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Inverse Scattering Theory and Transmission Eigenvalues
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Michell Structures
Optimal Shape Design
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IUTAM Symposium on Topological Design Optimization of Structures, Machines and Materials
Solving Numerical PDEs: Problems, Applications, Exercises
Linear Algebra and Matrices
Shape Optimization by the Homogenization Method
Fractals in Engineering: Theoretical Aspects and Numerical Approximations
Conception optimale de structures
Domain Decomposition Methods - Algorithms and Theory
An Introduction to Domain Decomposition Methods
Traffic and Granular Flow ' 07
Reconstruction of Small Inhomogeneities from Boundary Measurements
Domain Decomposition Methods in Science and Engineering XXVI

HUGHES DALTON

Inverse Scattering Theory and Transmission Eigenvalues Springer This is the first book to provide a systematic exposition of promising techniques for the reconstruction of small inhomogeneities from boundary measurements. In particular, theoretical results and numerical procedures for the inverse problems for the conductivity equation, the Lamé system, as well as the Helmholtz equation are discussed in a readable and informative manner. The general approach developed in this book is based on layer potential techniques and modern asymptotic analysis of partial differential equations. The book is particularly suitable for graduate students in mathematics.
An Introduction to Domain Decomposition Methods North Holland This text, based on the author's teaching at École Polytechnique, introduces the reader to the world of mathematical modelling and numerical simulation. Covering the finite difference method; variational formulation of elliptic problems; Sobolev spaces; elliptical problems; the finite element method; Eigenvalue problems; evolution problems; optimality conditions

and algorithms and methods of operational research, and including a several exercises throughout, this is an ideal text for advanced undergraduate students and graduates in applied mathematics, engineering, computer science, and the physical sciences.

Boundary Value Problems for Elliptic Systems Springer

The proceedings of the 9th conference on "Finite Volumes for Complex Applications" (Bergen, June 2020) are structured in two volumes. The first volume collects the focused invited papers, as well as the reviewed contributions from internationally leading researchers in the field of analysis of finite volume and related methods. Topics covered include convergence and stability analysis, as well as investigations of these methods from the point of view of compatibility with physical principles. Altogether, a rather comprehensive overview is given on the state of the art in the field. The properties of the methods considered in the conference give them distinguished advantages for a number of applications. These include fluid dynamics, magnetohydrodynamics, structural analysis, nuclear physics, semiconductor theory, carbon capture utilization and storage, geothermal energy and further topics. The second volume covers reviewed contributions reporting successful

applications of finite volume and related methods in these fields. The finite volume method in its various forms is a space discretization technique for partial differential equations based on the fundamental physical principle of conservation. Many finite volume methods preserve further qualitative or asymptotic properties, including maximum principles, dissipativity, monotone decay of free energy, and asymptotic stability, making the finite volume methods compatible discretization methods, which preserve qualitative properties of continuous problems at the discrete level. This structural approach to the discretization of partial differential equations becomes particularly important for multiphysics and multiscale applications. The book is a valuable resource for researchers, PhD and master's level students in numerical analysis, scientific computing and related fields such as partial differential equations, as well as engineers working in numerical modeling and simulations.

Finite Volumes for Complex Applications IX - Methods, Theoretical Aspects, Examples Springer Science & Business Media

Exploring ODEs is a textbook of ordinary differential equations for advanced undergraduates, graduate students, scientists, and

engineers. It is unlike other books in this field in that each concept is illustrated numerically via a few lines of Chebfun code. There are about 400 computer-generated figures in all, and Appendix B presents 100 more examples as templates for further exploration.?
Computational Methods for Option Pricing Springer Science & Business Media
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.
Analyse numérique et optimisation Springer Nature
It was mainly during the last two decades that the theory of homogenization or averaging of partial differential equations took shape as a distinct mathe matical discipline. This theory has a lot of important applications in mechanics of composite and

perforated materials, filtration, disperse media, and in many other branches of physics, mechanics and modern technology. There is a vast literature on the subject. The term averaging has been usually associated with the methods of non linear mechanics and ordinary differential equations developed in the works of Poincare, Van Der Pol, Krylov, Bogoliubov, etc. For a long time, after the works of Maxwell and Rayleigh, homogeniza tion problems for· partial differential equations were being mostly considered by specialists in physics and mechanics, and were staying beyond the scope of mathematicians. A great deal of attention was given to the so called disperse media, which, in the simplest case, are two-phase media formed by the main homogeneous material containing small foreign particles (grains, inclusions). Such two-phase bodies, whose size is considerably larger than that of each sep arate inclusion, have been discovered to possess stable physical properties (such as heat transfer, electric conductivity, etc.) which differ from those of the con stituent phases. For this reason, the word homogenized, or effective, is used in relation to these characteristics. An enormous number of results, approximation formulas, and estimates have been obtained in connection with such problems as

electromagnetic wave scattering on small particles, effective heat transfer in two-phase media, etc.

Exploring ODEs

Springer Science & Business Media

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.

Optimal Shape Design for Elliptic Systems

Elsevier

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.

Optimal Control of PDEs under Uncertainty SIAM

Conception optimale des structures est une introduction à la conception optimale de structures, appelée aussi optimisation de formes. Il est principalement destiné à un public mixte de mathématiciens appliqués et de mécaniciens que relient un même intérêt pour les applications numériques.

Numerical Analysis and Optimization Springer Nature

This book allows you to understand fully the modern tools of numerical analysis in finance.

