Global Optimization with Non-Convex Constraints

Sequential and Parallel Algorithms

Roman G. Strongin and Yaroslav D. Sergeyev
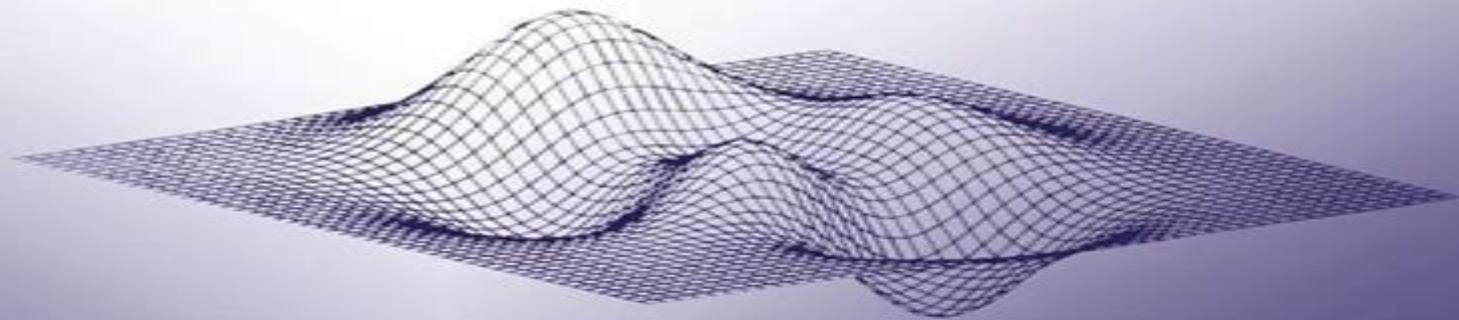
Global Optimization With Non Convex Constraints

Reiner Horst,Hoang Tuy

Global Optimization With Non Convex Constraints:

Global Optimization with Non-Convex Constraints Roman G. Strongin,Yaroslav D. Sergeyev,2013-11-09 Everything should be made as simple as possible but not simpler Albert Einstein Readers Digest 1977 The modern practice of creating technical systems and technological processes of high effi ciency besides the employment of new principles new materials new physical effects and other new solutions which is very traditional and plays the key role in the selection of the general structure of the object to be designed also includes the choice of the best combination for the set of parameters geometrical sizes electrical and strength characteristics etc concretizing this general structure because the Variation of these parameters with the structure or linkage being already set defined can essentially affect the objective performance indexes The mathematical tools for choosing these best combinations are exactly what is this book about With the advent of computers and the computer aided design the pro bations of the selected variants are usually performed not for the real examples this may require some very expensive building of sample op tions and of the special installations to test them but by the analysis of the corresponding mathematical models The sophistication of the mathematical models for the objects to be designed which is the natu ral consequence of the raising complexity of these objects greatly com plicates the objective performance analysis Today the main and very often the only available instrument for such an analysis is computer aided simulation of an object s behavior based on numerical experiments with its mathematical model *Optimization of Complex Systems: Theory, Models, Algorithms and Applications* Hoai An Le Thi,Hoai Minh Le,Tao Pham Dinh,2019-06-15 This book contains 112 papers selected from about 250 submissions to the 6th World Congress on Global Optimization WCGO 2019 which takes place on July 8 10 2019 at University of Lorraine Metz France The book covers both theoretical and algorithmic aspects of Nonconvex Optimization as well as its applications to modeling and solving decision problems in various domains It is composed of 10 parts each of them deals with either the theory and or methods in a branch of optimization such as Continuous optimization DC Programming and DCA Discrete optimization Network optimization Multiobjective programming Optimization under uncertainty or models and optimization methods in a specific application area including Data science Economics Finance Energy Water management Engineering systems Transportation Logistics Resource allocation Production management The researchers and practitioners working in Nonconvex Optimization and several application areas can find here many inspiring ideas and useful tools techniques for their works *Optimization on Low Rank Nonconvex Structures* Hiroshi Konno,Phan Thien Thach,Hoang Tuy,2013-12-01 Global optimization is one of the fastest developing fields in mathematical optimization In fact an increasing number of remarkably efficient deterministic algorithms have been proposed in the last ten years for solving several classes of large scale specially structured problems encountered in such areas as chemical engineering financial engineering location and network optimization production and inventory control engineering design computational geometry and multi objective and multi level optimization These new developments motivated the

