Christodoulos A. Floudas
and
Panos M. Pardalos,
Editors

RECENT ADVANCES IN GLOBAL OPTIMIZATION

Recent Advances In Global Optimization

Kenneth Price,Rainer M. Storn,Jouni A. Lampinen

Recent Advances In Global Optimization:

    Recent Advances in Global Optimization Christodoulos A. Floudas,Panos M. Pardalos,2014-07-14 This book will present the papers delivered at the first U S conference devoted exclusively to global optimization and will thus provide valuable insights into the significant research on the topic that has been emerging during recent years Held at Princeton University in May 1991 the conference brought together an interdisciplinary group of the most active developers of algorithms for global optimization in order to focus the attention of the mathematical programming community on the unsolved problems and diverse applications of this field The main subjects addressed at the conference were advances in deterministic and stochastic methods for global optimization parallel algorithms for global optimization problems and applications of global optimization Although global optimization is primarily a mathematical problem it is relevant to several other disciplines including computer science applied mathematics physical chemistry molecular biology statistics physics engineering operations research communication theory and economics Global optimization problems originate from a wide variety of mathematical models of real world systems Some of its applications are allocation and location problems and VLSI and data base design problems Originally published in 1991 The Princeton Legacy Library uses the latest print on demand technology to again make available previously out of print books from the distinguished backlist of Princeton University Press These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905   Global Optimization Marco Locatelli,Fabio Schoen,2013-10-16 This volume contains a thorough overview of the rapidly growing field of global optimization with chapters on key topics such as complexity heuristic methods derivation of lower bounds for minimization problems and branch and bound methods and convergence The final chapter offers both benchmark test problems and applications of global optimization such as finding the conformation of a molecule or planning an optimal trajectory for interplanetary space travel An appendix provides fundamental information on convex and concave functions Intended for Ph D students researchers and practitioners looking for advanced solution methods to difficult optimization problems It can be used as a supplementary text in an advanced graduate level seminar   **Handbook of Global Optimization** Panos M. Pardalos,H. Edwin Romeijn,2013-04-18 In 1995 the Handbook of Global Optimization first volume edited by R Horst and P M Pardalos was published This second volume of the Handbook of Global Optimization is comprised of chapters dealing with modern approaches to global optimization including different types of heuristics Topics covered in the handbook include various metaheuristics such as simulated annealing genetic algorithms neural networks taboo search shake and bake methods and deformation methods In addition the book contains chapters on new exact stochastic and deterministic approaches to continuous and mixed integer global optimization such as stochastic adaptive search two phase methods

branch and bound methods with new relaxation and branching strategies algorithms based on local optimization and dynamical search Finally the book contains chapters on experimental analysis of algorithms and software test problems and applications **Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming** Mohit Tawarmalani,Nikolaos V. Sahinidis,2013-04-17 Interest in constrained optimization originated with the simple linear pro gramming model since it was practical and perhaps the only computationally tractable model at the time Constrained linear optimization models were soon adopted in numerous application areas and are perhaps the most widely used mathematical models in operations research and management science at the time of this writing Modelers have however found the assumption of linearity to be overly restrictive in expressing the real world phenomena and problems in economics finance business communication engineering design computational biology and other areas that frequently demand the use of nonlinear expressions and discrete variables in optimization models Both of these extensions of the linear programming model are NP hard thus representing very challenging problems On the brighter side recent advances in algorithmic and computing technology make it possible to re visit these problems with the hope of solving practically relevant problems in reasonable amounts of computational time Initial attempts at solving nonlinear programs concentrated on the de velopment of local optimization methods guaranteeing globality under the assumption of convexity On the other hand the integer programming liter ature has concentrated on the development of methods that ensure global optima The aim of this book is to marry the advancements in solving nonlinear and integer programming models and to develop new results in the more general framework of mixed integer nonlinear programs MINLPs with the goal of devising practically efficient global optimization algorithms for MINLPs *Advances in Convex Analysis and Global Optimization* Nicolas Hadjisavvas,Panos M. Pardalos,2013-12-01 There has been much recent progress in global optimization algo rithms for nonconvex continuous and discrete problems from both a theoretical and a practical perspective Convex analysis plays a fun damental role in the analysis and development of global optimization algorithms This is due essentially to the fact that virtually all noncon vex optimization problems can be described using differences of convex functions and differences of convex sets A conference on Convex Analysis and Global Optimization was held during June 5 9 2000 at Pythagorion Samos Greece The conference was honoring the memory of C Caratheodory 1873 1950 and was en dorsed by the Mathematical Programming Society MPS and by the Society for Industrial and Applied Mathematics SIAM Activity Group in Optimization The conference was sponsored by the European Union through the EPEAEK program the Department of Mathematics of the Aegean University and the Center for Applied Optimization of the University of Florida by the General Secretariat of Research and Tech nology of Greece by the Ministry of Education of Greece and several local Greek government agencies and companies This volume contains a selective collection of refereed papers based on invited and contribut ing talks presented at this conference The two themes of convexity and global optimization pervade this book The conference provided a forum for researchers working on different

