Introduction To Shape Optimization Theory Approximation And Computation

Introduction to Shape Optimization *Shape Optimization Problems Shape Optimization and Spectral Theory* Topology Optimization **Shape Optimization by the Homogenization Method Introduction to Shape Optimization Topological Derivatives in Shape Optimization Introduction to Shape Optimization** Variational Methods in Shape Optimization Problems *Existence and Regularity Results for Some Shape Optimization Problems* **Numerical Methods in Sensitivity Analysis and Shape Optimization** *Shapes and Geometries* **Optimal Shape Design** *Applied Shape Optimization for Fluids* Optimization of Structural Topology, Shape, and Material Topology Design Methods for Structural Optimization **Shape Optimization and Free Boundaries Shape Optimization by the Homogenization Method** *Topology Optimization* **Finite Elements-based Optimization Optimization of Elliptic Systems** *Homogenization and Structural Topology Optimization* **Performance-Based Optimization of Structures Optimization and Computational Fluid Dynamics** *Modern Trends in Structural and Solid Mechanics 1* **Compressible Navier-Stokes Equations** *Advances in Design Optimization* Design Optimization using MATLAB and SOLIDWORKS **Shapes and Geometries Control and Boundary Analysis** *An Introduction to Structural Optimization* **Robust Optimization-Directed Design** Stability and Optimization of Structures **Fin Shape Thermal Optimization Using Bejan's Constructal Theory** *Shape Design Sensitivity Analysis and Optimization Using the Boundary Element Method* **Introduction to Shape Optimization** New Trends in Shape Optimization **Topological Derivatives in Shape Optimization Evolutionary Structural Optimization Optimization Theory with Applications**

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Shapes and Geometries Jun 05 2020 The tools to use for problems where the modeling, optimization, or control variable is the structure of a geometric object.
Stability and Optimization of Structures Jan 31 2020 This book focuses on the optimization of a geometrically-nonlinear structure under stability constraint. It presents a deep insight into optimization-based and computer-assisted stability design of discrete structures. Coverage combines design sensitivity analysis developed in structural optimization and imperfection-sensitivity analysis developed in stability analysis.
Topology Design Methods for Structural Optimization Jul 19 2021 Topology Design Methods for Structural Optimization provides engineers with a basic set of design tools for the development of 2D and 3D structures subjected to single and multi-load cases and experiencing linear elastic conditions. Written by an expert team who has collaborated over the past decade to develop the methods presented, the book discusses essential theories with clear guidelines on how to use them. Case studies and worked industry examples are included throughout to illustrate practical applications of topology design tools to achieve innovative structural solutions. The text is intended for professionals who are interested in using the tools provided, but does not require in-depth theoretical knowledge. It is ideal for researchers who want to expand the methods presented to new applications,

and includes a companion website with related tools to assist in further study. Provides design tools and methods for innovative structural design, focusing on the essential theory Includes case studies and real-life examples to illustrate practical application, challenges, and solutions Features accompanying software on a companion website to allow users to get up and running fast with the methods introduced Includes input from an expert team who has collaborated over the past decade to develop the methods presented

Topology Optimization Jul 31 2022 The topology optimization method solves the basic enginee- ring problem of distributing a limited amount of material in a design space. The first edition of this book has become the standard text on optimal design which is concerned with the optimization of structural topology, shape and material. This edition, has been substantially revised and updated to reflect progress made in modelling and computational procedures. It also encompasses a comprehensive and unified description of the state-of-the-art of the so-called material distribution method, based on the use of mathematical programming and finite elements. Applications treated include not only structures but also materials and MEMS.

Variational Methods in Shape Optimization Problems Feb 23 2022 Shape optimization problems are treated from the classical and modern perspectives Targets a broad audience of graduate students in pure and applied mathematics, as well as engineers requiring a solid mathematical basis for the solution of practical problems Requires only a standard knowledge in the calculus of variations, differential equations, and functional analysis Driven by several good examples and illustrations Poses some open questions.