authors to write a new book devoted to global optimization problems with special structures Most of these problems though highly nonconvex can be characterized by the property that they reduce to convex minimization problems when some of the variables are fixed A number of recently developed algorithms have been proved surprisingly efficient for handling typical classes of problems exhibiting such structures namely low rank nonconvex structures Audience The book will serve as a fundamental reference book for all those who are interested in mathematical optimization   **Variational and Non-variational Methods in Nonlinear Analysis and Boundary Value Problems** Dumitru Motreanu,Vicentiu D. Radulescu,2013-06-29 This book reflects a significant part of authors research activity dur ing the last ten years The present monograph is constructed on the results obtained by the authors through their direct cooperation or due to the authors separately or in cooperation with other mathematicians All these results fit in a unitary scheme giving the structure of this work The book is mainly addressed to researchers and scholars in Pure and Applied Mathematics Mechanics Physics and Engineering We are greatly indebted to Viorica Venera Motreanu for the careful reading of the manuscript and helpful comments on important issues We are also grateful to our Editors of Kluwer Academic Publishers for their professional assistance Our deepest thanks go to our numerous scientific collaborators and friends whose work was so important for us D Motreanu and V Radulescu IX Introduction The present monograph is based on original results obtained by the authors in the last decade This book provides a comprehensive expo sition of some modern topics in nonlinear analysis with applications to the study of several classes of boundary value problems Our framework includes multivalued elliptic problems with discontinuities variational inequalities hemivariational inequalities and evolution problems The treatment relies on variational methods monotonicity principles topo logical arguments and optimization techniques Excepting Sections 1 and 3 in Chapter 1 and Sections 1 and 3 in Chapter 2 the material is new in comparison with any other book representing research topics where the authors contributed The outline of our work is the following   *Models and Algorithms for Global Optimization* Aimo Törn,Julius Žilinskas,2007-04-08 The research of Antanas Zilinskas has focused on developing models for global optimization implementing and investigating the corresponding algorithms and applying those algorithms to practical problems This volume dedicated to Professor Zilinskas on the occasion of his 60th birthday contains new survey papers in which leading researchers from the field present various models and algorithms for solving global optimization problems   *Global Optimization* Reiner Horst,Hoang Tuy,2013-11-27 The enormous practical need for solving global optimization problems coupled with a rapidly advancing computer technology has allowed one to consider problems which a few years ago would have been considered computationally intractable As a consequence we are seeing the creation of a large and increasing number of diverse algorithms for solving a wide variety of multiextremal global optimization problems The goal of this book is to systematically clarify and unify these diverse approaches in order to provide insight into the underlying concepts and their pro perties Aside from a coherent view of the field much new material is presented By definition a multiextremal global

optimization problem seeks at least one global minimizer of a real valued objective function that possesses different local n minimizers The feasible set of points in IR is usually determined by a system of inequalities It is well known that in practically all disciplines where mathematical models are used there are many real world problems which can be formulated as multi extremal global optimization problems *Numerical Computations: Theory and Algorithms* Yaroslav D. Sergeyev,Dmitri E. Kvasov,Annabella Astorino,2024-12-31 The three volume set LNCS 14476 14478 constitutes the post conference proceedings of the 4th International Conference on Numerical Computations Theory and Algorithms NUMTA 2023 held in Pizzo Calabro Italy during June 14 20 2023 The 45 full papers presented in this book together with 60 short papers were carefully reviewed and selected from 170 submissions The papers focus on topics such as continuous and discrete single and multi objective problems local global and large scale optimization classification in machine learning optimal control and applications computational and applied mathematics such as approximation theory computational geometry computational fluid dynamics dynamical systems and differential equations numerical algebra etc and applications in engineering and science numerical models methods and software using traditional and emerging high performance computational tools and paradigms including the infinity and quantum computing and their application in artificial intelligence and data science bioinformatics economics and management engineering and technology mathematical education number theory and foundations of mathematics etc

