Design And Weight Optimization Of Gravity Roller Conveyor

Performance-Based Optimization of Structures introduces a method to bridge the gap between structural optimization theory and its practical application to structural engineering. The Performance-Based Optimization (PBO) method combines modern structural optimisation theory with performance based design concepts to produce a powerful technique for use in structural design. This book provides the latest PBO techniques for achieving optimal topologies and shapes of continuum structures with stress, displacement and mean compliance constraints. The emphasis is strongly placed on practical applications of automated PBO techniques to the strut-and-tie modelling of structural concrete, which includes reinforced and prestressed concrete structures. Basic concepts underlying the development of strut-and-lie models, design optimization procedure, and detailing of structural concrete are described in detail. Alternative approaches to topology optimization are also introduced. The book contains numerous practical design examples illustrating the nature of the load transfer mechanism of structures.
Thermal systems play an increasingly symbiotic role alongside mechanical systems in varied applications spanning materials processing, energy conversion, pollution, aerospace, and automobiles. Responding to the need for a flexible, yet systematic approach to designing thermal systems across such diverse fields, Design and Optimization of Thermal
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.
Radiators for rejecting waste heat from power generators in space can be an important weight contributor to the total weight of space power systems. For the rejection of from a few hundred watts up to perhaps a few kilowatts of waste heat straight fin radiators are the most practical. In a recent study program of weight optimization of thermoelectric power generators, a technique was established which permits the rapid determination of the geometry of a minimum weight finned radiator system. From data presented in the literature, three design equations were derived which relate twelve geometric, thermal, environmental and material parameters of an idealized fin system with no base cylinder interaction. A fourth equation was derived to take into account the base cylinder interaction and to reduce the idealized design to the realistic case. Three families of curves and auxiliary tables were prepared to assist in the rapid reduction of the idealized design equations.
Describing a new optimization algorithm, the “Teaching-Learning-Based Optimization (TLBO),” in a clear and lucid style, this book maximizes reader insights into how the TLBO algorithm can be used to solve continuous and discrete optimization problems involving single or multiple objectives. As the algorithm operates on the principle of teaching and learning, where teachers influence the quality of learners’ results, the elitist version of TLBO algorithm (ETLBO) is described along with applications of the TLBO algorithm in the fields of electrical engineering, mechanical design, thermal engineering, manufacturing engineering, civil engineering, structural engineering, computer engineering, electronics engineering, physics and biotechnology. The book offers a valuable resource for scientists, engineers and practitioners involved in the development and usage of advanced optimization algorithms.
Topology Optimization in Engineering Structure Design explores the recent advances and applications of topology optimization in engineering

structures design, with a particular focus on aircraft and aerospace structural systems. To meet the increasingly complex engineering challenges provided by rapid developments in these industries, structural optimization techniques have developed in conjunction with them over the past two decades. The latest methods and theories to improve mechanical performances and save structural weight under static, dynamic and thermal loads are summarized and explained in detail here, in addition to potential applications of topology optimization techniques such as shape preserving design, smart structure design and additive manufacturing. These new design strategies are illustrated by a host of worked examples, which are inspired by real engineering situations, some of which have been applied to practical structure design with significant effects. Written from a forward-looking applied engineering perspective, the authors not only summarize the latest developments in this field of structure design but also provide both theoretical knowledge and a practical guideline. This book should appeal to graduate students, researchers and engineers, in detailing how to use topology optimization methods to improve product design. Combines practical applications and topology optimization methodologies Provides problems inspired by real engineering difficulties Designed to help researchers in universities acquire more engineering requirements

A rigorous yet accessible graduate textbook covering both fundamental and advanced optimization theory and algorithms.

Multidisciplinary design optimization (MDO) can be used in computer aided engineering (CAE) to efficiently improve and balance performance of automotive structures. However, large-scale MDO is not yet generally integrated within automotive product development due to several challenges, of which excessive computing times is the most important one. In this thesis, a metamodel-based MDO process that fits normal company organizations and CAE-based development processes is presented. The introduction of global metamodels offers means to increase computational efficiency and distribute work without implementing complicated multi-level MDO methods. The presented MDO process is proven to be efficient for thickness optimization studies with the objective to minimize mass. It can also be used for spot weld optimization if the models are prepared correctly. A comparison of different methods reveals that topology optimization, which requires less model preparation and computational effort, is an alternative if load cases involving simulations of linear systems are judged to be of major importance. A technical challenge when performing metamodel-based design optimization is lack of accuracy for metamodels representing complex responses including discontinuities, which are common in for example crashworthiness applications. The decision boundary from a support vector machine (SVM) can be used to identify the border between different types of deformation behaviour. In this thesis, this information is used to improve the accuracy of feedforward neural network metamodels. Three different approaches are tested; to split the design space and fit separate metamodels for the different regions, to add estimated guiding samples to the fitting set along the boundary before a global metamodel is fitted, and to use a special SVM-based sequential sampling method. Substantial improvements in accuracy are observed, and it is found that implementing SVM-based sequential sampling and estimated guiding samples can result in successful optimization studies for cases where more conventional methods fail.