Shape Optimization and Free Boundaries Jun 17 2021 Shape optimization deals with problems where the design or control variable is no longer a vector of parameters or functions but the shape of a geometric domain. They include engineering applications to shape and structural optimization, but also original applications to image segmentation, control theory, stabilization of membranes and plates by boundary variations, etc. Free and moving boundary problems arise in an impressingly wide range of new and challenging applications to change of phase. The class of problems which are amenable to this approach can arise from such diverse disciplines as combustion, biological growth, reactive geological flows in porous media, solidification, fluid dynamics, electrochemical machining, etc. The objective and orginality of this NATO-ASI was to bring together theories and examples from shape optimization, free and moving boundary problems, and materials with microstructure which

are fundamental to static and dynamic domain and boundary problems.

Finite Elements-based Optimization Mar 15 2021 This book is intended to be a cookbook for students and researchers to understand the finite element method and optimization methods and couple them to effect shape optimization. The optimization part of the book will survey optimization methods and focus on the genetic algorithm and Powell's method for implementation in the codes. It will contain pseudo-code for the relevant algorithms and homework problems to reinforce the theory to compile finite element programs capable of shape optimization. Features Enables readers to understand the finite element method and optimization methods and couple them to effect shape optimization Presents simple approach with algorithms for synthesis Focuses on automated computer aided design (CAD) of electromagnetic devices Provides a unitary framework involving optimization and numerical modelling Discusses how to integrate open-source mesh generators into your code Indicates how parallelization of algorithms, especially matrix solution and optimization, may be approached cheaply using the graphics processing unit (GPU) that is available on most PCs today Includes coupled problem optimization using hyperthermia as an example

Optimization Theory with Applications Jun 25 2019 Broad-spectrum approach to important topic. Explores the classic theory of minima and maxima, classical calculus of variations, simplex technique and linear programming, optimality and dynamic programming, more. 1969 edition.

Evolutionary Structural Optimization Jul 27 2019 Evolutionary Structural Optimization (ESO) is a design method based on the simple concept of gradually removing inefficient material from a structure as it is being designed. Through this method, the resulting structure will evolve towards its optimum shape. The latest techniques and results of ESO are presented here, illustrated by numerous clear and detailed examples. Sections cover the fundamental aspects of the method, the application to multiple load cases and multiple support environments, frequency optimization, stiffness and displacement constraints, buckling, jointed frame structures, shape optimization, and stress reduction. This is followed by a section describing Evolve97, a software package which will allow readers to try the ideas of ESO themselves and to solve their optimization problems. This software is provided on a computer diskette which accompanies the book.

Optimization of Elliptic Systems Feb 11 2021 The present monograph is intended to provide a comprehensive

and accessible introduction to the optimization of elliptic systems. This area of mathematical research, which has many important applications in science and technology. has experienced an impressive development during the past two decades. There are already many good textbooks dealing with various aspects of optimal design problems. In this regard, we refer to the works of Pironneau [1984], Haslinger and Neittaanmaki [1988], [1996], Sokolowski and Zolksio [1992], Litvinov [2000], Allaire [2001], Mohammadi and Pironneau [2001], Delfour and Zolksio [2001], and Makinen and Haslinger [2003]. Already Lions [I9681 devoted a major part of his classical monograph on the optimal control of partial differential equations to the optimization of elliptic systems. Let us also mention that even the very first known problem of the calculus of variations, the brachistochrone studied by Bernoulli back in 1696. is in fact a shape optimization problem. The natural richness of this mathematical research subject, as well as the extremely large field of possible applications, has created the unusual situation that although many important results and methods have already been est- lished, there are still pressing unsolved questions. In this monograph, we aim to address some of these open problems; as a consequence, there is only a minor overlap with the textbooks already existing in the field.

Control and Boundary Analysis May 05 2020 This volume comprises selected papers from the 21st Conference on System Modeling and Optimization in Sophia Antipolis, France. It covers over three decades of studies involving partial differential systems and equations. Topics include: the modeling of continuous mechanics involving fixed boundary, control theory, shape optimization and moving boundaries, and topological shape optimization. This edition discusses all developments that lead to current moving boundary analysis and the stochastic approach.

