

Acoustic And Electromagnetic Equations Integral Representations For Harmonic Problems Applied Mathematical Sciences

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**Computational Methods for
Electromagnetic Phenomena** - Wei Cai
2013-01-03

The first book of its kind to cover a wide range of computational methods for electromagnetic phenomena, from atomistic to continuum scales, this integrated and balanced treatment of mathematical formulations, algorithms and the underlying physics enables us to engage in innovative and advanced interdisciplinary computational research.

**Domain Decomposition Methods in Science
and Engineering XXII** - Thomas Dickopf
2016-03-11

These are the proceedings of the 22nd International Conference on Domain Decomposition Methods, which was held in Lugano, Switzerland. With 172 participants from over 24 countries, this conference continued a long-standing tradition of internationally oriented meetings on Domain Decomposition Methods. The book features a well-balanced mix of established and new topics, such as the manifold theory of Schwarz Methods, Isogeometric Analysis, Discontinuous Galerkin Methods, exploitation of modern HPC

architectures and industrial applications. As the conference program reflects, the growing capabilities in terms of theory and available hardware allow increasingly complex non-linear and multi-physics simulations, confirming the tremendous potential and flexibility of the domain decomposition concept.

Unified Transform for Boundary Value Problems
- Athanasios S. Fokas 2015-01-01

This book describes state-of-the-art advances and applications of the unified transform and its relation to the boundary element method. The authors present the solution of boundary value problems from several different perspectives, in particular the type of problems modeled by partial differential equations (PDEs). They discuss recent applications of the unified transform to the analysis and numerical modeling of boundary value problems for linear and integrable nonlinear PDEs and the closely related boundary element method, a well-established numerical approach for solving linear elliptic PDEs. The text is divided into three parts. Part I contains new theoretical results on linear and nonlinear evolutionary and elliptic problems. New explicit solution

representations for several classes of boundary value problems are constructed and rigorously analyzed. Part II is a detailed overview of variational formulations for elliptic problems. It places the unified transform approach in a classic context alongside the boundary element method and stresses its novelty. Part III presents recent numerical applications based on the boundary element method and on the unified transform.

Computational Acoustics of Noise Propagation in Fluids - Finite and Boundary Element Methods - Steffen Marburg
2008-02-27

The book provides a survey of numerical methods for acoustics, namely the finite element method (FEM) and the boundary element method (BEM). It is the first book summarizing FEM and BEM (and optimization) for acoustics. The book shows that both methods can be effectively used for many other cases, FEM even for open domains and BEM for closed ones. Emphasis of the book is put on numerical aspects and on treatment of the exterior problem in acoustics, i.e. noise radiation.

Bifurcation Theory - Hansjörg Kielhöfer
2006-04-10

In the past three decades, bifurcation theory has matured into a well-established and vibrant branch of mathematics. This book gives a unified presentation in an abstract setting of the main theorems in bifurcation theory, as well as more recent and lesser known results. It covers both the local and global theory of one-parameter bifurcations for operators acting in infinite-dimensional Banach spaces, and shows how to apply the theory to problems involving partial differential equations. In addition to existence, qualitative properties such as stability and nodal structure of bifurcating solutions are treated in depth. This volume will serve as an important reference for mathematicians, physicists, and theoretically-inclined engineers working in bifurcation theory and its applications to partial differential equations.

Artificial Boundary Method - Houde Han
2013-04-13

"Artificial Boundary Method" systematically introduces the artificial boundary method for the numerical solutions of partial differential equations in unbounded domains. Detailed

discussions treat different types of problems, including Laplace, Helmholtz, heat, Schrödinger, and Navier and Stokes equations. Both numerical methods and error analysis are discussed. The book is intended for researchers working in the fields of computational mathematics and mechanical engineering. Prof. Houde Han works at Tsinghua University, China; Prof. Xiaonan Wu works at Hong Kong Baptist University, China.

Multi-wave Medical Imaging: Mathematical Modelling And Imaging Reconstruction - Nguyen Loc Hoang
2017-03-03

Super-Resolution imaging refers to modern techniques of achieving resolution below conventional limits. This book gives a comprehensive overview of mathematical and computational techniques used to achieve this, providing a solid foundation on which to develop the knowledge and skills needed for practical application of techniques. Split into five parts, the first looks at the mathematical and probabilistic tools needed, before moving on to description of different types of imaging; single-wave, anomaly, multi-wave and spectroscopic and nanoparticle. As an important contribution to the understanding of super-resolution techniques in biomedical imaging, this book is a useful resource for scientists and engineers in the fields of biomedical imaging and super-resolution, and is self-contained reference for any newcomers to these fields.

