Introduction To Shape Optimization Theory Approximation And Computation | e2db844d4dcbdbda823c9764ddcac145

Variational Methods in Shape Optimization ProblemsOPTIMIZATION AND OPERATIONS RESEARCH - Volume IIIModelling, Simulation and OptimizationConstrained Optimization and Optimal Control for Partial Differential EquationsIsogeometric Analysis and Applications 2014Introduction to Optimization of StructuresIntroduction to Shape OptimizationStochastic Processes, Estimation, and ControlMathematical Modeling, Simulation and Optimization for Power Engineering and ManagementLarge-Scale Scientific ComputingThe Shape of ThingsApplied Dynamic Programming for Optimization of Dynamical SystemsPrimer on Optimal Control TheoryCompressible Navier-Stokes EquationsThe Shapes of ThingsTopological Derivatives in Shape OptimizationNumerical Mathematics and Advanced ApplicationsShape Optimization and Free BoundariesControl and Optimization with Differential-Algebraic ConstraintsThe Feature-Driven Method for Structural OptimizationNew Trends in Shape OptimizationAn Introduction to Structural OptimizationIntroduction to Shape OptimizationCoupled Fluid Flow in Energy, Biology and Environmental ResearchGame Theory with Engineering ApplicationsApplications to Regular and Bang-Bang ControlAIMD Dynamics and Distributed Resource AllocationNonlinear Time Scale Systems in Standard and Nonstandard FormsNonlinear Control Under Nonconstant DelaysShape Optimization by the Homogenization MethodApplied and Numerical Partial Differential EquationsProceedings：10th Taiwan—Philippines Symposium on AnalysisComputational Fluid Dynamics in Food ProcessingAdvances in Structural and Multidisciplinary OptimizationStructural Optimization with UncertaintiesSystem Modeling and OptimizationMathematical Modeling and Optimization of Complex StructuresIntroduction to Shape OptimizationEvolutionary ComputationMathematical Analysis of Continuum Mechanics and Industrial Applications III

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.

Since many processes in the food industry involve fluid flow and heat and mass transfer, Computational Fluid Dynamics (CFD) provides a powerful early-stage simulation tool for gaining a qualitative and quantitative assessment of the performance of food processing, allowing engineers to test concepts all the way through the development of a process or system. Published in 2007, the first edition was the first book to address the use of CFD in food processing applications, and its aims were to present a comprehensive review of CFD applications for the food industry and pinpoint the research and development trends in the development of the technology; to provide the engineer and technologist working in research, development, and operations in the food industry with critical, comprehensive, and readily accessible information on the art and science of CFD; and to serve as an essential reference source to undergraduate and postgraduate students and researchers in universities and research institutions. This will continue to be the purpose of this second edition. In the second edition, in order to reflect the most recent research and development trends in the technology, only a few original chapters are updated with the latest developments. Therefore, this new edition mostly contains new chapters covering the analysis and optimization of cold chain facilities, simulation of thermal processing and modeling of heat exchangers, and CFD applications in other food processes.

Progress in Computational Physics is a new e-book series devoted to recent research trends in computational physics. It contains chapters contributed by outstanding experts of modeling of physical problems. The series focuses on interdisciplinary computational perspectives of current physical challenges, new numerical techniques for the solution of mathematical wave equations and describes certain real-world applications. With the help of powerful computers and sophisticated methods of numerical mathematics it is possible to simulate many ultramodern devices, e.g. photonic crystals structures, semiconductor nanostructures or fuel cell stacks devices, thus preventing expensive and longstanding design and optimization in the laboratories. In this book series, research manuscripts are shortened as single chapters and focus on one hot topic per volume. Engineers, physicists, meteorologists, etc. and applied mathematicians can benefit from the series content. Readers will get a deep and active insight into state-of-the art modeling and simulation techniques of ultra-modern devices and problems. The second volume of this series, titled Coupled Fluid Flow in Energy, Biology and Environmental Research covers the following scientific topics in the fields of modeling, numerical methods and applications: · Coupling between free and porous media flow · Coupling of flow and transport models · Coupling of atmospheric and ground water models This second volume contains both, the mathematical analysis of the coupling between fluid flow and porous media flow and state-of-the art numerical techniques, like tailor-made finite element and finite volume methods. Finally, readers will come across articles devoted to concrete applications of these models in the field of energy, biology and environmental research.