Topological Derivatives in Shape Optimization Apr 27 2022 The topological derivative is defined as the first term (correction) of the asymptotic expansion of a given shape functional with respect to a small parameter that measures the size of singular domain perturbations, such as holes, inclusions, defects, source-terms and cracks. Over the last decade, topological asymptotic analysis has become a broad, rich and fascinating research area from both theoretical and numerical standpoints. It has applications in many different fields such as shape and topology optimization, inverse problems, imaging processing and mechanical modeling including synthesis and/or optimal design of microstructures, fracture mechanics sensitivity analysis and damage evolution modeling. Since

there is no monograph on the subject at present, the authors provide here the first account of the theory which combines classical sensitivity analysis in shape optimization with asymptotic analysis by means of compound asymptotic expansions for elliptic boundary value problems. This book is intended for researchers and graduate students in applied mathematics and computational mechanics interested in any aspect of topological asymptotic analysis. In particular, it can be adopted as a textbook in advanced courses on the subject and shall be useful for readers interested on the mathematical aspects of topological asymptotic analysis as well as on applications of topological derivatives in computation mechanics.

New Trends in Shape Optimization Sep 28 2019 This volume reflects “New Trends in Shape Optimization” and is based on a workshop of the same name organized at the Friedrich-Alexander University Erlangen-Nürnberg in September 2013. During the workshop senior mathematicians and young scientists alike presented their latest findings. The format of the meeting allowed fruitful discussions on challenging open problems, and triggered a number of new and spontaneous collaborations. As such, the idea was born to produce this book, each chapter of which was written by a workshop participant, often with a collaborator. The content of the individual chapters ranges from survey papers to original articles; some focus on the topics discussed at the Workshop, while others involve arguments outside its scope but which are no less relevant for the field today. As such, the book offers readers a balanced introduction to the emerging field of shape optimization.

Topological Derivatives in Shape Optimization Aug 27 2019 The topological derivative is defined as the first term (correction) of the asymptotic expansion of a given shape functional with respect to a small parameter that measures the size of singular domain perturbations, such as holes, inclusions, defects, source-terms and cracks. Over the last decade, topological asymptotic analysis has become a broad, rich and fascinating research area from both theoretical and numerical standpoints. It has applications in many different fields such as shape and topology optimization, inverse problems, imaging processing and mechanical modeling including synthesis and/or optimal design of microstructures, fracture mechanics sensitivity analysis and damage evolution modeling. Since there is no monograph on the subject at present, the authors provide here the first account of the theory which combines classical sensitivity analysis in shape optimization with asymptotic analysis by means of compound asymptotic expansions for elliptic boundary value problems. This book is intended for researchers and graduate

students in applied mathematics and computational mechanics interested in any aspect of topological asymptotic analysis. In particular, it can be adopted as a textbook in advanced courses on the subject and shall be useful for readers interested on the mathematical aspects of topological asymptotic analysis as well as on applications of topological derivatives in computation mechanics.

An Introduction to Structural Optimization Apr 03 2020 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.

Shape Optimization and Spectral Theory Sep 01 2022 "Shape optimization and spectral theory" is a survey book aiming to give an overview of recent results in spectral geometry and its links with shape optimization. It covers most of the issues which are important for people working in PDE and differential geometry interested in sharp inequalities and qualitative behaviour for eigenvalues of the Laplacian with different kind of boundary conditions (Dirichlet, Robin and Steklov). This includes: existence of optimal shapes, their regularity, the case of special domains like triangles, isospectrality, quantitative form of the isoperimetric inequalities, optimal partitions, universal inequalities and numerical results. Much progress has been made in these extremum problems during

the last ten years and this edited volume presents a valuable update to a wide community interested in these topics. List of contributors Antunes Pedro R.S., Ashbaugh Mark, Bonnaillie-Noel Virginie, Brasco Lorenzo, Bucur Dorin, Buttazzo Giuseppe, De Philippis Guido, Freitas Pedro, Girouard Alexandre, Helffer Bernard, Kennedy James, Lamboley Jimmy, Laugesen Richard S., Oudet Edouard, Pierre Michel, Polterovich Iosif, Siudeja Bartlomiej A., Velichkov Bozhidar

