries. Therefore, a guideline for CMDO implementation in conceptual design is proposed in this thesis that can be easily followed by design engineers with limited prior knowledge in MDO. The performance of the framework is evaluated in a number of case studies, including applications such as aircraft design and the design of a tidal water power plant, and by engineers in industry and student groups in academia.
Computer Supported Cooperative Work in Design II Weiming Shen 2006-02-26 This book constitutes the thoroughly refereed post-proceedings of the 9th International Conference on Computer Supported Cooperative Work in Design, CSCWD 2005, held in Coventry, UK, in May 2005. The 65 revised full papers presented were carefully reviewed and selected from numerous submissions during at least two rounds of reviewing and improvement.
A Web-Based System for Monitoring and Controlling Multidisciplinary Design Projects National Aeronautics and Space Administration (NASA) 2018-08-10 In today's competitive environment, both industry and government agencies are under enormous pressure to reduce the time and cost of multidisciplinary design projects. A number of frameworks have been introduced to assist in this process by facilitating the integration of and communication among diverse disciplinary

codes. An examination of current frameworks reveals weaknesses in various areas such as sequencing, displaying, monitoring, and controlling the design process. The objective of this research is to explore how Web technology, in conjunction with an existing framework, can improve these areas of weakness. This paper describes a system that executes a sequence of programs, monitors and controls the design process through a Web-based interface, and visualizes intermediate and final results through the use of Java(Tm) applets. A small sample problem, which includes nine processes with two analysis programs that are coupled to an optimizer, is used to demonstrate the feasibility of this approach. Salas, Andrea O. and Rogers, James L. Langley Research Center NASA/TM-97-206287, L-17685, NAS 1.15:206287 RTOP 509-10-11-01...

Engineering Design Optimization Joaquim R. R. A. Martins 2021-11-18 Based on course-tested material, this rigorous yet accessible graduate textbook covers both fundamental and advanced optimization theory and algorithms. It covers a wide range of numerical methods and topics, including both gradient-based and gradient-free algorithms, multidisciplinary design optimization, and uncertainty, with instruction on how to determine which algorithm should be used for a given application. It also provides an overview of models and how to prepare them for use with numerical optimization, including derivative computation. Over 400 high-quality visualizations and numerous examples facilitate understanding of the theory, and practical tips address common issues encountered in practical engineering design optimization and how to address them. Numerous end-of-chapter homework problems, progressing in difficulty, help put knowledge into practice. Accompanied online by a solutions manual for instructors and source code for problems, this is ideal for a one- or two-semester graduate course on optimization in aerospace, civil, mechanical, electrical, and chemical engineering departments.

Advances in Evolutionary and Deterministic Methods for Design, Optimization and Control in Engineering and Sciences António Gaspar-Cunha 2020-11-23 This book presents improved and extended versions of selected papers from EUROGEN 2019, a conference with interest on developing or applying evolutionary and deterministic methods in optimization of design and emphasizing on industrial and societal applications.

Multidisciplinary Design Analysis and Optimization of Aerospace Composites Charles Lu 2019-04-30 Multidisciplinary Design and Optimization of Aerospace Composite Materials is a collection of ten SAE technical papers focusing on the design analysis of aerospace composite structures from the perspective of various disciplines. The book concentrates on the following aspects: Analytical methods for weight design of aircraft structures, including a parametric geometry model capable of generating dedicated models for both aerodynamic and structural solvers. Methodologies for evaluating the structural performance of carbon/epoxy composite panels. An aerodynamic design of flexible wings made of composite structures. Thermal design and analysis of composite enclosures. Methodologies for analyzing the acoustic performance of composite structures, including the design optimization method to evaluate the acoustic performance in terms of transmission loss (TL) of various composite panels. The lightening effect on composites, presenting a theoretical method to compute the electrical current propagating through composite structures due to lightning strikes. The issue of fire resistance as most polymer resins are flammable once the respective ignition temperatures are reached. A probabilistic-based reliability analysis of the composite structures. The method is demonstrated on a graphite/epoxy composite space habitat subjected to the debris attacks. A sustainability analysis of aircraft composite materials, including improved durability, less maintenance, and lower energy consumption.