Elements of Applied Bifurcation Theory - Yuri Kuznetsov
2013-03-09

Providing readers with a solid basis in dynamical systems theory, as well as explicit procedures for application of general mathematical results to particular problems, the focus here is on efficient numerical implementations of the developed techniques. The book is designed for advanced undergraduates or graduates in applied mathematics, as well as for Ph.D. students and researchers in physics, biology, engineering, and economics who use dynamical systems as model tools in their studies. A moderate mathematical background is assumed, and, whenever possible, only elementary mathematical tools are used. This new edition preserves the structure of the first while updating the context to incorporate recent theoretical developments, in particular new and

improved numerical methods for bifurcation analysis.

Mathematical and Statistical Methods for Multistatic Imaging - Habib Ammari 2013-11-29

This book covers recent mathematical, numerical, and statistical approaches for multistatic imaging of targets with waves at single or multiple frequencies. The waves can be acoustic, elastic or electromagnetic. They are generated by point sources on a transmitter array and measured on a receiver array. An important problem in multistatic imaging is to quantify and understand the trade-offs between data size, computational complexity, signal-to-noise ratio, and resolution. Another fundamental problem is to have a shape representation well suited to solving target imaging problems from multistatic data. In this book the trade-off between resolution and stability when the data are noisy is addressed. Efficient imaging algorithms are provided and their resolution and stability with respect to noise in the measurements analyzed. It also shows that high-order polarization tensors provide an accurate representation of the target. Moreover, a dictionary-matching technique based on new invariants for the generalized polarization tensors is introduced. Matlab codes for the main algorithms described in this book are provided. Numerical illustrations using these codes in order to highlight the performance and show the limitations of numerical approaches for multistatic imaging are presented.

Mathematical Problems in Image Processing - Gilles Aubert 2006-11-30

The updated 2nd edition of this book presents a variety of image analysis applications, reviews their precise mathematics and shows how to discretize them. For the mathematical community, the book shows the contribution of mathematics to this domain, and highlights unsolved theoretical questions. For the computer vision community, it presents a clear, self-contained and global overview of the mathematics involved in image processing problems. The second edition offers a review of progress in image processing applications covered by the PDE framework, and updates the existing material. The book also provides programming tools for creating simulations with minimal effort.

Analysis, Probability, Applications, and Computation - Karl-Olof Lindahl 2019-04-29

This book is a collection of short papers from the 11th International ISAAC Congress 2017 in Växjö, Sweden. The papers, written by the best international experts, are devoted to recent results in mathematics with a focus on analysis. The volume provides to both specialists and non-specialists an excellent source of information on the current research in mathematical analysis and its various interdisciplinary applications. Abstract and Applied Analysis - N. M. Chuong 2004

This volume takes up various topics in Mathematical Analysis including boundary and initial value problems for Partial Differential Equations and Functional Analytic methods. Topics include linear elliptic systems for composite material ? the coefficients may jump from domain to domain; Stochastic Analysis ? many applied problems involve evolution equations with random terms, leading to the use of stochastic analysis. The proceedings have been selected for coverage in: ? Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings)? CC Proceedings ? Engineering & Physical Sciences Parallel Algorithms and Cluster Computing - Karl Heinz Hoffmann 2007-06-24

This book presents advances in high performance computing as well as advances accomplished using high performance computing. It contains a collection of papers presenting results achieved in the collaboration of scientists from computer science, mathematics, physics, and mechanical engineering. From science problems to mathematical algorithms and on to the effective implementation of these algorithms on massively parallel and cluster computers, the book presents state-of-the-art methods and technology, and exemplary results in these fields.