This is an exposition of the theory, techniques, and the basic formulation of structural optimization problems. The author considers applications of design optimization criteria involving strength, rigidity, stability and weight. Analytic and numerical techniques are introduced for research in optimal shapes and internal configurations of deformable bodies and structures. Problems of the optimal design of beams, systems of rods, plates and shells, are studied in detail. With regard to applications, this work is oriented towards solutions of real problems, such as reduction of the volume or weight of the material, and improvement of mechanical properties of structures. This book is written for readers specializing in applied mechanics, applied mathematics, and numerical analysis."

Edited by professionals with years of experience, this book provides an introduction to the theory of evolutionary algorithms and single- and multi-objective optimization, and then goes on to discuss to explore applications of evolutionary algorithms for many uses with real-world applications. Covering both the theory and applications of evolutionary computation, the book offers exhaustive coverage of several topics on nontraditional evolutionary techniques, details working principles of new and popular evolutionary algorithms, and discusses case studies on both scientific and real-world applications of optimization

This volume contains selected papers in three closely related areas: mathematical modeling in mechanics, numerical analysis, and optimization methods. The papers are based upon talks presented on the International Conference for Mathematical Modeling and Optimization in Mechanics, held in Jyv ä skyl ä , Finland, March 6-7, 2014 dedicated to Prof. N. Banichuk on the occasion of his 70th birthday. The articles are written by well-known scientists working in computational mechanics and in optimization of complicated technical models. Also, the volume contains papers discussing the historical development, the state of the art, new ideas, and open problems arising in modern continuum mechanics and applied optimization problems. Several papers are concerned with mathematical problems in numerical analysis, which are also closely related to important mechanical models. The main topics treated include: * Computer simulation methods in mechanics, physics, and biology; * Variational problems and methods; minimization algorithms; * Optimal control problems with distributed and discrete control; * Shape optimization and shape design problems in science and engineering; * Sensitivity analysis and parameters optimization of complex systems.

Based on the results of over 10 years of research and development by the authors, this book presents a broad cross section of dynamic programming (DP) techniques applied to the optimization of dynamical systems. The main goal of the research effort was to develop a robust path planning/trajectory optimization tool that did not require an initial guess. The goal was partially met with a combination of DP and homotopy algorithms. DP algorithms are presented here with a theoretical development, and their successful application to variety of practical engineering problems is emphasized.

The authors have developed a methodology for control of nonlinear systems in the presence of long delays, with large and rapid variation in the actuation or sensing path, or in the presence of long delays affecting the internal state of a system. In addition to control synthesis, they introduce tools to quantify the performance and the robustness properties of the designs provided in the book. The book is based on the concept of predictor feedback and infinite-dimensional backstepping transformation for linear systems and the authors guide the reader from the basic ideas of the concept?with constant delays only on the input?all the way through to nonlinear systems with state-dependent delays on the input as well as on system states. Readers will find the book useful because the authors provide elegant and systematic treatments of long-standing problems in delay systems, such as systems with state-dependent delays that arise in many applications. In addition, the authors give all control designs by explicit formulae, making the book especially useful for engineers who have faced delay-related challenges and are concerned with actual implementations and they accompany all control designs with Lyapunov-based analysis for establishing stability and performance guarantees.

Computer-Aided Design and system analysis aim to find mathematical models that allow emulating the behaviour of components and facilities. The high competitiveness in industry, the little time available for product development and the high cost in terms of time and money of producing the initial prototypes means that the computer-aided design and analysis of products are taking on major importance. On the other hand, in most areas of engineering the components of a system are interconnected and belong to different domains of physics (mechanics, electrics, hydraulics, thermal). When developing a complete multidisciplinary system, it needs to integrate a design procedure to ensure that it will be successfully achieved. Engineering systems require an analysis of their dynamic behaviour (evolution over time or path of their different variables). The purpose of modelling and simulating dynamic systems is to generate a set of algebraic and differential equations or a mathematical model. In order to perform rapid product optimisation iterations, the models must be formulated and evaluated in the most efficient way. Automated environments contribute to this. One of the pioneers of simulation technology in medicine defines simulation as a technique, not a technology, that replaces real experiences with guided experiences reproducing important aspects of the real world in a fully interactive fashion [iii]. In the following chapters the reader will be introduced to the world of simulation in topics of current interest such as medicine, military purposes and their use in industry for diverse applications that range from the use of networks to combining thermal, chemical or electrical aspects, among others. We hope that after reading the different sections of this book we will have succeeded in bringing across what the scientific community is doing in the field of simulation and that it will be to your interest and liking. Lastly, we would like to thank all the authors for their excellent contributions in the different areas of simulation.