Design Optimization of Unmanned Aerial Vehicles Athanasios Papageorgiou 2019-11-13 Over the last years, Unmanned Aerial Vehicles (UAVs) have gradually become a more efficient alternative to manned aircraft, and at present, they are being deployed in a broad spectrum of both military as well as civilian missions. This has led to an unprecedented market expansion with new challenges for the aeronautical industry, and as a result, it has created a need to implement the latest design tools in order to achieve faster idea-to-market times and higher product performance. As a complex engineering product, UAVs are comprised of numerous sub-systems with intricate synergies and hidden dependencies. To this end, Multidisciplinary Design Optimization (MDO) is a method that can identify systems with better performance through the concurrent consideration of several engineering disciplines under a common framework. Nevertheless, there are still many limitations in MDO, and to this date, some of the most critical gaps can be found in the disciplinary modeling, in the analysis capabilities, and in the organizational integration of the method. As an aeronautical product, UAVs are also expected to work together with other systems and to perform in various operating environments. In this respect, System of Systems (SoS) models enable the exploration of design interactions in various missions, and hence, they allow decision makers to identify capabilities that are beyond those of each individual system. As expected, this significantly more complex formulation raises new challenges regarding the decomposition of the problem, while at the same time, it sets further requirements in terms of analyses and mission simulation. In this light, this thesis focuses on the design optimization of UAVs by enhancing the current MDO capabilities and by exploring the use of SoS models. Two literature reviews serve as the basis for identifying the gaps and trends in the field, and in turn, five case studies try to address them by proposing a set of expansions. On the whole, the problem is approached from a technical as well as an organizational point of view, and thus, this research aims to propose solutions that can lead to better performance and that are also meaningful to the Product Development Process (PDP). Having established the above foundation, this work delves firstly into MDO, and more specifically, it presents a framework that has been enhanced with further system models and analysis capabilities, efficient computing solutions, and data visualization tools. At a secondary level, this work addresses the topic of SoS, and in particular, it presents a multi-level decomposition strategy, multi-fidelity disciplinary models, and a mission simulation module. Overall, this thesis presents quantitative data which aim to illustrate the benefits of design optimization on the performance of UAVs, and it concludes with a qualitative assessment of the effects that the proposed methods and tools can have on both the PDP and the organization.

Influence of flight control laws on structural sizing of commercial aircraft Rahmetalla Nazzeri 2021-11-15 The increasing demand for new civil aircraft pushes aircraft manufacturers to develop innovative solutions that lead in particular to mass reductions. One way to achieve these kinds of improvements is the use of multidisciplinary analysis and optimization. In this sense the intention of this PhD thesis is to develop a multidisciplinary framework in order to quantify the impact of load alleviation function parameter changes on structural components like the wing and fuselage in terms of resulting mass changes. The developed iterative process chain covers the loads calculation including an active load alleviation system, a structural assessment of the wing and fuselage components