Aeroacoustic and Vibroacoustic Advancement in Aerospace and Automotive Systems - Roberto Citarella 2018-06-26

This book is a printed edition of the Special Issue "Advances in Vibroacoustics and Aeroacoustics of Aerospace and Automotive Systems" that was published in Applied Sciences **Some contributions in time-harmonic**

dissipative problems. -

Direct and Inverse Problems in Wave Propagation and Applications - Ivan Graham
2013-10-14

This book is the third volume of three volume series recording the "Radon Special Semester 2011 on Multiscale Simulation & Analysis in Energy and the Environment" taking place in Linz, Austria, October 3-7, 2011. This book surveys recent developments in the analysis of wave propagation problems. The topics covered include aspects of the forward problem and problems in inverse problems, as well as applications in the earth sciences. Wave propagation problems are ubiquitous in environmental applications such as seismic analysis, acoustic and electromagnetic scattering. The design of efficient numerical methods for the forward problem, in which the scattered field is computed from known geometric configurations is very challenging due to the multiscale nature of the problems. Even more challenging are inverse problems where material parameters and configurations have to be determined from measurements in conjunction with the forward problem. This book contains review articles covering several state-of-the-art numerical methods for both forward and inverse problems. This collection of survey articles focusses on the efficient computation of wave propagation and scattering is a core problem in numerical mathematics, which is currently of great research interest and is central to many applications in energy and the environment. Two generic applications which resonate strongly with the central aims of the Radon Special Semester 2011 are forward wave propagation in heterogeneous media and seismic inversion for subsurface imaging. As an example of the first application, modelling of absorption and scattering of radiation by clouds, aerosol and precipitation is used as a tool for interpretation of (e.g.) solar, infrared and radar measurements, and as a component in larger weather/climate prediction models in numerical weather forecasting. As an example of the second application, inverse problems in wave propagation in heterogeneous media arise in the problem of imaging the subsurface below land or marine deposits. The book records the

achievements of Workshop 3 "Wave Propagation and Scattering, Inverse Problems and Applications in Energy and the Environment". It brings together key numerical mathematicians whose interest is in the analysis and computation of wave propagation and scattering problems, and in inverse problems, together with practitioners from engineering and industry whose interest is in the applications of these core problems.

Polarization and Moment Tensors - Habib Ammari 2007-06-16

This book presents important recent developments in mathematical and computational methods used in impedance imaging and the theory of composite materials. By augmenting the theory with interesting practical examples and numerical illustrations, the exposition brings simplicity to the advanced material. An introductory chapter covers the necessary basics. An extensive bibliography and open problems at the end of each chapter enhance the text.

Modeling and Inverse Problems in Imaging Analysis - Bernard Chalmond 2003-01-14

More mathematicians have been taking part in the development of digital image processing as a science and the contributions are reflected in the increasingly important role modeling has played solving complex problems. This book is mostly concerned with energy-based models. Most of these models come from industrial projects in which the author was involved in robot vision and radiography: tracking 3D lines, radiographic image processing, 3D reconstruction and tomography, matching, deformation learning. Numerous graphical illustrations accompany the text.

Dynamics in Infinite Dimensions - Jack K. Hale 2006-04-18

State-of-the-art in qualitative theory of functional differential equations; Most of the new material has never appeared in book form and some not even in papers; Second edition updated with new topics and results; Methods discussed will apply to other equations and applications

Stability and Wave Motion in Porous Media - Brian Straughan 2008-12-10

This book describes several tractable theories for fluid flow in porous media. The important

mathematical questions about structural stability and spatial decay are addressed. Thermal convection and stability of other flows in porous media are covered. A chapter is devoted to the problem of stability of flow in a fluid overlying a porous layer. Nonlinear wave motion in porous media is analysed. In particular, waves in an elastic body with voids are investigated while acoustic waves in porous media are also analysed in some detail. A chapter is enclosed on efficient numerical methods for solving eigenvalue problems which occur in stability problems for flows in porous media. Brian Straughan is a professor at the Department of Mathematical Sciences at Durham University, United Kingdom.

Field Representations and Introduction to Scattering - V. V. Varadan 1991

This is the first volume in the Handbook on Acoustic, Electromagnetic and Elastic Wave Scattering subseries and it serves as an introduction to the remaining volumes. The basic objective of this series is to serve as a major reference source for the uniform treatment of acoustic, electromagnetic and elastodynamic field problems. It provides an indispensable guide for the scientific community and graduate students by acquainting them very quickly with the basic principles of a certain technique as it is applied to any of the three fields, and also provides appropriate references. It was felt that in presenting such a comprehensive collection of treatment methods as they are applied to all three wave fields it would open up a whole range of new ideas to solid mechanists, who would perhaps otherwise not come into contact with such electromagnetic waves literature. These three subseries of volumes will prove a useful aid to researchers in reading and understanding the jargon used in the literature on acoustic, electromagnetic and elastodynamic fields, as well as providing them with the opportunity for the cross-fertilization of ideas.