aspects of convexity and global opti mization to present their recent discoveries and to interact with people working on complementary aspects of mathematical programming *Stochastic Global Optimization* Gade Pandu Rangaiah,2010 Ch 1 Introduction Gade Pandu Rangaiah ch 2 Formulation and illustration of Luus Jaakola optimization procedure Rein Luus ch 3 Adaptive random search and simulated annealing optimizers algorithms and application issues Jacek M Jezowski Grzegorz Poplewski and Roman Bochenek ch 4 Genetic algorithms in process engineering developments and implementation issues Abdunnaser Younes Ali Elkamel and Shawki Areibi ch 5 Tabu search for global optimization of problems having continuous variables Sim Mong Kai Gade Pandu Rangaiah and Mekapati Srinivas ch 6 Differential evolution method developments and chemical engineering applications Chen Shaoqiang Gade Pandu Rangaiah and Mekapati Srinivas ch 7 Ant colony optimization details of algorithms suitable for process engineering V K Jayaraman und weitere ch 8 Particle swarm optimization for solving NLP and MINLP in chemical engineering Bassem Jarboui und weitere ch 9 An introduction to the harmony search algorithm Gordon Ingram and Tonghua Zhang ch 10 Meta heuristics evaluation and reporting techniques Abdunnaser Younes Ali Elkamel and Shawki Areibi ch 11 A hybrid approach for constraint handling in MINLP optimization using stochastic algorithms G A Durand und weitere ch 12 Application of Luus Jaakola optimization procedure to model reduction parameter estimation and optimal control Rein Luus ch 13 Phase stability and equilibrium calculations in reactive systems using differential evolution and tabu search Adrian Bonilla Petriciolet und weitere ch 14 Differential evolution with tabu list for global optimization evaluation of two versions on benchmark and phase stability problems Mekapati Srinivas and Gade Pandu Rangaiah ch 15 Application of adaptive random search optimization for solving industrial water allocation problem Grzegorz Poplewski and Jacek M Jezowski ch 16 Genetic algorithms formulation for retrofitting heat exchanger network Roman Bochenek and Jacek M Jezowski ch 17 Ant colony optimization for classification and feature selection V K Jayaraman und weitere ch 18 Constraint programming and genetic algorithm Prakash R Kotecha Mani Bhushan and Ravindra D Gudi ch 19 Schemes and implementations of parallel stochastic optimization algorithms application of tabu search to chemical engineering problems B Lin and D C Miller **Introduction to Global Optimization** R. Horst,Panos M. Pardalos,Nguyen Van Thoai,1995-06-30 Global optimization concerns the computation and characterization of global optima of nonlinear functions Such problems are widespread in the mathematical modelling of real systems in a very wide range of applications and the last 30 years have seen the development of many new theoretical algorithmic and computational contributions which have helped to solve globally multiextreme problems in important practical applications Most of the existing books on optimization focus on the problem of computing locally optimal solutions Introduction to Global Optimization however is a comprehensive textbook on constrained global optimization that covers the fundamentals of the subject presenting much new material including algorithms applications and complexity results for quadratic programming concave minimization DC and Lipschitz problems and nonlinear network flow Each chapter contains illustrative examples and