Parallel Computing Technologies Victor Malyshkin,2013-09-24 This book constitutes the proceedings of the 12th International Conference on Parallel Computing Technologies PaCT 2013 held in St Petersburg Russia during September 30 October 4 2013 The 41 full papers presented together with 2 invited papers were carefully reviewed and selected from 83 submissions The papers are organized in topical sections on all technological aspects of the applications of parallel computer systems High level parallel programming languages and systems methods and tools for parallel solution of large scale problems languages environments and software tools supporting parallel processing operating systems scheduling mapping load balancing general architectural concepts cellular automata performance measurement and analysis tools teaching parallel processing software for grid and cloud computing scalable computing fragmentation and aggregation of algorithms and programs as well as programs assembling and reuse   A Practical Guide to Averaging Functions Gleb Beliakov,Humberto Bustince Sola,Tomasa Calvo,2015-10-15 This book offers an easy to use and practice oriented reference guide to mathematical averages It presents different ways of aggregating input values given on a numerical scale and of choosing and or constructing aggregating functions for specific applications Building on a previous monograph by Beliakov et al published by Springer in 2007 it outlines new aggregation methods developed in the interim with a special focus on the topic of averaging aggregation functions It examines recent advances in the field such as aggregation on lattices penalty based aggregation and weakly monotone averaging and extends many of the already existing methods such as ordered weighted averaging OWA fuzzy integrals and mixture functions A substantial mathematical background is not called for as all

the relevant mathematical notions are explained here and reported on together with a wealth of graphical illustrations of distinct families of aggregation functions The authors mainly focus on practical applications and give central importance to the conciseness of exposition as well as the relevance and applicability of the reported methods offering a valuable resource for computer scientists IT specialists mathematicians system architects knowledge engineers and programmers as well as for anyone facing the issue of how to combine various inputs into a single output value   *Optimizing Massive MIMO* Hei Victor Cheng,2018-04-11 The past decades have seen a rapid growth of mobile data traffic both in terms of connected devices and data rate To satisfy the evergrowing data traffic demand in wireless communication systems thecurrent cellular systems have to be redesigned to increase both spectralefficiency and energy efficiency Massive MIMO Multiple Input Multiple Output is one solution that satisfy bothrequirements In massive MIMO systems hundreds of antennas areemployed at the base station to provide service to many users at thesame time and frequency This enables the system to serve the userswith uniformly good quality of service simultaneously with low costhardware and without using extra bandwidth and energy To achievethis proper resource allocation is needed Among the availableresources transmit power beamforming are the most important degrees offreedom to control the spectral efficiency and energy efficiency Dueto the use of excessive number of antennas and low end hardware at thebase station new aspects of power allocation and beamforming compared to currentsystems arises In the first part of the thesis new uplink power allocation schemes that based on long term channel statistics isproposed Since quality of the channel estimates is crucial in massive MIMO in addition to data power allocation joint power allocationthat includes the pilot power as additional variable should be considered Therefore a new framework for power allocation thatmatches practical systems is developed as the methods developed in the literature cannot be applied directly to massive MIMO systems Simulation results confirm the advantages brought by the the proposed new framework In the second part we introduces a new approach to solve the joint precoding and power allocation for different objective in downlink scenarios by a combination of random matrix theory and optimization theory The new approach results in a simplified problem that though non convex obeys a simple separable structure Simulation results showed that the proposed scheme provides large gains over heuristic solutions when the number of users in the cell is large which is suitable for applying in massive MIMO systems In the third part we investigate the effects of using low end amplifiers at the basestations The non linear behavior of power consumption in these amplifiers changes the power consumption model at the basestation thereby changes the power allocation and beamforming design Different scenarios are investigated and resultsshow that a certain number of antennas can be turned off in some scenarios In the last part we consider the use of non orthogonal multiple access NOMA inside massive MIMO systems in practical scenarios where channel state information CSI is acquired through pilot signaling Achievable rate analysis is carried out for different pilot signaling schemes including both uplink and downlink pilots Numerical results show that when downlink CSI is available at the users our proposed NOMA scheme outperforms