Shape Design Sensitivity Analysis and Optimization Using the Boundary Element Method Nov 30 2019 This book investigates the various aspects of shape optimization of two dimensional continuum structures, including shape design sensitivity analysis, structural analysis using the boundary element method (BEM), and shape optimization implementation. The book begins by reviewing the developments of shape optimization, followed by the presentation of the mathematical programming methods for solving optimization problems. The basic theory of the BEM is presented which will be employed later on as the numerical tool to provide the structural responses and the shape design sensitivities. The key issue of shape optimization, the shape design sensitivity analy sis, is fully investigated. A general formulation of stress sensitivity using the continuum approach is presented. The difficulty of the modelling of the ad joint problem is studied, and two approaches are presented for the modelling of the adjoint problem. The first approach uses distributed loads to smooth the concentrated adjoint loads, and the second approach employs the singu larity subtraction method to remove the singular boundary displacements and tractions from the BEM equation. A novel finite difference based approach to shape design sensitivity is pre sented, which overcomes the two drawbacks of the conventional finite difference method. This approach has the advantage of being simple in concept, and eas ier implementation. A shape optimization program for two-dimensional continuum structures is developed, including structural analysis using the BEM, shape design sensitiv ity analysis, mathematical programming, and the design boundary modelling.

Advances in Design Optimization Aug 08 2020 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.

Homogenization and Structural Topology Optimization Jan 13 2021 Structural topology optimization is a fast growing field that is finding numerous applications in automotive, aerospace and mechanical design processes. Homogenization is a mathematical theory with applications in several engineering problems that are governed by partial differential equations with rapidly oscillating coefficients Homogenization and Structural Topology Optimization brings the two concepts together and successfully bridges the previously overlooked gap between the mathematical theory and the practical implementation of the homogenization method. The book is presented in a unique self-teaching style that includes numerous illustrative examples, figures and detailed explanations of concepts. The text is divided into three parts which maintains the book's reader-friendly appeal.

Fin Shape Thermal Optimization Using Bejan's Constructal Theory Jan 01 2020 The book contains research results obtained by applying Bejan's Constructal Theory to the study and therefore the optimization of fins, focusing on T-shaped and Y-shaped ones. Heat transfer from finned surfaces is an example of combined heat transfer natural or forced convection on the external parts of the fin, and conducting along the fin. Fin's heat exchange is rather complex, because of variation of both temperature along the fin and convective heat transfer coefficient. Furthermore possible presence of more fins invested by the same fluid flow has to be considered. Classical fin theory tried to reduce the coupled heat transfer problem to a one-dimensional problem by defining an average temperature of the fin and writing equations using this parameter. However, it was shown that this approach cannot be used because of the effects of two-dimensional heat transfer, especially in the presence of short fins. CFD codes offer the possibility to consider bi-dimensional (and more generally, three-dimensional) effects and then a more real approach to the physic phenomena of finned surface's heat exchange. A commercial CFD code was used to analyse the case of heat exchange in presence of T-shaped fins, following an approach suggested by Bejan's Constructal Theory. The comparative results showed a significant agreement with previous research taken as a reference, and this result allows for the application of this approach to a wider range of systems. T-shaped optimized fin geometry is the starting point for further research. Starting from the optimal results (T-shape optimized fins), we show the trend of the assessment parameter (the dimensionless conductance) in function of the angle between the two horizontal arms of the fin. A value for, 90

Optimization of Structural Topology, Shape, and Material Aug 20 2021 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.

