Nonsmooth Approach to Optimization Problems with Equilibrium Constraints

Jiří Outrata, Michal Kočvara and Jochem Zowe
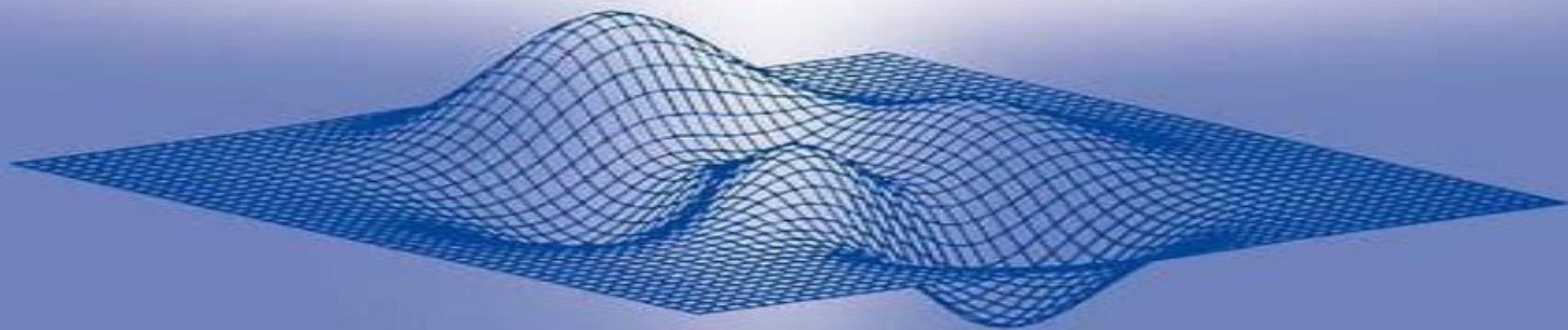
Nonsmooth Approach To Optimization Problems With Equilibrium Constraints Theory Applications And Numerical Results

Ronald Hoppe

Nonsmooth Approach To Optimization Problems With Equilibrium Constraints Theory Applications And Numerical Results:

Nonsmooth Approach to Optimization Problems with Equilibrium Constraints Jiri Outrata,M. Kocvara,J. Zowe,1998-07-31 This book presents an in depth study and a solution technique for an important class of optimization problems This class is characterized by special constraints parameter dependent convex programs variational inequalities or complementarity problems All these so called equilibrium constraints are mostly treated in a convenient form of generalized equations The book begins with a chapter on auxiliary results followed by a description of the main numerical tools a bundle method of nonsmooth optimization and a nonsmooth variant of Newton s method Following this stability and sensitivity theory for generalized equations is presented based on the concept of strong regularity This enables one to apply the generalized differential calculus for Lipschitz maps to derive optimality conditions and to arrive at a solution method A large part of the book focuses on applications coming from continuum mechanics and mathematical economy A series of nonacademic problems is introduced and analyzed in detail Each problem is accompanied with examples that show the efficiency of the solution method This book is addressed to applied mathematicians and engineers working in continuum mechanics operations research and economic modelling Students interested in optimization will also find the book useful *Nonsmooth Approach to Optimization Problems with Equilibrium Constraints* Jiri Outrata,M. Kocvara,J. Zowe,2013-06-29 In the early fifties applied mathematicians engineers and economists started to pay c10se attention to the optimization problems in which another lower Ievel optimization problem arises as a side constraint One of the motivating factors was the concept of the Stackelberg solution in game theory together with its economic applications Other problems have been encountered in the seventies in natural sciences and engineering Many of them are of practical importance and have been extensively studied mainly from the theoretical point of view Later applications to mechanics and network design have lead to an extension of the problem formulation Constraints in form of variation al inequalities and complementarity problems were also admitted The term generalized bi level programming problems was used at first but later probably in Harker and Pang 1988 a different terminology was introduced Mathematical programs with equilibrium constraints or simply MPECs In this book we adhere to MPEC terminology A large number of papers deals with MPECs but to our knowledge there is only one monograph Luo et al 1997 This monograph concentrates on optimality conditions and numerical methods Our book is oriented similarly but we focus on those MPECs which can be treated by the implicit programming approach the equilibrium constraint locally defines a certain implicit function and allows to convert the problem into a mathematical program with a nonsmooth objective **A Nonsmooth Approach to Optimization Problems with Equilibrium Constraints** Michal Kočvara,Jiří V. Outrata,1996