The performance of a process -- for example, how an aircraft consumes fuel -- can be enhanced when the most effective controls and operating points for the process are determined. This holds true for many physical, economic, biomedical, manufacturing, and engineering processes whose behavior can often be influenced by altering certain parameters or controls to optimize some desired property or output.

Structural optimization is currently attracting considerable attention. Interest in - search in optimal design has grown in connection with the rapid development of aeronautical and space technologies, shipbuilding, and design of precision mach- ery. A special ?eld in these investigations is devoted to structural optimization with incomplete information (incomplete data). The importance of these investigations is explained as follows. The conventional theory of optimal structural design - sumes precise knowledge of material parameters, including damage characteristics and loadings applied to the structure. In practice such precise knowledge is seldom available. Thus, it is important to be able to predict the sensitivity of a designed structure to random ?uctuations in the environment and to variations in the material properties. To design reliable structures it is necessary to apply the so-called gu- anteed approach, based on a “worst case scenario” or a more optimistic probabilistic approach, if we have additional statistical data. Problems of optimal design with incomplete information also have consid- able theoretical importance. The introduction and investigations into new types of mathematical problems are interesting in themselves. Note that some ga- theoretical optimization problems arise for which there are no systematic techniques of investigation. This monograph is devoted to the exposition of new ways of formulating and solving problems of structural optimization with incomplete information. We recall some research results concerning the optimum shape and structural properties of bodies subjected to external loadings.

These proceedings collect the major part of the lectures given at ENU MATH2003, the European Conference on Numerical Mathematics and Ad vanced Applications, held in Prague, Czech Republic, from 18 August to 22 August, 2003. The importance of numerical and computational mathematics and sci entific computing is permanently growing. There is an increasing number of different research areas, where numerical simulation is necessary. Let us men tion fluid dynamics, continuum mechanics, electromagnetism, phase transi tion, cosmology, medicine, economics, finance, etc. The success of applications of numerical methods is conditioned by changing its basic instruments and looking for new appropriate techniques adapted to new problems as well as new computer architectures. The ENUMATH conferences were established in order to provide a fo rum for discussion of current topics of numerical mathematics. They seek to convene leading experts and young scientists with special emphasis on con tributions from Europe. Recent results and new trends are discussed in the analysis of numerical algorithms as well as in their applications to challenging scientific and industrial problems. The first ENUMATH conference was organized in Paris in 1995, then the series continued by the conferences in Heidelberg 1997, Jyvaskyla 1999 and Ischia Porto 2001. It was a great pleasure and honour for the Czech numerical community that it was decided at Ischia Porto to organize the ENUMATH2003 in Prague. It was the first time when this conference crossed the former Iron Courtain and was organized in a postsocialist country.

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.

This edited monograph offers a summary of future mathematical methods supporting the recent energy sector transformation. It collects current contributions on innovative methods and algorithms. Advances in mathematical techniques and scientific computing methods are presented centering around economic aspects, technical realization and large-scale networks. Over twenty authors focus on the mathematical modeling of such future systems with careful analysis of desired properties and arising scales. Numerical investigations include efficient methods for the simulation of possibly large-scale interconnected energy systems and modern techniques for optimization purposes to guarantee stable and reliable future operations. The target audience comprises research scientists, researchers in the R&D field, and practitioners. Since the book highlights possible future research directions, graduate students in the field of mathematical modeling or electrical engineering may also benefit strongly. .

Engineering systems are highly distributed collective systems that have humans in the loop. Engineering systems emphasize the potential of control and games beyond traditional applications. Game theory can be used to design incentives to obtain socially desirable behaviors on the part of the players, for example, a change in the consumption patterns on the part of the ?prosumers? (producers-consumers) or better redistribution of traffic. This unique book addresses the foundations of game theory, with an emphasis on the physical intuition behind the concepts, an analysis of design techniques, and a discussion of new trends in the study of cooperation and competition in large complex distributed systems.