Topics in Computational Wave Propagation - Mark Ainsworth 2012-12-06

These ten detailed and authoritative survey articles on numerical methods for direct and inverse wave propagation problems are written by leading experts. Researchers and practitioners in computational wave propagation, from postgraduate level onwards,

will find the breadth and depth of coverage of recent developments a valuable resource. The articles describe a wide range of topics on the application and analysis of methods for time and frequency domain PDE and boundary integral formulations of wave propagation problems. Electromagnetic, seismic and acoustic equations are considered. Recent developments in methods and analysis ranging from finite differences to hp-adaptive finite elements, including high-accuracy and fast methods are described with extensive references.

Acoustic and Electromagnetic Equations - Jean-Claude Nedelec 2001-03-30

Acoustic and electromagnetic waves underlie a range of modern technology from sonar, radio, and television to microwave heating and electromagnetic compatibility analysis. This book, written by an international researcher, presents some of the research in a complete way. It is useful for graduate students in mathematics, physics, and engineering.

Dynamics of Evolutionary Equations - George R. Sell 2013-04-17

The theory and applications of infinite dimensional dynamical systems have attracted the attention of scientists for quite some time. This book serves as an entrée for scholars beginning their journey into the world of dynamical systems, especially infinite dimensional spaces. The main approach involves the theory of evolutionary equations.

Maxwell's Equations in Periodic Structures - Gang Bao 2021-11-22

This book addresses recent developments in mathematical analysis and computational methods for solving direct and inverse problems for Maxwell's equations in periodic structures. The fundamental importance of the fields is clear, since they are related to technology with significant applications in optics and electromagnetics. The book provides both introductory materials and in-depth discussion to the areas in diffractive optics that offer rich and challenging mathematical problems. It is also intended to convey up-to-date results to students and researchers in applied and computational mathematics, and engineering disciplines as well.

Abstract and Applied Analysis - N M Chuong 2004-06-01

This volume takes up various topics in Mathematical Analysis including boundary and initial value problems for Partial Differential Equations and Functional Analytic methods. Topics include linear elliptic systems for composite material — the coefficients may jump from domain to domain; Stochastic Analysis — many applied problems involve evolution equations with random terms, leading to the use of stochastic analysis. The proceedings have been selected for coverage in: • Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings) • CC Proceedings — Engineering & Physical Sciences Contents: Deterministic Analysis: Differentiation of Hypergeometric Functions with Respect to Parameters (Yu A Brychkov & K O Geddes) On the Lagrange Problem About the Strongest Columns (Yu V Egorov) Wavelet Based Fast Solution of Boundary Integral Equations (H Harbrecht & R Schneider) Semi-Classical Methods in Ginzburg-Landau Theory (B Helffer) Stability of Equilibria in One-Dimensional Motion of Compressible Viscous Gas Forced by Self-Gravity (Y Iwata & Y Yamamoto) Estimates for Elliptic Systems for Composite Material (L Nirenberg) On Asymptotics for the Mabuchi Energy Functional (D H Phong & J Sturm) Regularity of Solutions of the Initial Boundary Value Problem for Linearized Equations of Ideal Magneto-Hydrodynamics (M Yamamoto) Stochastic Analysis: Impulsive Stochastic Evolution Inclusions with Multi-Valued Diffusion (N U Ahmed) Some of Future Directions of White Noise Analysis (T Hida) Constructing Random Probability Distributions (T P Hill & D E R Sitton) Multiparameter Additive Processes of Mixture Type (K Inoue) The Random Integral Representation Hypothesis Revisited: New Classes of S-Selfdecomposable Laws (Z J Jurek) Semigroups and Processes with Parameter in a Cone (J Pedersen & K-I Sato) and other papers Readership: Researchers and academics in the fields of analysis and differential equations, approximation theory, probability and statistics. Keywords: Almost Complex Manifolds; Noncommutative Geometry; Lagrange Problem; Boundary Value Problem

Modeling and Computations in Electromagnetics - Habib Ammari 2008-01-12

This is nothing less than an essential text in what is a new and growing discipline. Electromagnetic modeling and computations is expanding as a result of the steadily increasing demand for designing electrical devices, modeling electromagnetic materials, and simulating electromagnetic fields in nanoscale structures. The aim of this volume is to bring together prominent worldwide experts to review state-of-the-art developments and future trends of modeling and computations in electromagnetics.