These proceedings contain the texts of 37 contributions presented at the International Conference on Engineering Optimization in an Industrial Environment, which took place on 3 - 4 September 1990 at the Karlsruhe Nuclear Hesearch Center, I~H Germany. The presentations consisted of oral and poster contributions arranged in five sessions: • Shape and layout optimization • Structural optimization with advanced materials • Optimal designs with special structural and material beha viour • Sensitivity analysis - Programme systems • Optimization with stability constraints - Special problems The editors wish to express their appreciation to all authors and invited speakers for their in teresting contributions. The proceedings cover a wide range of topics in structural optimization representing the present state of the

art in the fields of research and in the industrial environment as well. The editors hope that this book will also contribute towards new ideas and concepts in a world of ever decreasing natural resources and ever increasing demands for lighter and yet stronger and safer technical components. I"inally, the editors wish to thank all colleagues who helped in the organisation of the conference, especially Mrs. E. Schroder anq Dr. K.llethge, as well as Mr. A. von llagen and Mrs. E. Haufelder, Springer Publishing Company, Heidelberg for the good cooperation and help in the publication of these proceedings.

IBCAST is a scientific event covering wide range of topics in the fields of Advanced Materials, Aero Strucutures, Biosciences, Control & Signal Processing, Cyber Security & Assurance Technologies, Fluid Dynamics, Medical Sciences, Underwater Technologies, Wireless Communication & Radar

This book discusses the application of independent continuous mapping method in predicting and the optimization of the mechanical performance of buckling with displacement, stress and static constrains. Each model is explained by mathematical theories and followed by simulation with frequently-used softwares. With abundant project data, the book is an essential reference for mechanical engineers, structural engineers and industrial designers.

This book has grown out of lectures and courses given at Linköping University, Sweden, over a period of 15 years. It gives an introductory treatment of problems and methods of structural optimization. The three basic classes of geometrical - timization problems of mechanical structures, i. e. , size, shape and topology op- mization, are treated. The focus is on concrete numerical solution methods for d- crete and (?nite element) discretized linear elastic structures. The style is explicit and practical: mathematical proofs are provided when arguments can be kept e- mentary but are otherwise only cited, while implementation details are frequently provided. Moreover, since the text has an emphasis on geometrical design problems, where the design is represented by continuously varying—frequently very many— variables, so-called ?rst order methods are central to the treatment. These methods are based on sensitivity analysis, i. e. , on establishing ?rst order derivatives for - jectives and constraints. The classical ?rst order methods that we emphasize are CONLIN and MMA, which are based on explicit, convex and separable appro- mations. It should be remarked that the classical and frequently used so-called op- mality criteria method is also of this kind. It may also be noted in this context that zero order methods such as response surface methods, surrogate models, neural n- works, genetic algorithms, etc. , essentially apply to different types of problems than the ones treated here and should be presented elsewhere.

Design and weight optimization of an automotive subframe by CAE methodsA Design Procedure for the Weight Optimization of Straight Finned Radiators

Design Optimization of Fluid Machinery: Applying Computational Fluid Dynamics and Numerical Optimization Drawing on extensive research and experience, this timely reference brings together numerical optimization methods for fluid machinery and its key industrial applications. It logically lays out the context required to understand computational fluid dynamics by introducing the basics of fluid mechanics, fluid machines and their components. Readers are then introduced to single and multi-objective optimization methods, automated optimization, surrogate models, and evolutionary algorithms. Finally, design approaches and applications in the areas of pumps, turbines, compressors, and other fluid machinery systems are clearly explained, with special emphasis on renewable energy systems. Written by an international team of leading experts in the field Brings together