Optimal Shape Design Oct 22 2021 Optimal Shape Design is concerned with the optimization of some performance criterion dependent (besides the constraints of the problem) on the "shape" of some region. The main topics covered are: the optimal design of a geometrical object, for instance a wing, moving in a fluid; the optimal shape of a region (a harbor), given suitable constraints on the size of the entrance to the harbor, subject to incoming waves; the optimal design of some electrical device subject to constraints on the performance. The aim is to show that Optimal Shape Design, besides its interesting industrial applications, possesses nontrivial mathematical aspects. The main theoretical tools developed here are the homogenization method and domain variations in PDE. The style is mathematically rigorous, but specifically oriented towards applications, and it is intended for both pure and applied mathematicians. The reader is required to know classical PDE theory and basic functional analysis.

Numerical Methods in Sensitivity Analysis and Shape Optimization Dec 24 2021 Sensitivity analysis and optimal shape design are key issues in engineering that have been affected by advances in numerical tools currently available. This book, and its supplementary online files, presents basic optimization techniques that can be used to compute the sensitivity of a given design to local change, or to improve its performance by local optimization of these data. The relevance and scope of these techniques have improved dramatically in recent years because of progress in discretization strategies, optimization algorithms, automatic differentiation, software availability, and the power of personal computers. Numerical Methods in Sensitivity Analysis and Shape Optimization will be of interest to graduate students involved in mathematical modeling and simulation, as well as engineers and researchers in applied mathematics looking for an up-to-date introduction to optimization techniques, sensitivity analysis, and optimal design.

Existence and Regularity Results for Some Shape Optimization Problems Jan 25 2022 ?We study the existence and regularity of optimal domains for functionals depending on the spectrum of the Dirichlet Laplacian or of more general Schrödinger operators. The domains are subject to perimeter and volume constraints; we also take into account the possible presence of geometric obstacles. We investigate the properties of the optimal sets and of the optimal state functions. In particular, we prove that the eigenfunctions are Lipschitz continuous up to the boundary and that the optimal sets subject to the perimeter constraint have regular free boundary. We also consider spectral optimization problems in non-Euclidean settings and optimization problems for potentials and measures, as well as multiphase and optimal partition problems.
Shape Optimization Problems Oct 02 2022 This book provides theories on non-parametric shape optimization problems, systematically keeping in mind readers with an engineering background. Non-parametric shape optimization problems are defined as problems of finding the shapes of domains in which boundary value problems of partial differential equations are defined. In these problems, optimum shapes are obtained from an arbitrary form without any geometrical parameters previously assigned. In particular, problems in which the optimum shape is sought by making a hole in domain are called topology optimization problems. Moreover, a problem in which the optimum shape is obtained based on domain variation is referred to as a shape optimization problem of domain variation type, or a shape optimization problem in a limited sense. Software has been developed to solve these problems, and it is being used to seek practical optimum shapes. However, there are no books explaining such theories beginning with their foundations. The structure of the book is shown in the Preface. The theorems are built up using mathematical results. Therefore, a mathematical style is introduced, consisting of definitions and theorems to summarize the key points. This method of expression is advanced as provable facts are clearly shown. If something to be investigated is contained in the framework of mathematics, setting up a theory using theorems prepared by great mathematicians is thought to be an extremely effective approach. However, mathematics attempts to heighten the level of abstraction in order to understand many things in a unified fashion. This characteristic may baffle readers with an engineering background. Hence in this book, an attempt has been made to provide explanations in engineering terms, with examples from mechanics, after accurately denoting the provable facts using definitions and theorems.