ends with carefully selected exercises designed to help students grasp the material and enhance their knowledge of the methods involved Audience Students of mathematical programming and all scientists from whatever discipline who need global optimization methods in such diverse areas as economic modelling fixed charges finance networks and transportation databases chip design image processing nuclear and mechanical design chemical engineering design and control molecular biology and environmental engineering **Advances and Trends in Optimization with Engineering Applications** Tamas Terlaky,Miguel F. Anjos,Shabbir Ahmed,2017-04-26 Optimization is of critical importance in engineering Engineers constantly strive for the best possible solutions the most economical use of limited resources and the greatest efficiency As system complexity increases these goals mandate the use of state of the art optimization techniques In recent years the theory and methodology of optimization have seen revolutionary improvements Moreover the exponential growth in computational power along with the availability of multicore computing with virtually unlimited memory and storage capacity has fundamentally changed what engineers can do to optimize their designs This is a two way process engineers benefit from developments in optimization methodology and challenging new classes of optimization problems arise from novel engineering applications Advances and Trends in Optimization with Engineering Applications reviews 10 major areas of optimization and related engineering applications providing a broad summary of state of the art optimization techniques most important to engineering practice Each part provides a clear overview of a specific area and discusses a range of real world problems The book provides a solid foundation for engineers and mathematical optimizers alike who want to understand the importance of optimization methods to engineering and the capabilities of these methods **Combinatorial And Global Optimization** Rainer E Burkard,Athanasios Migdalas,Panos M Pardalos,2002-04-05 Combinatorial and global optimization problems appear in a wide range of applications in operations research engineering biological science and computer science In combinatorial optimization and graph theory many approaches have been developed that link the discrete universe to the continuous universe through geometric analytic and algebraic techniques Such techniques include global optimization formulations semidefinite programming and spectral theory Recent major successes based on these approaches include interior point algorithms for linear and discrete problems the celebrated Goemans Williamson relaxation of the maximum cut problem and the Du Hwang solution of the Gilbert Pollak conjecture Since integer constraints are equivalent to nonconvex constraints the fundamental difference between classes of optimization problems is not between discrete and continuous problems but between convex and nonconvex optimization problems This volume is a selection of refereed papers based on talks presented at a conference on Combinatorial and Global Optimization held at Crete Greece **Global Optimization Methods in Geophysical Inversion** Mrinal K. Sen,Paul L. Stoffa,2013-02-21 An up to date overview of global optimization methods used to formulate and interpret geophysical observations for researchers graduate students and professionals **Advances in Applied Mathematics and Global Optimization** David Y. Gao,Hanif D.

Sherali,2009-04-09 The articles that comprise this distinguished annual volume for the Advances in Mechanics and Mathematics series have been written in honor of Gilbert Strang a world renowned mathematician and exceptional person Written by leading experts in complementarity duality global optimization and quantum computations this collection reveals the beauty of these mathematical disciplines and investigates recent developments in global optimization nonconvex and nonsmooth analysis nonlinear programming theoretical and engineering mechanics large scale computation quantum algorithms and computation and information theory **Convex Analysis and Global Optimization** Hoang Tuy,2013-03-09 Due to the general complementary convex structure underlying most nonconvex optimization problems encountered in applications convex analysis plays an essential role in the development of global optimization methods This book develops a coherent and rigorous theory of deterministic global optimization from this point of view Part I constitutes an introduction to convex analysis with an emphasis on concepts properties and results particularly needed for global optimization including those pertaining to the complementary convex structure Part II presents the foundation and application of global search principles such as partitioning and cutting outer and inner approximation and decomposition to general global optimization problems and to problems with a low rank nonconvex structure as well as quadratic problems Much new material is offered aside from a rigorous mathematical development Audience The book is written as a text for graduate students in engineering mathematics operations research computer science and other disciplines dealing with optimization theory It is also addressed to all scientists in various fields who are interested in mathematical optimization State of the Art in Global Optimization Christodoulos A. Floudas,Panos M. Pardalos,2013-12-01 Optimization problems abound in most fields of science engineering and tech nology In many of these problems it is necessary to compute the global optimum or a good approximation of a multivariable function The variables that define the function to be optimized can be continuous and or discrete and in addition many times satisfy certain constraints Global optimization problems belong to the complexity class of NP hard prob lems Such problems are very difficult to solve Traditional descent optimization algorithms based on local information are not adequate for solving these problems In most cases of practical interest the number of local optima increases on the aver age exponentially with the size of the problem number of variables Furthermore most of the traditional approaches fail to escape from a local optimum in order to continue the search for the global solution Global optimization has received a lot of attention in the past ten years due to the success of new algorithms for solving large classes of problems from diverse areas such as engineering design and control computational chemistry and biology structural optimization computer science operations research and economics This book contains refereed invited papers presented at the conference on State of the Art in Global Optimization Computational Methods and Applications held at Princeton University April 28 30 1995 The conference presented current re search on global optimization and related applications in science and engineering The papers included in this book cover a wide spectrum of approaches for solving global optimization problems and