orthogonal schemes However with more groups of users present in the cell it is preferable to use multi user beamforming in stead of NOMA   *Methods and Tools of Parallel Programming Multicomputers* Ching-Hsien Hsu,Victor Malyshkin,2010-09-25 It is our great pleasure to present the proceedings of the second Russia Taiwan Symposium on Methods and Tools of Parallel Programming MTPP 2010 MTPP is the main regular event of the Russia Taiwan scientific forum that covers the many dimensions of methods and tools of parallel programming algorithms and architectures encompassing fundamental theoretical approaches practical experimental projects and commercial components and systems As applications of computing systems have permeated every aspect of daily life the power of computing systems has become increasingly critical Therefore MTPP is intended to play an important role allowing researchers to exchange information regarding advancements in the state of the art and practice of IT driven services and applications as well as to identify emerging research topics and define the future directions of parallel computing We received a large number of high quality submissions this year In the first stage all papers submitted were screened for their relevance and general submission requirements These manuscripts then underwent a rigorous peer review process with at least three reviewers per paper At the end 33 papers were accepted for presentation and included in the main proceedings To encourage and promote the work presented at MTPP 2010 we are delighted to inform the authors that some of the papers will be accepted in special issues of the Journal of Supercomputing which has played a prominent role in promoting the development and use of parallel and distributed processing   *Parallel Computational Technologies* Leonid Sokolinsky,Mikhail Zymbler,2021-07-08 This book constitutes refereed proceedings of the 15th International Conference on Parallel Computational Technologies PCT 2021 held in March April 2021 Due to the COVID 19 pandemic the conference was held online The 22 revised full papers presented were carefully reviewed and selected from 89 submissions The papers are organized in topical sections on high performance architectures tools and technologies parallel numerical algorithms supercomputer simulation   **Supercomputing** Vladimir Voevodin,Sergey Sobolev,2017-11-14 This book constitutes the refereed proceedings of the Third Russian Supercomputing Days RuSCDays 2017 held in Moscow Russia in September 2017 The 41 revised full papers and one revised short paper presented were carefully reviewed and selected from 120 submissions The papers are organized in topical sections on parallel algorithms supercomputer simulation high performance architectures tools and technologies   *Multivalued Analysis and Nonlinear Programming Problems with Perturbations* B. Luderer,L. Minchenko,T. Satsura,2013-03-09 The book presents a treatment of topological and differential properties of multivalued mappings and marginal functions In addition applications to sensitivity analysis of nonlinear programming problems under perturbations are studied Properties of marginal functions associated with optimization problems are analyzed under quite general constraints defined by means of multivalued mappings A unified approach to directional differentiability of functions and multifunctions forms the base of the volume Nonlinear programming problems involving quasidifferentiable functions are considered as well A significant part of

the results are based on theories and concepts of two former Soviet Union researchers Demyanov and Rubinov and have never been published in English before It contains all the necessary information from multivalued analysis and does not require special knowledge but assumes basic knowledge of calculus at an undergraduate level   Nonsmooth/Nonconvex Mechanics David Yang Gao,Raymond W. Ogden,Georgios E. Stavroulakis,2013-12-01 Nonsmooth and nonconvex models arise in several important applications of mechanics and engineering The interest in this field is growing from both mathematicians and engineers The study of numerous industrial applications including contact phenomena in statics and dynamics or delamination effects in composites require the consideration of nonsmoothness and nonconvexity The mathematical topics discussed in this book include variational and hemivariational inequalities duality complementarity variational principles sensitivity analysis eigenvalue and resonance problems and minimax problems Applications are considered in the following areas among others nonsmooth statics and dynamics stability of quasi static evolution processes friction problems adhesive contact and debonding inverse problems pseudoelastic modeling of phase transitions chaotic behavior in nonlinear beams and nonholonomic mechanical systems This volume contains 22 chapters written by various leading researchers and presents a cohesive and authoritative overview of recent results and applications in the area of nonsmooth and nonconvex mechanics Audience Faculty graduate students and researchers in applied mathematics optimization control and engineering   **Computational Methods in Systems Biology** Alessandro Abate,Tatjana Petrov,Verena Wolf,2020-10-01 This book constitutes the refereed proceedings of the 18th International Conference on Computational Methods in Systems Biology CMSB 2020 held in Konstanz Germany in September 2020 The 17 full papers and 5 tool papers were carefully reviewed and selected from 30 submissions In addition 3 abstracts of invited talks and 2 tutorials have been included in this volume Topics of interest include formalisms for modeling biological processes models and their biological applications frameworks for model verification validation analysis and simulation of biological systems high performance computational systems biology and parallel implementations model inference from experimental data model integration from biological databases multi scale modeling and analysis methods computational approaches for synthetic biology and case studies in systems and synthetic biology The conference was held virtually due to the COVID 19 pandemic   **Mathematical Optimization Theory and Operations Research** Michael Khachay,Yury Kochetov,Panos Pardalos,2019-06-12 This book constitutes the proceedings of the 18th International Conference on Mathematical Optimization Theory and Operations Research MOTOR 2019 held in Ekaterinburg Russia in July 2019 The 48 full papers presented in this volume were carefully reviewed and selected from 170 submissions MOTOR 2019 is a successor of the well known International and All Russian conference series which were organized in Ural Siberia and the Far East for a long time The selected papers are organized in the following topical sections mathematical programming bi level optimization integer programming combinatorial optimization optimal control and approximation data mining and computational geometry games