Applied and Numerical Partial Differential Equations - W. Fitzgibbon 2010-01-08

Standing at the intersection of mathematics and scientific computing, this collection of state-of-the-art papers in nonlinear PDEs examines their applications to subjects as diverse as dynamical systems, computational mechanics, and the mathematics of finance.

Imperfect Bifurcation in Structures and Materials - Kiyohiro Ikeda 2013-03-09

Most physical systems lose or gain stability through bifurcation behavior. This book explains a series of experimentally found bifurcation phenomena by means of the methods of static bifurcation theory.

Multiscale, Nonlinear and Adaptive

Approximation - Ronald DeVore 2009-09-16

The book of invited articles offers a collection of high-quality papers in selected and highly topical areas of Applied and Numerical Mathematics and Approximation Theory which have some connection to Wolfgang Dahmen's scientific work. On the occasion of his 60th birthday, leading experts have contributed survey and research papers in the areas of Nonlinear Approximation Theory, Numerical Analysis of Partial Differential and Integral Equations, Computer-Aided Geometric Design, and Learning Theory. The main focus and common theme of all the articles in this volume is the mathematics building the foundation for most efficient numerical algorithms for simulating complex phenomena.

Modern Solvers for Helmholtz Problems - Domenico Lahaye 2017-03-02

This edited volume offers a state of the art overview of fast and robust solvers for the Helmholtz equation. The book consists of three parts: new developments and analysis in

Helmholtz solvers, practical methods and implementations of Helmholtz solvers, and industrial applications. The Helmholtz equation appears in a wide range of science and engineering disciplines in which wave propagation is modeled. Examples are: seismic inversion, ultrasonic medical imaging, sonar detection of submarines, waves in harbours and many more. The partial differential equation looks simple but is hard to solve. In order to approximate the solution of the problem numerical methods are needed. First a discretization is done. Various methods can be used: (high order) Finite Difference Method, Finite Element Method, Discontinuous Galerkin Method and Boundary Element Method. The resulting linear system is large, where the size of the problem increases with increasing frequency. Due to higher frequencies the seismic images need to be more detailed and, therefore, lead to numerical problems of a larger scale. To solve these three dimensional problems fast and robust, iterative solvers are required. However for standard iterative methods the number of iterations to solve the system becomes too large. For these reasons a number of new methods are developed to overcome this hurdle. The book is meant for researchers both from academia and industry and graduate students. A prerequisite is knowledge on partial differential equations and numerical linear algebra.

[Piecewise-smooth Dynamical Systems](#) - Mario Bernardo 2008-01-01

This book presents a coherent framework for understanding the dynamics of piecewise-smooth and hybrid systems. An informal introduction expounds the ubiquity of such models via numerous examples. The results are presented in an informal style, and illustrated with many examples. The book is aimed at a wide audience of applied mathematicians, engineers and scientists at the beginning postgraduate level. Almost no mathematical background is assumed other than basic calculus and algebra.

Boundary Element Analysis - Martin Schanz 2007-04-29

This volume contains eleven contributions on boundary integral equation and boundary element methods. Beside some historical and more analytical aspects in the formulation and analysis of boundary integral equations, modern

fast boundary element methods are also described and analyzed from a mathematical point of view. In addition, the book presents engineering and industrial applications that show the ability of boundary element methods to solve challenging problems from different fields.