Optimization and Operations Research is a component of Encyclopedia of Mathematical Sciences in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. The Theme on Optimization and Operations Research is organized into six different topics which represent the main scientific areas of the theme: 1. Fundamentals of Operations Research; 2. Advanced Deterministic Operations Research; 3. Optimization in Infinite Dimensions; 4. Game Theory; 5. Stochastic Operations Research; 6. Decision Analysis, which are then expanded into multiple subtopics, each as a chapter. These four volumes are aimed at the following five major target audiences: University and College students Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.

Treats sizing and shape optimization in a comprehensive way, covering everything from mathematical theory through computational aspects to industrial applications.

This book introduces key concepts for systematically controlling engineering systems that possess interacting phenomena occurring at widely different speeds. The aim is to present the reader with control techniques that extend the benefits of model reduction of singular perturbation theory to a larger class of nonlinear dynamical systems. New results and relevant background are presented through insightful examples that cover a wide range of applications from different branches of engineering. This book is unique because it: presents a new perspective on existing control methods and thus broadens their application to a larger class of nonlinear dynamical systems; discusses general rather than problem-specific developments to certain applications or disciplines in order to provide control engineers with useful analytical tools ; addresses new control problems using singular perturbation methods, including closed-form results for control of nonminimum phase systems.

The Feature-Driven Method for Structural Optimization details a novel structural optimization method within a CAD framework, integrating structural optimization and feature-based design. The book presents cutting-edge research on advanced structures and introduces the feature-driven structural optimization method by regarding engineering features as basic design primitives. Consequently, it presents a method that allows structural optimization and feature design to be done simultaneously so that feature attributes are preserved throughout the design process. The book illustrates and supports the effectiveness of the method described, showing potential applications through numerical modeling techniques and programming. This volume presents a high-performance optimization method adapted to engineering structures–a novel perspective that will help engineers in the computation, modeling and design of advanced structures. Integrates two independent methods - structural optimization and feature-based design–into one framework Adapts the high performance optimization method to the practice of designing engineering structures Provides numerical evidence for the effectiveness and potential of the methods described Works within a computer-aided design framework to develop a novel structural optimization methodology Presents engineering features as the basic design primitives in structural optimization

Many things around us have properties that depend on their shape--for example, the drag characteristics of a rigid body in a flow. This self-contained overview of differential geometry explains how to differentiate a function (in the calculus sense) with respect to a "shape variable." This approach, which is useful for understanding mathematical models containing geometric partial differential equations (PDEs), allows readers to obtain formulas for geometric quantities (such as curvature) that are clearer than those usually offered in differential geometry texts. Readers will learn how to compute sensitivities with respect to geometry by developing basic calculus tools on surfaces and combining them with the calculus of variations. Several applications that utilize shape derivatives and many illustrations that help build intuition are included.

Uncertainty and risk are integral to engineering because real systems have inherent ambiguities that arise naturally or due to our inability to model complex physics. The authors discuss probability theory, stochastic processes, estimation, and stochastic control strategies and show how probability can be used to model uncertainty in control and estimation problems. The material is practical and rich in research opportunities.

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.

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.

This special volume focuses on optimization and control of processes governed by partial differential equations. The contributors are mostly participants of the DFG-priority program 1253: Optimization with PDE-constraints which is active since 2006. The book is organized in sections which cover almost the entire spectrum of modern research in this emerging field. Indeed, even though the field of optimal control and optimization for PDE-constrained problems has undergone a dramatic increase of interest during the last four decades, a full theory for nonlinear problems is still lacking. The contributions of this volume, some of which have the character of survey articles, therefore, aim at creating and developing further new ideas for optimization, control and corresponding numerical simulations of systems of possibly coupled nonlinear partial differential equations. The research conducted within this unique network of groups in more than fifteen German universities focuses on novel methods of optimization, control and identification for problems in infinite-dimensional spaces, shape and topology problems, model reduction and adaptivity, discretization concepts and important applications. Besides the theoretical interest, the most prominent question is about the effectiveness of model-based numerical optimization methods for PDEs versus a black-box approach that uses existing codes, often heuristic-based, for optimization.

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.

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.

This is the first comprehensive book on the AIMD algorithm, the most widely used method for allocating a limited resource among competing agents without centralized control. The authors offer a new approach that is based on positive switched linear systems. It is used to develop most of the main results found in the book, and fundamental results on stochastic switched nonnegative and consensus systems are derived to obtain these results. The original and best known application of the algorithm is in the context of congestion control and resource allocation on the Internet, and readers will find details of several variants of the algorithm in order of increasing complexity, including deterministic, random, linear, and nonlinear versions. In each case, stability and convergence results are derived based on unifying principles. Basic and fundamental properties of the algorithm are described, examples are used to illustrate the richness of the resulting dynamical systems, and applications are provided to show how the algorithm can be used in the context of smart cities, intelligent transportation systems, and the smart grid.