optimization methods using computational fluid dynamics for fluid machinery in one handy reference Features industrially important applications, with key sections on renewable energy systems Design Optimization of Fluid Machinery is an essential guide for graduate students, researchers, engineers working in fluid machinery and its optimization methods. It is a comprehensive reference text for advanced students in mechanical engineering and related fields of fluid dynamics and aerospace engineering.
An aerobrake structural concept for a lunar transfer vehicle was weight optimized through the use of the Taguchi design method, finite element analyses, and element sizing routines. Six design parameters were chosen to represent the aerobrake structural configuration. The design parameters included honeycomb core thickness, diameter-depth ratio, shape, material, number of concentric ring frames, and number of radial frames. Each parameter was assigned three levels. The aerobrake structural configuration with the minimum weight was 44 percent less than the average weight of all the remaining satisfactory experimental configurations. In addition, the results of this study have served to bolster the advocacy of the Taguchi method for aerospace vehicle design. Both reduced analysis time and an optimized design demonstrated the applicability of the Taguchi method to aerospace vehicle design. Bush, Lance B. and Unal, Resit and Rowell, Lawrence F. and Rehder, John J. Langley Research Center RTOP 593-11-11-01...
This is an exposition of the theory, techniques, and the basic formulation of structural optimization problems. The author considers applications of design optimization criteria involving strength, rigidity, stability and weight. Analytic and numerical techniques are introduced for research in optimal shapes and internal configurations of deformable bodies and structures. Problems of the optimal design of beams, systems of rods, plates and shells, are studied in detail. With regard to applications, this work is oriented towards solutions of real problems, such as reduction of the volume or weight of the material, and improvement of mechanical properties of structures. This book is written for readers specializing in applied mechanics, applied mathematics, and numerical analysis."
Today's highly capitalized societies require maximum benefit with minimum cost. In order to find a low cost design in practice, experienced engineers have traditionally used trial-and-error methods based on their intuitive engineering sense. However, their approaches have not guaranteed optimal or near-optimal designs, which is why researchers have been interested in optimization methods. Mathematically speaking, optimization refers to finding the best vector from a set of feasible alternative vectors. Civil engineering, which includes structural engineering, geotechnical engineering, water resources engineering, environmental engineering, transportation engineering, and construction management, can be an industrial sector which derives great benefit from the optimization because these techniques can Save a lot of costs in public infrastructure construction and management that require enormous budget. Thus, this book intends to show a big picture how the optimization techniques can be applied to various civil engineering problems in 1) construction and project management, 2) structural engineering, 3) water and environmental engineering, and 4) transportation engineering.
This volume offers edited papers presented at the IUTAM-Symposium Topological design optimization of structures, machines and materials - status and perspectives, October 2005. The papers cover the application of topological design optimization to fluid-solid

interaction problems, acoustics problems, and to problems in biomechanics, as well as to other multiphysics problems. Also in focus are new basic modelling paradigms, covering new geometry modelling such as level-set methods and topological derivatives.

Structural optimization, a broad interdisciplinary field, requires skillful combining of mathematical and mechanical knowledge with engineering. It is both intellectually attractive and technologically rewarding. The Symposium on Optimization in Structural Design was the second IUTAM Symposium in Poland. Fifteen years have elapsed since the Symposium on Nonhomogeneity in Elasticity and Plasticity, presided by Professor Olszak, was held in Warsaw. These fifteen years mean a lot for mechanics in Poland. Continuing the tradition of Professor Maksymilian Tytus Huber's research, considerable development of the mechanical sciences has been achieved in this country mostly due to the knowledge, vision and persistence of Professors Wit old Nowacki and Waclaw Olszak, eminent Members of our Academy. The Institute of Fundamental Technological Research was established, competent research groups grew, matured and contri buted to thermo-elasticity, plasticity, general theory of constitutive equations, and to structural mechanics-just to mention a few do mains. Mechanics is now penetrating into the technology of this country at an accelerating pace. The optimization in mechanics has a tradition in Poland. In 1936 Professor Zbigniew Wasiutynski formulated the optimality criterion for mean stiffness design using an elastic energy concept. Further work in this field has been done since, mostly in the last ten years. On behalf of the Committee for Mechanics of the Polish Academy of Sciences I wish to thank the IUTA1V[Bureau for the decision to hold in Warsaw the Symposium the present volume contains the contribu tions to.

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.