and a dedicated feedback loop in order to update mass and stiffness properties of the loads calculation model. The study shows that significant mass reductions are achievable while on the other hand estimated mass penalties are irrelevant.
Concurrent Engineering in the 21st Century Josip Stjepandić 2015-01-30 Presenting the gradual evolution of the concept of Concurrent Engineering (CE), and the technical, social methods and tools that have been developed, including the many theoretical and practical challenges that still exist, this book serves to summarize the achievements and current challenges of CE and will give readers a comprehensive picture of CE as researched and practiced in different regions of the world. Featuring in-depth analysis of complex real-life applications and experiences, this book demonstrates that Concurrent Engineering is used widely in many industries and that the same basic engineering principles can also be applied to new, emerging fields like sustainable mobility. Designed to serve as a valuable reference to industry experts, managers, students, researchers, and software developers, this book is intended to serve as both an introduction to development and as an analysis of the novel approaches and techniques of CE, as well as being a compact reference for more experienced readers.
Jiao yu za zhi suo yin 1936
Evolutionary Optimization and Game Strategies for Advanced Multi-Disciplinary Design Jacques Periaux 2015-04-13 Many complex aeronautical design problems can be formulated with efficient multi-objective evolutionary optimization methods and game strategies. This book describes the role of advanced innovative evolution tools in the solution, or the set of solutions of single or multi disciplinary optimization. These tools use the concept of multi-population, asynchronous parallelization and hierarchical topology which allows different models including precise, intermediate and approximate models with each node belonging to the different hierarchical layer handled by a different Evolutionary Algorithm. The efficiency of evolutionary algorithms for both single and multi-objective optimization problems are significantly improved by the coupling of EAs with games and in particular by a new dynamic methodology named “Hybridized Nash-Pareto games”. Multi objective Optimization techniques and robust design problems taking into account uncertainties are introduced and explained in detail. Several applications dealing with civil aircraft and UAV, UCAV systems are implemented numerically and discussed. Applications of increasing optimization complexity are presented as well as two hands-on test cases problems. These examples focus on aeronautical applications and will be useful to the practitioner in the laboratory or in industrial design environments. The evolutionary methods coupled with games presented in this volume can be applied to other areas including surface and marine transport, structures, biomedical engineering, renewable energy and environmental problems. This book will be of interest to students, young scientists and engineers involved in the field of multi physics optimization.
Multidisciplinary Design Optimization and Its Application in Deep Manned Submersible Design Binbin Pan 2020-08-28 This book investigates Reliability-based Multidisciplinary Design Optimization (RBMDO) theory and its application in the design of deep manned submersibles (DMSs). Multidisciplinary Design Optimization (MDO) is an effective design method for large engineering systems like aircraft, warships, and satellites, which require designers and engineers from various disciplines to cooperate with each other. MDO can be used to handle the conflicts that arise between these disciplines, and focuses on the optimal design of the system as a whole. However, it can also push designs to the brink of failure. In order to keep the system balanced, Reliability-based Design (RBD) must be incorporated into MDO. Consequently, new algorithms and methods have to be developed for RBMDO theory. This book provides an essential overview of MDO, RBD, and RBMDO and subsequently introduces key algorithms and methods by means of case analyses. In closing, it introduces readers to the design of DMSs and applies RBMDO methods to the design of the manned hull and the general concept design. The book is intended for all students and researchers who are interested in system design theory, and for engineers working on large, complex engineering systems.
Towards a Multidisciplinary Framework for the Design and Analysis of Security Ceremonies Marcelo Carlos 2014
Design Optimization of Wind Energy Conversion Systems with Applications Karam Maalawi 2020-04-15 Modern and larger horizontal-axis wind turbines with power capacity reaching 15 MW and rotors of more than 235-meter diameter are under continuous development for the merit of minimizing the unit cost of energy production (total annual cost/annual energy produced). Such valuable advances in this competitive source of clean energy have made numerous research contributions in developing wind industry technologies worldwide. This book provides important information on the optimum design of wind energy conversion systems (WECS) with a comprehensive and self-contained handling of design fundamentals of wind turbines. Section I deals with optimal production of energy, multi-disciplinary optimization of wind turbines, aerodynamic and structural dynamic optimization and aeroelasticity of the rotating blades. Section II considers operational monitoring, reliability and optimal control of wind turbine components.
Multidisciplinary Design Optimization Supported by Knowledge Based Engineering Jaroslaw Sobieszczanski-Sobieski 2017-05-08 Multidisciplinary Design Optimization supported by Knowledge Based Engineering supports engineers confronting this daunting and new design paradigm. It describes methodology for conducting a system design in a systematic and rigorous manner that supports human creativity to optimize the design objective(s) subject to constraints and uncertainties. The material presented builds on decades of experience in Multidisciplinary Design Optimization (MDO) methods, progress in concurrent computing, and Knowledge Based Engineering (KBE) tools. Key features: Comprehensively covers MDO and is the only book to directly link this with KBE methods Provides a pathway through basic optimization methods to MDO methods Directly links design optimization methods to the massively concurrent computing technology Emphasizes real world engineering design practice in the application of optimization methods Multidisciplinary Design Optimization supported by Knowledge Based Engineering is a one-stop-shop guide to the state-of-the-art tools in the MDO and KBE disciplines for systems design engineers and managers. Graduate or post-graduate students can use it to support their design courses, and researchers or developers of computer-aided design methods will find it useful as a wide-ranging reference.
Multidisciplinary Design Optimization Framework For Multi-Phase Building Design Process - Technology Demonstration Using Design Of Office Building And Robotically 3D Printed Habitat Naveen Kumar Muthumanickam 2021 A growing body of work in the building design field acknowledges that the design of buildings is growing into a complex multidisciplinary problem that must reconcile multiple conflicting environmental, economic, social, and technical design objectives. This fact has been driving research in Architecture, Engineering and Construction (AEC) toward development of rigorous evidence-based (simulation-based) design optimization frameworks that generate and evaluate numerous building design alternatives using optimization in concert with simulation and analysis models. While such frameworks are well-known and widely employed in engineering design domains, similar efforts