Numerical Nonsmooth Optimization Adil M. Bagirov,Manlio Gaudioso,Napsu Karmitsa,Marko M. Mäkelä,Sona Taheri,2020-02-28 Solving nonsmooth optimization NSO problems is critical in many practical applications and real world

modeling systems The aim of this book is to survey various numerical methods for solving NSO problems and to provide an overview of the latest developments in the field Experts from around the world share their perspectives on specific aspects of numerical NSO The book is divided into four parts the first of which considers general methods including subgradient bundle and gradient sampling methods In turn the second focuses on methods that exploit the problem s special structure e g algorithms for nonsmooth DC programming VU decomposition techniques and algorithms for minimax and piecewise differentiable problems The third part considers methods for special problems like multiobjective and mixed integer NSO and problems involving inexact data while the last part highlights the latest advancements in derivative free NSO Given its scope the book is ideal for students attending courses on numerical nonsmooth optimization for lecturers who teach optimization courses and for practitioners who apply nonsmooth optimization methods in engineering artificial intelligence machine learning and business Furthermore it can serve as a reference text for experts dealing with nonsmooth optimization

   Optimization with PDE Constraints Ronald Hoppe,2014-09-11 This book on PDE Constrained Optimization contains contributions on the mathematical analysis and numerical solution of constrained optimal control and optimization problems where a partial differential equation PDE or a system of PDEs appears as an essential part of the constraints The appropriate treatment of such problems requires a fundamental understanding of the subtle interplay between optimization in function spaces and numerical discretization techniques and relies on advanced methodologies from the theory of PDEs and numerical analysis as well as scientific computing The contributions reflect the work of the European Science Foundation Networking Programme Optimization with PDEs OPTPDE   *Trends in PDE Constrained Optimization* Günter Leugering,Peter Benner,Sebastian Engell,Andreas Griewank,Helmut Harbrecht,Michael Hinze,Rolf Rannacher,Stefan Ulbrich,2014-12-22 Optimization problems subject to constraints governed by partial differential equations PDEs are among the most challenging problems in the context of industrial economical and medical applications Almost the entire range of problems in this field of research was studied and further explored as part of the Deutsche Forschungsgemeinschaft DFG priority program 1253 on Optimization with Partial Differential Equations from 2006 to 2013 The investigations were motivated by the fascinating potential applications and challenging mathematical problems that arise in the field of PDE constrained optimization New analytic and algorithmic paradigms have been developed implemented and validated in the context of real world applications In this special volume contributions from more than fifteen German universities combine the results of this interdisciplinary program with a focus on applied mathematics The book is divided into five sections on Constrained Optimization Identification and Control Shape and Topology Optimization Adaptivity and Model Reduction Discretization Concepts and Analysis and Applications Peer reviewed research articles present the most recent results in the field of PDE constrained optimization and control problems Informative survey articles give an overview of topics that set sustainable trends for future research This makes this special volume interesting not only for mathematicians but also for engineers and for natural and

medical scientists working on processes that can be modeled by PDEs *Encyclopedia of Optimization* Christodoulos A. Floudas,Panos M. Pardalos,2008-09-04 The goal of the Encyclopedia of Optimization is to introduce the reader to a complete set of topics that show the spectrum of research the richness of ideas and the breadth of applications that has come from this field The second edition builds on the success of the former edition with more than 150 completely new entries designed to ensure that the reference addresses recent areas where optimization theories and techniques have advanced Particularly heavy attention resulted in health science and transportation with entries such as Algorithms for Genomics Optimization and Radiotherapy Treatment Design and Crew Scheduling **Restructured Electric Power Systems** Xiao-Ping Zhang,2010-10-15 The latest practical applications of electricity market equilibrium models in analyzing electricity markets Electricity market deregulation is driving the power energy production from a monopolistic structure into a competitive market environment The development of electricity markets has necessitated the need to analyze market behavior and power Restructured Electric Power Systems reviews the latest developments in electricity market equilibrium models and discusses the application of such models in the practical analysis and assessment of electricity markets Drawing upon the extensive involvement in the research and industrial development of the leading experts in the subject area the book starts by explaining the current developments of electrical power systems towards smart grids and then relates the operation and control technologies to the aspects in electricity markets It explores The problems of electricity market behavior and market power Mathematical programs with equilibrium constraints MPEC and equilibrium problems with equilibrium constraints EPEC Tools and techniques for solving the electricity market equilibrium problems Various electricity market equilibrium models State of the art techniques for computing the electricity market equilibrium problems The application of electricity market equilibrium models in assessing the economic benefits of transmission expansions for market environments forward and spot markets short term power system security and analysis of reactive power impact Also featured are computational resources to allow readers to develop algorithms on their own as well as future research directions in modeling and computational techniques in electricity market analysis Restructured Electric Power Systems is an invaluable reference for electrical engineers and power system economists from power utilities and for professors postgraduate students and undergraduate students in electrical power engineering as well as those responsible for the design engineering research and development of competitive electricity markets and electricity market policy Finite Element Method for Hemivariational Inequalities J. Haslinger,M. Miettinen,Panagiotis D. Panagiotopoulos,2013-03-09 Hemivariational inequalities represent an important class of problems in nonsmooth and nonconvex mechanics By means of them problems with nonmonotone possibly multivalued constitutive laws can be formulated mathematically analyzed and finally numerically solved The present book gives a rigorous analysis of finite element approximation for a class of hemivariational inequalities of elliptic and parabolic type Finite element models are described and their convergence properties are established Discretized models are