This book contains the edited version of lectures and selected papers presented at the NATO ADVANCED STUDY INSTITUTE ON COMPUTER AIDED OPTIMAL DESIGN: Structural and Mechanical Systems, held in Tr6ia, Portugal, 29th June to 11th July 1986, and organized by CEMUL -Center of Mechanics and Materials of the Technical University of Lisbon. The Institute was attended by 120 participants from 21 countries, including leading scientists and engineers from universities, research institutions and industry, and Ph.D. students. Some participants presented invited and contributed papers during the Institute and almost all participated actively in discussions

on scientific aspects during the Institute. The Advanced Study Institute provided a forum for interaction among eminent scientists and engineers from different schools of thought and young reseachers. The Institute addressed the foundations and current state of the art of essential techniques related to computer aided optimal design of structural and mechanical systems, namely: Vari ational and Finite Element Methods in Optimal Design, Numerical Optimization Techniques, Design Sensitivity Analysis, Shape Optimal Design, Adaptive Finite Element Methods in Shape Optimization, CAD Technology, Software Development Techniques, Integrated Computer Aided Design and Knowledge Based Systems. Special topics of growing importance were also pre sented.

Mechanical design includes an optimization process in which designers always consider objectives such as strength, deflection, weight, wear, corrosion, etc. depending on the requirements. However, design optimization for a complete mechanical assembly leads to a complicated objective function with a large number of design variables. It is a good practice to apply optimization techniques for individual components or intermediate assemblies than a complete assembly. Analytical or numerical methods for calculating the extreme values of a function may perform well in many practical cases, but may fail in more complex design situations. In real design problems, the number of design parameters can be very large and their influence on the value to be optimized (the goal function) can be very complicated, having nonlinear character. In these complex cases, advanced optimization algorithms offer solutions to the problems, because they find a solution near to the global optimum within reasonable time and computational costs. Mechanical Design Optimization Using Advanced Optimization Techniques presents a comprehensive review on latest research and development trends for design optimization of mechanical elements and devices. Using examples of various mechanical elements and devices, the possibilities for design optimization with advanced optimization techniques are demonstrated. Basic and advanced concepts of traditional and advanced optimization techniques are presented, along with real case studies, results of applications of the proposed techniques, and the best optimization strategies to achieve best performance are highlighted. Furthermore, a novel advanced optimization method named teaching-learning-based optimization (TLBO) is presented in this book and this method shows better performance with less computational effort for the large scale problems. Mechanical Design Optimization Using Advanced Optimization Techniques is intended for designers, practitioners, managers, institutes involved in design related projects, applied research workers, academics, and graduate students in mechanical and industrial engineering and will be useful to the industrial product designers for realizing a product as it presents new models and optimization techniques to make tasks easier, logical, efficient and effective. .

In the past, the possibilities of structural optimization were restricted to an optimal choice of profiles and shape. Further improvement can be obtained by selecting appropriate advanced materials and by optimizing the topology, i.e. finding the best position and arrangement of structural elements within a construction. The optimization of structural topology permits the use of optimization algorithms at a very early stage of the design process. The method presented in this book has been developed by Martin Bendsoe in cooperation with other researchers and can be considered as one of the most effective approaches to the optimization of layout and material design.

Multiscale Structural Topology Optimization discusses the development of a multiscale design framework for topology optimization of multiscale nonlinear structures. With the intention to alleviate the heavy computational burden of the design framework, the authors present a POD-based adaptive surrogate model for the RVE solutions at the microscopic scale and make a step further towards the design of multiscale elastoviscoplastic structures. Various optimization methods for structural size, shape, and topology designs have been developed and widely employed in engineering applications. Topology optimization has been recognized as one of the most effective tools for least weight and performance design, especially in aeronautics and aerospace engineering. This book focuses on the simultaneous design of both

macroscopic structure and microscopic materials. In this model, the material microstructures are optimized in response to the macroscopic solution, which results in the nonlinearity of the equilibrium problem of the interface of the two scales. The authors include a reduce database model from a set of numerical experiments in the space of effective strain. Presents the first attempts towards topology optimization design of nonlinear highly heterogeneous structures Helps with simultaneous design of the topologies of both macroscopic structure and microscopic materials Helps with development of computer codes for the designs of nonlinear structures and of materials with extreme constitutive properties Focuses on the simultaneous design of both macroscopic structure and microscopic materials Includes a reduce database model from a set of numerical experiments in the space of effective strain

Design and Optimization of Thermal Systems, Third Edition: with MATLAB® Applications provides systematic and efficient approaches to the design of thermal systems, which are of interest in a wide range of applications. It presents basic concepts and procedures for conceptual design, problem formulation, modeling, simulation, design evaluation, achieving feasible design, and optimization. Emphasizing modeling and simulation, with experimentation for physical insight and model validation, the third edition covers the areas of material selection, manufacturability, economic aspects, sensitivity, genetic and gradient search methods, knowledge-based design methodology, uncertainty, and other aspects that arise in practical situations. This edition features many new and revised examples and problems from diverse application areas and more extensive coverage of analysis and simulation with MATLAB®.