Imagine Math 3 Springer

These are the proceedings of the 26th International Conference on Domain Decomposition Methods in Science and Engineering, which was hosted by the Chinese University of Hong Kong and held online in December 2020. Domain

decomposition methods are iterative methods for solving the often very large systems of equations that arise when engineering problems are discretized, frequently using finite elements or other modern techniques. These methods are specifically designed to make effective use of massively parallel, high-performance computing systems. The book presents both theoretical and computational advances in this domain, reflecting the state of art in 2020.
Introduction to Shape Optimization Springer Science & Business Media
This book covers various topics regarding the design of compliant mechanisms using topology optimization that have attracted a great deal of attention in recent decades. After comprehensively describing state-of-the-art methods for designing compliant mechanisms, it provides a new topology optimization method for finding new flexure hinges. It then presents several attempts to obtain distributed compliant mechanisms using the topology optimization method. Further, it discusses a Jacobian-based topology optimization method for compliant parallel mechanisms, and introduces readers to the topology optimization of compliant mechanisms, taking into account geometrical nonlinearity and

reliability. Providing a systematic method for topology optimization of flexure hinges, which are essential for designing compliant mechanisms, the book offers a valuable resource for all readers who are interested in designing compliant mechanism-based positioning stages. In addition, the methods for solving the de facto hinges in topology optimized compliant mechanisms will benefit all engineers seeking to design micro-electro-mechanical system (MEMS) structures.

Domain Decomposition Methods in Science and Engineering XX

SIAM

The purpose of this book is to offer an overview of the most popular domain decomposition methods for partial differential equations (PDEs). These methods are widely used for numerical simulations in solid mechanics, electromagnetism, flow in porous media, etc., on parallel machines from tens to hundreds of thousands of cores. The appealing feature of domain decomposition methods is that, contrary to direct methods, they are naturally parallel. The authors focus on parallel linear solvers. The authors present all popular algorithms, both at the PDE level and at the discrete level in terms of matrices, along with systematic scripts for sequential implementation in a free open-source finite element package as well as some parallel

scripts. Also included is a new coarse space construction (two-level method) that adapts to highly heterogeneous problems.?

The Mechanics and Thermodynamics of Continua John Wiley & Sons

Fractal structures or geometries currently play a key role in all models for natural and industrial processes that exhibit the formation of rough surfaces and interfaces. Computer simulations, analytical theories and experiments have led to significant advances in modeling these phenomena across wild media. Many problems coming from engineering, physics or biology are characterized by both the presence of different temporal and spatial scales and the presence of contacts among different components through (irregular) interfaces that often connect media with different characteristics. This work is devoted to collecting new results on fractal applications in engineering from both theoretical and numerical perspectives. The book is addressed to researchers in the field.

Acoustic Waves in Periodic Structures, Metamaterials, and Porous Media Springer Science & Business Media

This book delivers a comprehensive and up-to-date treatment of practical applications of metamaterials, structured media, and conventional porous materials. With

increasing levels of urbanization, a growing demand for motorized transport, and inefficient urban planning, environmental noise exposure is rapidly becoming a pressing societal and health concern. Phononic and sonic crystals, acoustic metamaterials, and metasurfaces can revolutionize noise and vibration control and, in many cases, replace traditional porous materials for these applications. In this collection of contributed chapters, a group of international researchers reviews the essentials of acoustic wave propagation in metamaterials and porous absorbers with viscothermal losses, as well as the most recent advances in the design of acoustic metamaterial absorbers. The book features a detailed theoretical introduction describing commonly used modelling techniques such as plane wave expansion, multiple scattering theory, and the transfer matrix method. The following chapters give a detailed consideration of acoustic wave propagation in viscothermal fluids and porous media, and the extension of this theory to non-local models for fluid saturated metamaterials, along with a description of the relevant numerical methods. Finally, the book reviews a range of practical industrial applications, making it especially attractive as a white book targeted

at the building, automotive, and aeronautic industries. **Approximation of Free-Discontinuity Problems** Springer 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.

Women in the Geosciences Springer Nature

Functionals involving both volume and surface energies have a number of applications ranging from Computer Vision to Fracture Mechanics. In order to tackle numerical and dynamical problems linked to such functionals many approximations by functionals defined on smooth functions have been proposed (using high-order singular perturbations, finite-difference or non-local energies, etc.) The purpose of this book is to present a global approach to these approximations using the theory of gamma-convergence and of special functions of bounded variation. The book is directed to PhD students and researchers in calculus of variations, interested in approximation problems with possible applications.

Geometric Partial Differential Equations - Part 2 SIAM

Read an interview with the author: "Working Toward Gender Parity in the Geosciences" The geoscience workforce has a lower proportion of women

compared to the general population of the United States and compared to many other STEM fields. This volume explores issues pertaining to gender parity in the geosciences, and sheds light on some of the best practices that increase participation by women and promote parity. Volume highlights include: • Lessons learned from NSF-ADVANCE • Data on gender composition of faculty at top earth science institutions in the US • Implicit bias and gender as a social structure • Strategies for institutional change • Dual career couples • Family friendly policies • Role of mentoring • Career advancement for women • Recruiting diverse faculty • Models of institutional transformation Women in the Geosciences is a valuable contribution to the existing literature on gender issues in STEM disciplines. It focuses specifically on the geosciences, with a goal to spreading awareness on the best practices for gender parity in academic geoscience departments. Geoscientists, policymakers, educators and administrators could all greatly benefit from the contents of this volume.

The Lanczos and Conjugate Gradient Algorithms Springer Science & Business Media

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.

Michell Structures

SIAM

This book offers a comprehensive presentation of some of the most successful and popular domain decomposition preconditioners for finite and spectral element approximations of partial differential equations. It places strong emphasis on both algorithmic and mathematical aspects. It covers in detail important methods such as FETI and balancing Neumann-Neumann methods and algorithms for spectral element methods.