numerically treated as nonconvex and nonsmooth optimization problems The book includes a comprehensive description of typical representants of nonsmooth optimization methods Basic knowledge of finite element mathematics functional and nonsmooth analysis is needed The book is self contained and all necessary results from these disciplines are summarized in the introductory chapter Audience Engineers and applied mathematicians at universities and working in industry Also graduate level students in advanced nonlinear computational mechanics mathematics of finite elements and approximation theory Chapter 1 includes the necessary prerequisite materials **Applied Functional Analysis** Abul Hasan Siddiqi,2003-09 The methods of functional analysis have helped solve diverse real world problems in optimization modeling analysis numerical approximation and computer simulation Applied Functional Analysis presents functional analysis results surfacing repeatedly in scientific and technological applications and presides over the most current analytical and numerical methods in infinite dimensional spaces This reference highlights critical studies in projection theorem Riesz representation theorem and properties of operators in Hilbert space and covers special classes of optimization problems Supported by 2200 display equations this guide incorporates hundreds of up to date citations *Non-Smooth and Complementarity-Based Distributed Parameter Systems* Michael Hintermüller,Roland Herzog,Christian Kanzow,Michael Ulbrich,Stefan Ulbrich,2022-02-18 Many of the most challenging problems in the applied sciences involve non differentiable structures as well as partial differential operators thus leading to non smooth distributed parameter systems This edited volume aims to establish a theoretical and numerical foundation and develop new algorithmic paradigms for the treatment of non smooth phenomena and associated parameter influences Other goals include the realization and further advancement of these concepts in the context of robust and hierarchical optimization partial differential games and nonlinear partial differential complementarity problems as well as their validation in the context of complex applications Areas for which applications are considered include optimal control of multiphase fluids and of superconductors image processing thermoforming and the formation of rivers and networks Chapters are written by leading researchers and present results obtained in the first funding phase of the DFG Special Priority Program on Nonsmooth and Complementarity Based Distributed Parameter Systems Simulation and Hierarchical Optimization that ran from 2016 to 2019 **Bi-Level Strategies in Semi-Infinite Programming** Oliver Stein,2013-12-01 Semi infinite optimization is a vivid field of active research Recently semi infinite optimization in a general form has attracted a lot of attention not only because of its surprising structural aspects but also due to the large number of applications which can be formulated as general semi infinite programs The aim of this book is to highlight structural aspects of general semi infinite programming to formulate optimality conditions which take this structure into account and to give a conceptually new solution method In fact under certain assumptions general semi infinite programs can be solved efficiently when their bi Ievel structure is exploited appropriately After a brief introduction with some historical background in Chapter 1 we be gin our presentation by a motivation for the appearance of standard and

general semi infinite optimization problems in applications Chapter 2 lists a number of problems from engineering and economics which give rise to semi infinite models including reverse Chebyshev approximation minimax problems ro bust optimization design centering defect minimization problems for operator equations and disjunctive programming

Introduction to the Theory of Nonlinear Optimization Johannes Jahn,2020-07-02 This book serves as an introductory text to optimization theory in normed spaces and covers all areas of nonlinear optimization It presents fundamentals with particular emphasis on the application to problems in the calculus of variations approximation and optimal control theory The reader is expected to have a basic knowledge of linear functional analysis   **6GN for Future Wireless Networks** Xiaofei Wang,Victor C. M. Leung,Keqiu Li,Haijun Zhang,Xiping Hu,Qiang Liu,2021-01-28 This book constitutes the proceedings of the Third International Conference on 6G for Future Wireless Networks 6GN 2020 held in Tianjin China in August 2020 The conference was held virtually due to the COVID 19 pandemic The 45 full papers were selected from 109 submissions and present the state of the art and practical applications of 6G technologies The papers are arranged thematically on network scheduling and optimization wireless system and platform intelligent applications network performance evaluation cyber security and privacy technologies for private 5G 6G   *Shape Optimization, Homogenization and Optimal Control* Volker Schulz,Diaraf Seck,2018-09-05 The contributions in this volume give an insight into current research activities in Shape Optimization Homogenization and Optimal Control performed in Africa Germany and internationally Seeds for collaboration can be found in the first four papers in the field of homogenization Modelling and optimal control in partial differential equations is the topic of the next six papers again mixed from Africa and Germany Finally new results in the field of shape optimization are discussed in the final international three papers This workshop held at the AIMS Center Senegal March 13 16 2017 has been supported by the Deutsche Forschungsgemeinschaft DFG and by the African Institute for Mathematical Sciences AIMS in Senegal which is one of six centres of a pan African network of centres of excellence for postgraduate education research and outreach in mathematical sciences   **Computers in Railways XIV** C. A. Brebbia,N. Tomii,P. Tzieropoulos,J. M. Mera,2014-06-24 This book contains the 14th proceedings of the very successful International conference on Railway Engineering Design and Optimization COMPRAIL 2014 which began in 1987 Encouraging the update and use of advanced systems the book promotes their general awareness throughout the business management design manufacture and operation of railways and other emerging passenger freight and transit systems It particularly emphasises the use of computer systems in advanced railway engineering Topics covered include Timetable planning Computer techniques and simulations Actual train control Operations quality Risk management Planning Monitoring and maintenance Energy supply and consumption Communications and signalling Rescheduling Safety and security Railway vehicle dynamics Driverless and automatic train operation   **Bilevel Optimization** Stephan Dempe,Alain Zemkoho,2020-11-23 2019 marked the 85th anniversary of Heinrich Freiherr von Stackelberg s habilitation thesis Marktform und Gleichgewicht which formed the roots