in the AEC field are largely compartmentalized into separate domains such as structural, energy, daylighting, and other performance factors. Most of the building design optimization efforts are either multidisciplinary optimization (MDO) confined to just a specific design phase or single disciplinary optimization (SDO) spanning across multiple phases. This dissertation is a three-part presentation on (1) identifying technological deficiencies impeding the implementation of multi-phase MDO in AEC field; (2) developing technologies to address the identified deficiencies, thereby constituting a multi-phase MDO framework for AEC field; and (3) test the developed MDO framework by implementing it in representative building design problems. Specifically, the developed MDO framework includes a generative algorithm for batch modelling of large sets of building designs, metamodels for rapid analysis of such large sets of designs for energy, daylighting (using machine learning) and constructability and computational framework to support interoperability between these tools. The developed MDO framework is used to design a sample office building (optimized for energy and daylighting) and a 3D Printed habitat (optimized for structural, spatial layout and robotic constructability). Finally, the advantages and limitations of the developed framework along with learnings and future avenues for research in AEC field are also discussed.

Industrial Control Systems Adedeji B. Badiru 2016-04-19 Issues such as logistics, the coordination of different teams, and automatic control of machinery become more difficult when dealing with large, complex projects. Yet all these activities have common elements and can be represented by mathematics. Linking theory to practice, Industrial Control Systems: Mathematical and Statistical Models and Techni

Modular Systems for Energy Usage Management Yatish T. Shah 2020-01-22 "...[a] very unique book that integrates benefits of modular systems for enhanced sustainability to meet the global challenges of rapid and sometimes uncontrolled industrialization in the 21st century."—Pinakin Patel, T2M Global This book examines the role of the modular approach for the back end of the energy industry—energy usage management. It outlines the use of modular approaches for the processes used to improve energy conservation and efficiency, which are preludes to the prudent use of energy. Since energy consumption is conventionally broken down into four sectors—residential, transportation, industrial, and commercial—the discussions on energy usage management are also broken down into these four sectors in the book. The book examines the use of modular systems for five application areas that cover the sectors described above: buildings, vehicles, computers and electrical/electronic products, district heating, and wastewater treatment and desalination. This book also discusses the use of a modular approach for energy storage and transportation. Finally, it describes how the modular approach facilitates bottom-up, top-down, and hybrid simulation and modeling of the energy systems from various scientific and socioeconomic perspectives. Aimed at industry professionals and researchers involved in the energy industry, this book illustrates in detail, with the help of concrete industrial examples, how a modular approach can facilitate management of energy usage.

Multi-Disciplinary Analysis and Optimization Frameworks Cynthia Gutierrez Naiman 2013-06 Since July 2008, the Multidisciplinary Analysis & Optimization Working Group (MDAO WG) of the Systems Analysis Design & Optimization (SAD&O) discipline in the Fundamental Aeronautics Program s Subsonic Fixed Wing (SFW) project completed one major milestone, Define Architecture & Interfaces for Next Generation Open Source MDAO Framework Milestone (9/30/08), and is completing the Generation 1 Framework validation milestone, which is due December 2008. Included in the presentation are: details of progress on developing the Open MDAO framework, modeling and testing the Generation 1 Framework, progress toward establishing partnerships with external parties, and discussion of additional potential collaborations.