and mathematical economics   Mixed Integer Nonlinear Programming Jon Lee,Sven Leyffer,2011-12-02 Many engineering operations and scientific applications include a mixture of discrete and continuous decision variables and nonlinear relationships involving the decision variables that have a pronounced effect on the set of feasible and optimal solutions Mixed integer nonlinear programming MINLP problems combine the numerical difficulties of handling nonlinear functions with the challenge of optimizing in the context of nonconvex functions and discrete variables MINLP is one of the most flexible modeling paradigms available for optimization but because its scope is so broad in the most general cases it is hopelessly intractable Nonetheless an expanding body of researchers and practitioners including chemical engineers operations researchers industrial engineers mechanical engineers economists statisticians computer scientists operations managers and mathematical programmers are interested in solving large scale MINLP instances   **Parallel Processing and Applied Mathematics** Roman Wyrzykowski,Ewa Deelman,Jack Dongarra,Konrad Karczewski,2020-03-19 The two volume set LNCS 12043 and 12044 constitutes revised selected papers from the 13th International Conference on Parallel Processing and Applied Mathematics PPAM 2019 held in Bialystok Poland in September 2019 The 91 regular papers presented in these volumes were selected from 161 submissions For regular tracks of the conference 41 papers were selected from 89 submissions The papers were organized in topical sections named as follows Part I numerical algorithms and parallel scientific computing emerging HPC architectures performance analysis and scheduling in HPC systems environments and frameworks for parallel distributed cloud computing applications of parallel computing parallel non numerical algorithms soft computing with applications special session on GPU computing special session on parallel matrix factorizations Part II workshop on language based parallel programming models WLPP 2019 workshop on models algorithms and methodologies for hybrid parallelism in new HPC systems workshop on power and energy aspects of computations PEAC 2019 special session on tools for energy efficient computing workshop on scheduling for parallel computing SPC 2019 workshop on applied high performance numerical algorithms for PDEs minisymposium on HPC applications in physical sciences minisymposium on high performance computing interval methods workshop on complex collective systems Chapters Parallel Adaptive Cross Approximation for the Multi trace Formulation of Scattering Problems and A High Order Discontinuous Galerkin Solver with Dynamic Adaptive Mesh Refinement to Simulate Cloud Formation Processes are available open access under a Creative Commons Attribution 4 0 International License via link springer com   *Foundations of Bilevel Programming* Stephan Dempe,2005-12-19 Bilevel programming problems are hierarchical optimization problems where the constraints of one problem the so called upper level problem are defined in part by a second parametric optimization problem the lower level problem If the lower level problem has a unique optimal solution for all parameter values this problem is equivalent to a one level optimization problem having an implicitly defined objective function Special emphasize in the book is on problems having non unique lower level optimal solutions the optimistic or weak and the pessimistic or strong

approaches are discussed The book starts with the required results in parametric nonlinear optimization This is followed by the main theoretical results including necessary and sufficient optimality conditions and solution algorithms for bilevel problems Stationarity conditions can be applied to the lower level problem to transform the optimistic bilevel programming problem into a one level problem Properties of the resulting problem are highlighted and its relation to the bilevel problem is investigated Stability properties numerical complexity and problems having additional integrality conditions on the variables are also discussed Audience Applied mathematicians and economists working in optimization operations research and economic modelling Students interested in optimization will also find this book useful

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