Robust Optimization-Directed Design Mar 03 2020 Robust design—that is, managing design uncertainties such as model uncertainty or parametric uncertainty—is the often unpleasant issue crucial in much multidisciplinary optimal design work. Recently, there has been enormous practical interest in strategies for applying optimization tools to the development of robust solutions and designs in several areas, including aerodynamics, the integration of sensing (e.g., laser radars, vision-based systems, and millimeter-wave radars) and control, cooperative control with poorly modeled uncertainty, cascading failures in military and civilian applications, multi-mode seekers/sensor fusion, and data association problems and tracking systems. The contributions to this book explore these different strategies. The expression "optimization-directed" in this book's title is meant to suggest that the focus is not agonizing over whether optimization strategies identify a true global optimum, but rather whether these strategies make significant design improvements.
Topology Optimization Apr 15 2021 The topology optimization method solves the basic enginee- ring problem of distributing a limited amount of material in a design space. The first edition of this book has become the standard text on optimal design which is concerned with the optimization of structural topology, shape and material. This edition, has been substantially revised and updated to reflect progress made in modelling and computational procedures. It also encompasses a comprehensive and unified description of the state-of-the-art of the so-called material distribution method, based on the use of mathematical programming and finite elements. Applications treated include not only structures but also materials and MEMS.
Introduction to Shape Optimization May 29 2022 This book is motivated largely by a desire to solve shape optimization prob lems that arise in applications, particularly in structural mechanics and in the optimal control of distributed parameter systems. Many such problems can be formulated as the minimization of functionals defined over a class of admissible domains. Shape optimization is quite indispensable in the design and construction of industrial structures. For example, aircraft and spacecraft have to satisfy, at the same time, very strict criteria on mechanical performance while weighing as little as possible. The shape optimization problem for such a structure consists in finding a geometry of the structure which minimizes a given functional (e. g. such as the weight of the structure) and yet simultaneously satisfies specific constraints (like thickness, strain energy, or displacement bounds). The geometry of the structure can be considered as a given domain in the three-dimensional Euclidean

space. The domain is an open, bounded set whose topology is given, e. g. it may be simply or doubly connected. The boundary is smooth or piecewise smooth, so boundary value problems that are defined in the domain and associated with the classical partial differential equations of mathematical physics are well posed. In general the cost functional takes the form of an integral over the domain or its boundary where the integrand depends smoothly on the solution of a boundary value problem.

Introduction to Shape Optimization Oct 29 2019 The efficiency and reliability of manufactured products depend on, among other things, geometrical aspects; it is therefore not surprising that optimal shape design problems have attracted the interest of applied mathematicians and engineers. This self-contained, elementary introduction to the mathematical and computational aspects of sizing and shape optimization enables readers to gain a firm understanding of the theoretical and practical aspects so they may confidently enter this field. Introduction to Shape Optimization: Theory, Approximation, and Computation treats sizing and shape optimization comprehensively, covering everything from mathematical theory (existence analysis, discretizations, and convergence analysis for discretized problems) through computational aspects (sensitivity analysis, numerical minimization methods) to industrial applications. Applications include contact stress minimization for elasto-plastic bodies, multidisciplinary optimization of an airfoil, and shape optimization of a dividing tube. By presenting sizing and shape optimization in an abstract way, the authors are able to use a unified approach in the mathematical analysis for a large class of optimization problems in various fields of physics. Audience: the book is written primarily for students of applied mathematics, scientific computing, and mechanics. Most of the material is directed toward graduate students, although a portion of it is suitable for senior undergraduate students. Readers are assumed to have some knowledge of partial differential equations and their numerical solution, as well as modern programming language such as C++ Fortran 90.

Shape Optimization by the Homogenization Method Jun 29 2022 This book provides an introduction to the theory and numerical developments of the homogenization method. It's main features are: a comprehensive presentation of homogenization theory; an introduction to the theory of two-phase composite materials; a detailed treatment of structural optimization by using homogenization; a complete discussion of the resulting numerical algorithms with many documented test problems. It will be of interest to researchers, engineers, and advanced