Non-Deterministic Metamodeling for Multidisciplinary Design Optimization of Aircraft Systems Under Uncertainty Daniel L. Clark (Jr.) 2019 To make coupled multi-physics-informed design decisions, multidisciplinary analysis, design optimization and uncertainty quantification must be present to accurately represent the full system under investigation. Unfortunately, all of these processes are computationally demanding, requiring a large number of system evaluations with identified uncertain variables, and iterative system evaluations with respect to the design variables of interest. Surrogate or metamodels are used to alleviate the computational burden in both these design exploration activities by trading accuracy with efficiency. The primary objective of this dissertation is to develop a flexible surrogate modeling technique capable of quantifying the uncertainty of multidisciplinary systems in an iterative and efficient procedure.In this work, the Non-Deterministic Kriging (NDK) method is derived. This surrogate model represents a flexible approach for approximating epistemic and aleatory uncertainty. To achieve an iterative and efficient computational framework additional tasks were established: (1) characterize and develop a unified stochastic process incorporating incomplete and mixed uncertainty data; (2) develop a novel adaptive sampling method that effectively and efficiently updates the NDK model to enable a global multidisciplinary design optimization technique under uncertainty; (3) derive analytic sensitivities to achieve non-deterministic sensitivities with respect to the design variables; (4) propose an efficient reliability-based design optimization framework for multidisciplinary systems using NDK to reduce the design space.

Systems Engineering Models Adedeji B. Badiru 2019-03-19 This book presents a comprehensive compilation of practical systems engineering models. The application and recognition of systems engineering is spreading rapidly, however there is no book that addresses the availability and usability of systems engineering models. Notable among the models to be included are the V-Model, DEJI Model, and Waterfall Model. There are other models developed for specific organizational needs, which will be identified and presented in a practical template so that other organizations can learn and use them. A better understanding of the models, through a comprehensive book, will make these models more visible, embraced, and applied across the spectrum. Visit www.DEJImodel.com for model details. Features Covers applications to both small and large problems Displays decomposition of complex problems into smaller manageable chunks Discusses direct considerations of the pertinent constraints that exist in the problem domain Presents systematic linking of inputs to goals and outputs

The Design of a Distributed, Object-oriented, Component-based Framework in Multidisciplinary Design Optimization Babak Mahdavi 2002 "The Multidisciplinary Design Optimization (MDO) can be defined as a methodology for the design of complex engineering systems where collaboration and abilities to mutually interacting between different disciplines are fundamental. In this thesis, Virtual Aircraft Design and Optimization fRamework (VADOR), a distributed, object-oriented, component-based framework enabling MDO practice at Bombardier Aerospace is introduced. The purpose of the VADOR framework is to enable the seamless

integration of commercial and in-house analysis applications in a heterogeneous, distributed computing environment, and allow the management and sharing of the data. The VADOR distributed environment offers visibility to the process, permitting the teams to monitor progress or track changes in design projects and problems. Documentation of the MDO process is vital to ensure clear communication of the process within the team defining it and in the broader design team interacting with it. VADOR is implemented in Java, providing an object-oriented, platform-independent framework. The concepts of design pattern and component-based approach are used along with multi-tiered distributed design to deliver highly modular and flexible architecture. (Abstract shortened by UMI.)" --

Human Work Interaction Design. Work Analysis and HCI Pedro Campos 2013-12-12 This book constitutes the thoroughly refereed post-conference proceedings of the Third IFIP WG 13.6 Working Conference on Human Work Interaction Design, HWID 2012, held in Copenhagen, Denmark, in December 2012. The 16 revised papers presented were carefully selected for inclusion in this volume. The papers reflect many different areas and address many complex and diverse work domains, ranging from medical user interfaces, work and speech interactions at elderly care facilities, greenhouse climate control, navigating through large oil industry engineering models, crisis management, library usability, and mobile probing. They have been organized in the following topical sections: work analysis: dimensions and methods; interactions, models and approaches; and evaluations, interactions and applications.

Digital Transformation of Multidisciplinary Design Firms Marcella M. Bonanomi 2019-06-19 This book analyzes the process-oriented and organizational changes related to the digital transformation of multidisciplinary design firms. Based on this it proposes a systematic analysis-based methodology for change management, which consists of two distinct, but complementary components: a framework and a set of analysis methods. It particularly focuses on the relationship between the new paradigms, perspectives, and context of change related to digital transformation. The proposed framework combines these three elements in order to identify and address areas of investigation concerning process-oriented and organizational changes in the context of digital transformation, and also quantitatively and qualitatively assesses these changes in practice. This book offers the first comprehensive review of change management and digital practice, and includes case studies to enhance readers’ understanding of change management in the context of the digitalization. As such it is of interest to both industry practitioners and researchers.