This book focuses on mathematical theory and numerical simulation related to various areas of continuum mechanics, such as fracture mechanics, (visco)elasticity, optimal shape design, modelling of earthquakes and Tsunami waves, material structure, interface dynamics and complex systems. Written by leading researchers from the fields of applied mathematics, physics, seismology, engineering, and industry with an extensive knowledge of mathematical analysis, it helps readers understand how mathematical theory can be applied to various phenomena, and conversely, how to formulate actual phenomena as mathematical problems. This book is the sequel to the proceedings of the International Conference of Continuum Mechanics Focusing on Singularities (CoMFoS) 15 and CoMFoS16.

This book has grown out of lectures and courses given at Link ö ping 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.

A book devoted to second-order optimality conditions in the calculus of variations and optimal control, suitable for researchers and engineers.

Coverage in this proceedings volume includes robust multilevel and hierarchical preconditioning methods, applications for large scale computations and optimization of coupled engineering problems, and applications of metaheuristics to large-scale problems.

Many things around us have properties that depend on their shape?for example, the drag characteristics of a rigid body in a flow. This self-contained overview of differential geometry explains how to differentiate a function (in the calculus sense) with respect to a ?shape variable.? This approach, which is useful for understanding mathematical models containing geometric partial differential equations (PDEs), allows readers to obtain formulas for geometric quantities (such as curvature) that are clearer than those usually offered in differential geometry texts. Readers will learn how to compute sensitivities with respect to geometry by developing basic calculus tools on surfaces and combining them with the calculus of variations. Several applications that utilize shape derivatives and many illustrations that help build intuition are included.

rd This book constitutes a collection of extended versions of papers presented at the 23 IFIP TC7 Conference on System Modeling and Optimization, which was held in C- cow, Poland, on July 23-27, 2007. It contains 7 plenary and 22 contributed articles, the latter selected via a peer reviewing process. Most of the papers are concerned with optimization and optimal control. Some of them deal with practical issues, e. g. , p- formance-based design for seismic risk reduction, or evolutionary optimization in structural engineering. Many contributions concern optimization of infini- dimensional systems, ranging from a general overview of the variational analysis, through optimization and sensitivity analysis of PDE systems, to optimal control of neutral systems. A significant group of papers is devoted to shape analysis and opti- zation. Sufficient optimality conditions for ODE problems, and stochastic control methods applied to mathematical finance, are also investigated. The remaining papers are on mathematical programming, modeling, and information technology. The conference was the 23rd event in the series of such meetings biennially org- ized under the auspices of the Seventh Technical Committee “Systems Modeling and Optimization” of the International Federation for Information Processing (IFIP TC7).

Isogeometric Analysis is a groundbreaking computational approach that promises the possibility of integrating the finite element method into conventional spline-based CAD design tools. It thus bridges the gap between numerical analysis and geometry, and moreover it allows to tackle new cutting edge applications at the frontiers of research in science and engineering. This proceedings volume contains a selection of outstanding research papers presented at the second International Workshop on Isogeometric Analysis and Applications, held at Annweiler, Germany, in April 2014.

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-N ü rnberg 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.

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.

The volume includes papers from the WSCMO conference in Braunschweig 2017 presenting research of all aspects of the optimal design of structures as well as multidisciplinary design optimization where the involved disciplines deal with the analysis of solids, fluids or other field problems. Also presented are practical applications of optimization methods and the corresponding software development in all branches of technology.

A cutting-edge guide to modelling complex systems with differential-algebraic equations, suitable for applied mathematicians, engineers and computational scientists.

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.

This volume is a special issue which is devoted to selected papers from the 10th Taiwan-Philippines Symposium on Analysis (10th TPSOA) held on 31/March-3/April 2014 at the Garden Villa Hotel, Kaohsiung city, Taiwan and organized mainly by National University of Kaohsiung. The article on page 311 has listed the bilateral participants of Taiwan and the Philippines for the 10 symposiums. The symposiums have brought together mathematicians from the Philippines and Taiwan to share their results and current research activities.