graduate students in applied mathematics, mechanical engineering, and structural optimization.
Compressible Navier-Stokes Equations Sep 08 2020 The book presents the modern state of the art in the mathematical theory of compressible Navier-Stokes equations, with particular emphasis on the applications to aerodynamics. The topics covered include: modeling of compressible viscous flows; modern mathematical theory of nonhomogeneous boundary value problems for viscous gas dynamics equations; applications to optimal shape design in aerodynamics; kinetic theory for equations with oscillating data; new approach to the boundary value problems for transport equations. The monograph offers a comprehensive and self-contained introduction to recent mathematical tools designed to handle the problems arising in the theory.
Applied Shape Optimization for Fluids Sep 20 2021 Contents: PREFACE; ACKNOWLEDGEMENTS; 1. Introduction; 2. Optimal shape design; 3. Partial differential equations for fluids; 4. Some numerical methods for fluids; 5. Sensitivity evaluation and automatic differentiation; 6. Parameterization and implementation issues; 7. Local and global optimization; 8. Incomplete sensitivities; 9. Consistent approximations and approximate gradients; 10. Numerical results on shape optimization; 11. Control of unsteady flows; 12. From airplane design to microfluidic; 13. Toplogical optimization for fluids; 14. Conclusion and perspectives; INDEX.
Performance-Based Optimization of Structures Dec 12 2020 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.
Design Optimization using MATLAB and SOLIDWORKS Jul 07 2020 A hands-on text integrating mathematics,

numerics and applications of optimization, with MATLAB code illustrating every concept.
Optimization and Computational Fluid Dynamics Nov 10 2020 The numerical optimization of practical applications has been an issue of major importance for the last 10 years. It allows us to explore reliable non-trivial configurations, differing widely from all known solutions. The purpose of this book is to introduce the state-of-the-art concerning this issue and many complementary applications are presented.
Shape Optimization by the Homogenization Method May 17 2021 This book provides an introduction to the theory and numerical developments of the homogenization method. It's main features are: a comprehensive presentation of homogenization theory; an introduction to the theory of two-phase composite materials; a detailed treatment of structural optimization by using homogenization; a complete discussion of the resulting numerical algorithms with many documented test problems. It will be of interest to researchers, engineers, and advanced graduate students in applied mathematics, mechanical engineering, and structural optimization.
Introduction to Shape Optimization Mar 27 2022 This book is motivated largely by a desire to solve shape optimization prob lems that arise in applications, particularly in structural mechanics and in the optimal control of distributed parameter systems. Many such problems can be formulated as the minimization of functionals defined over a class of admissible domains. Shape optimization is quite indispensable in the design and construction of industrial structures. For example, aircraft and spacecraft have to satisfy, at the same time, very strict criteria on mechanical performance while weighing as little as possible. The shape optimization problem for such a structure consists in finding a geometry of the structure which minimizes a given functional (e. g. such as the weight of the structure) and yet simultaneously satisfies specific constraints (like thickness, strain energy, or displacement bounds). The geometry of the structure can be considered as a given domain in the three-dimensional Euclidean space. The domain is an open, bounded set whose topology is given, e. g. it may be simply or doubly connected. The boundary is smooth or piecewise smooth, so boundary value problems that are defined in the domain and associated with the classical partial differential equations of mathematical physics are well posed. In general the cost functional takes the form of an integral over the domain or its boundary where the integrand depends smoothly on the solution of a boundary value problem.
Shapes and Geometries Nov 22 2021 Presents the latest groundbreaking theoretical foundation to shape

optimization in a form accessible to mathematicians, scientists and engineers.
Introduction to Shape Optimization Nov 03 2022 Treats sizing and shape optimization in a comprehensive way, covering everything from mathematical theory through computational aspects to industrial applications.
Modern Trends in Structural and Solid Mechanics 1 Oct 10 2020 This book - comprised of three separate volumes - presents the recent developments and research discoveries in structural and solid mechanics; it is dedicated to Professor Isaac Elishakoff. This first volume is devoted to the statics and stability of solid and structural members. Modern Trends in Structural and Solid Mechanics 1 has broad scope, covering topics such as: buckling of discrete systems (elastic chains, lattices with short and long range interactions, and discrete arches), buckling of continuous structural elements including beams, arches and plates, static investigation of composite plates, exact solutions of plate problems, elastic and inelastic buckling, dynamic buckling under impulsive loading, buckling and post-buckling investigations, buckling of conservative and non-conservative systems and buckling of micro and macro-systems. This book is intended for graduate students and researchers in the field of theoretical and applied mechanics.