This book summarizes advances in a number of fundamental areas of optimization with application in engineering design. The selection of the 'best' or 'optimum' design has long been a major concern of designers and in recent years interest has grown in applying mathematical optimization techniques to design of large engineering and industrial systems, and in using the computer-aided design packages with optimization capabilities which are now available.

Control and Dynamic Systems: Advances in Theory and Applications, Volume 57: Multidisciplinary Engineering Systems: Design and Optimization Techniques and their Application deals with techniques used in the design and optimization of future engineering systems. Comprised of 11 chapters, this book covers techniques for improving product design quality in multidisciplinary systems. These techniques include decomposition techniques for synthesis process; optimization for aircraft systems; actuator and sensor placement; and robust techniques in system design and control process. Students, research workers, and practising engineers will find this book invaluable.

Although the overall appearance of modern airliners has not changed a lot since the introduction of jetliners in the 1950s, their safety, efficiency and environmental friendliness have improved considerably. Main contributors to this have been gas turbine engine technology, advanced materials, computational aerodynamics, advanced structural analysis and on-board systems. Since aircraft design became a highly multidisciplinary activity, the development of multidisciplinary optimization (MDO) has become a popular new discipline. Despite this, the application of MDO during the conceptual

design phase is not yet widespread. Advanced Aircraft Design: Conceptual Design, Analysis and Optimization of Subsonic Civil Airplanes presents a quasi-analytical optimization approach based on a concise set of sizing equations. Objectives are aerodynamic efficiency, mission fuel, empty weight and maximum takeoff weight. Independent design variables studied include design cruise altitude, wing area and span and thrust or power loading. Principal features of integrated concepts such as the blended wing and body and highly non-planar wings are also covered. The quasi-analytical approach enables designers to compare the results of high-fidelity MDO optimization with lower-fidelity methods which need far less computational effort. Another advantage to this approach is that it can provide answers to “what if” questions rapidly and with little computational cost. Key features: Presents a new fundamental vision on conceptual airplane design optimization Provides an overview of advanced technologies for propulsion and reducing aerodynamic drag Offers insight into the derivation of design sensitivity information Emphasizes design based on first principles Considers pros and cons of innovative configurations Reconsiders optimum cruise performance at transonic Mach numbers Advanced Aircraft Design: Conceptual Design, Analysis and Optimization of Subsonic Civil Airplanes advances understanding of the initial optimization of civil airplanes and is a must-have reference for aerospace engineering students, applied researchers, aircraft design engineers and analysts.

Improving the performance of existing technologies has always been a focal practice in the development of computational systems. However, as circuitry is becoming more complex, conventional techniques are becoming outdated and new research methodologies are being implemented by designers. Performance Optimization Techniques in Analog, Mix-Signal, and Radio-Frequency Circuit Design features recent advances in the engineering of integrated systems with prominence placed on methods for maximizing the functionality of these systems. This book emphasizes prospective trends in the field and is an essential reference source for researchers, practitioners, engineers, and technology designers interested in emerging research and techniques in the performance optimization of different circuit designs.

Civil engineering structures such as buildings, bridges, stadiums, and offshore structures play an import role in our daily life. However, constructing these structures requires lots of budget. Thus, how to cost-efficiently design structures satisfying all required design constraints is an important factor to structural engineers. Traditionally, mathematical gradient-based optimal techniques have been applied to the design of optimal structures. While, many practical engineering optimal problems are very complex and hard to solve by traditional method. In the past few decades, swarm intelligence algorithms, which were inspired by the social behaviour of natural animals such as fish schooling and bird flocking, were developed because they do not require conventional mathematical assumptions and thus possess better

global search abilities than the traditional optimization algorithms and have attracted more and more attention. These intelligent based algorithms are very suitable for continuous and discrete design variable problems such as ready-made structural members and have been vigorously applied to various structural design problems and obtained good results. This book gathers the authors' latest research work related with particle swarm optimizer algorithm and group search optimizer algorithm as well as their application to structural optimal design. The readers can understand the full spectrum of the algorithms and apply the algorithms to their own research problems.