of bilevel optimization Research on the topic has grown tremendously since its introduction in the field of mathematical optimization Besides the substantial advances that have been made from the perspective of game theory many sub fields of bilevel optimization have emerged concerning optimal control multiobjective optimization energy and electricity markets management science security and many more Each chapter of this book covers a specific aspect of bilevel optimization that has grown significantly or holds great potential to grow and was written by top experts in the corresponding area In other words unlike other works on the subject this book consists of surveys of different topics on bilevel optimization Hence it can serve as a point of departure for students and researchers beginning their research journey or pursuing related projects It also provides a unique opportunity for experienced researchers in the field to learn about the progress made so far and directions that warrant further investigation All chapters have been peer reviewed by experts on mathematical optimization

Newton-Type Methods for Optimization and Variational Problems Alexey F. Izmailov,Mikhail V. Solodov,2014-07-08 This book presents comprehensive state of the art theoretical analysis of the fundamental Newtonian and Newtonian related approaches to solving optimization and variational problems A central focus is the relationship between the basic Newton scheme for a given problem and algorithms that also enjoy fast local convergence The authors develop general perturbed Newtonian frameworks that preserve fast convergence and consider specific algorithms as particular cases within those frameworks i e as perturbations of the associated basic Newton iterations This approach yields a set of tools for the unified treatment of various algorithms including some not of the Newton type per se Among the new subjects addressed is the class of degenerate problems In particular the phenomenon of attraction of Newton iterates to critical Lagrange multipliers and its consequences as well as stabilized Newton methods for variational problems and stabilized sequential quadratic programming for optimization This volume will be useful to researchers and graduate students in the fields of optimization and variational analysis Big Data Analytics in Future Power Systems Ahmed F. Zobaa,Trevor J. Bihl,2018-08-14 Power systems are increasingly collecting large amounts of data due to the expansion of the Internet of Things into power grids In a smart grids scenario a huge number of intelligent devices will be connected with almost no human intervention characterizing a machine to machine scenario which is one of the pillars of the Internet of Things The book characterizes and evaluates how the emerging growth of data in communications networks applied to smart grids will impact the grid efficiency and reliability Additionally this book discusses the various security concerns that become manifest with Big Data and expanded communications in power grids Provide a general description and definition of big data which has been gaining significant attention in the research community Introduces a comprehensive overview of big data optimization methods in power system Reviews the communication devices used in critical infrastructure especially power systems security methods available to vet the identity of devices and general security threats in CI networks Presents applications in power systems such as power flow and protection Reviews electricity theft concerns and the wide variety of data driven techniques and

applications developed for electricity theft detection   Computational Intelligence: Research Frontiers Jacek M. Zurada,Gary G. Yen,2008-05-13 This state of the art survey offers a renewed and refreshing focus on the progress in nature inspired and linguistically motivated computation The book presents the expertise and experiences of leading researchers spanning a diverse spectrum of computational intelligence in the areas of neurocomputing fuzzy systems evolutionary computation and adjacent areas The result is a balanced contribution to the field of computational intelligence that should serve the community not only as a survey and a reference but also as an inspiration for the future advancement of the state of the art of the field The 18 selected chapters originate from lectures and presentations given at the 5th IEEE World Congress on Computational Intelligence WCCI 2008 held in Hong Kong China in June 2008 After an introduction to the field and an overview of the volume the chapters are divided into four topical sections on machine learning and brain computer interface fuzzy modeling and control computational evolution and applications

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