Computational Electromagnetics - Carsten Carstensen 2012-12-06

The dimmed outlines of phenomenal things all into one another unless we put on the merge focusing-glass of theory, and screw it up some times to one pitch of definition and sometimes to another, so as to see down into different depths through the great millstone of the world James Clerk Maxwell (1831 - 1879) For a long time after the foundation of the modern theory of electromagnetism by James Clerk Maxwell in the 19th century, the mathematical approach to electromagnetic field problems was for a long time dominated by the analytical investigation of Maxwell's equations. The rapid development of computing facilities during the last century has then necessitated appropriate numerical methods and algorithmic tools for the simulation of electromagnetic phenomena. During the last few decades, a new research area "Computational Electromagnetics" has emerged comprising the mathematical analysis, design, implementation, and application of numerical schemes to simulate all kinds of relevant electromagnetic processes. This area is still rapidly evolving with a wide spectrum of challenging issues featuring, among others, such problems as the proper choice of spatial discretizations (finite differences, finite elements, finite volumes, boundary elements), fast solvers for the discretized equations (multilevel techniques, domain decomposition methods, multipole, panel clustering), and multiscale aspects in microelectronics and micromagnetics.

[Boundary Integral Equations](#) - George C. Hsiao 2021-03-26

This is the second edition of the book which has two additional new chapters on Maxwell's equations as well as a section on properties of solution spaces of Maxwell's equations and their trace spaces. These two new chapters, which summarize the most up-to-date results in the literature for the Maxwell's equations, are sufficient enough to serve as a self-contained

introductory book on the modern mathematical theory of boundary integral equations in electromagnetics. The book now contains 12 chapters and is divided into two parts. The first six chapters present modern mathematical theory of boundary integral equations that arise in fundamental problems in continuum mechanics and electromagnetics based on the approach of variational formulations of the equations. The second six chapters present an introduction to basic classical theory of the pseudo-differential operators. The aforementioned corresponding boundary integral operators can now be recast as pseudo-differential operators. These serve as concrete examples that illustrate the basic ideas of how one may apply the theory of pseudo-differential operators and their calculus to obtain additional properties for the corresponding boundary integral operators. These two different approaches are complementary to each other. Both serve as the mathematical foundation of the boundary element methods, which have become extremely popular and efficient computational tools for boundary problems in applications. This book contains a wide spectrum of boundary integral equations arising in fundamental problems in continuum mechanics and electromagnetics. The book is a major scholarly contribution to the modern approaches of boundary integral equations, and should be accessible and useful to a large community of advanced graduate students and researchers in mathematics, physics, and engineering.

Acoustic and Electromagnetic Equations - Jean-Claude Nedelec 2013-06-29

Acoustic and electromagnetic waves underlie a vast range of modern technology from sonar, radio, and television to microwave heating and electromagnetic compatibility analysis. Mathematical modeling of these waves has undergone considerable growth in recent years, and this timely book, written by a leading international researcher, presents the research in a careful and complete way.

The Energy Method, Stability, and Nonlinear Convection - brian straughan 2003-10-01

Six new chapters (14-19) deal with topics of current interest: multi-component convection diffusion, convection in a compressible fluid,

convection with temperature dependent viscosity and thermal conductivity, penetrative convection, nonlinear stability in ocean circulation models, and numerical solution of eigenvalue problems.

Direct Methods in the Calculus of Variations - Bernard Dacorogna 2007-11-21

This book is developed for the study of vectorial problems in the calculus of variations. The subject is a very active one and almost half of the book consists of new material. This is a new edition of the earlier book published in 1989 and it is suitable for graduate students. The book has been updated with some new material and examples added. Applications are included.

Front Tracking for Hyperbolic Conservation Laws - Helge Holden 2007-05-15

This book presents the theory of hyperbolic conservation laws from basic theory to the forefront of research. The text treats the theory of scalar conservation laws in one dimension in detail, showing the stability of the Cauchy problem using front tracking. The extension to multidimensional scalar conservation laws is obtained using dimensional splitting. The book includes detailed discussion of the recent proof of well-posedness of the Cauchy problem for one-dimensional hyperbolic conservation laws, and a chapter on traditional finite difference methods for hyperbolic conservation laws with error estimates and a section on measure valued solutions.

Optimization and Control for Partial Differential Equations - Roland Herzog 2022-03-07

This book highlights new developments in the wide and growing field of partial differential equations (PDE)-constrained optimization. Optimization problems where the dynamics evolve according to a system of PDEs arise in science, engineering, and economic applications and they can take the form of inverse problems, optimal control problems or optimal design problems. This book covers new theoretical, computational as well as implementation aspects for PDE-constrained optimization problems under uncertainty, in shape optimization, and in feedback control, and it illustrates the new developments on representative problems from a variety of applications.