applications **Global Optimization in Action** János D. Pintér,2013-03-14 In science engineering and economics decision problems are frequently modelled by optimizing the value of a primary objective function under stated feasibility constraints In many cases of practical relevance the optimization problem structure does not warrant the global optimality of local solutions hence it is natural to search for the globally best solution s Global Optimization in Action provides a comprehensive discussion of adaptive partition strategies to solve global optimization problems under very general structural requirements A unified approach to numerous known algorithms makes possible straightforward generalizations and extensions leading to efficient computer based implementations A considerable part of the book is devoted to applications including some generic problems from numerical analysis and several case studies in environmental systems analysis and management The book is essentially self contained and is based on theauthor s research in cooperation on applications with a number of colleagues Audience Professors students researchers and other professionals in the fields of operations research management science industrial and applied mathematics computer science engineering economics and the environmental sciences Recent Advances in Sustainable Process Design and Optimization Dominic C. Y. Foo,Mahmoud M. El-Halwagi,Raymond R. Tan,2012 This book is a compilation of the various recently developed techniques emphasizing better chemical processes and products with state of the art contributions by world renowned leaders in process design and optimization It covers various areas such as grass roots design retrofitting continuous and batch processing energy efficiency separations and pollution prevention striking a balance between fundamental techniques and applications The book also contains industrial applications and will serve as a good compilation of recent industrial experience for which the process design and optimization techniques were applied to enhance sustainability Academic researchers and industrial practitioners will find this book useful as a review of systematic approaches and best practices in sustainable design and optimization of industrial processes The book is accompanied by some electronic supplements i e models and programs for selected chapters **Differential Evolution** Kenneth Price,Rainer M. Storn,Jouni A. Lampinen,2006-03-04 Problems demanding globally optimal solutions are ubiquitous yet many are intractable when they involve constrained functions having many local optima and interacting mixed type variables The differential evolution DE algorithm is a practical approach to global numerical optimization which is easy to understand simple to implement reliable and fast Packed with illustrations computer code new insights and practical advice this volume explores DE in both principle and practice It is a valuable resource for professionals needing a proven optimizer and for students wanting an evolutionary perspective on global numerical optimization **Optimization in Computational Chemistry and Molecular Biology** Christodoulos A. Floudas,Panos M. Pardalos,2013-06-29 Optimization in Computational Chemistry and Molecular Biology Local and Global Approaches covers recent developments in optimization techniques for addressing several computational chemistry and biology problems A tantalizing problem that cuts across the fields of computational chemistry biology medicine engineering and applied mathematics is how proteins fold Global and local

optimization provide a systematic framework of conformational searches for the prediction of three dimensional protein structures that represent the global minimum free energy as well as low energy biomolecular conformations Each contribution in the book is essentially expository in nature but of scholarly treatment The topics covered include advances in local and global optimization approaches for molecular dynamics and modeling distance geometry protein folding molecular structure refinement protein and drug design and molecular and peptide docking Audience The book is addressed not only to researchers in mathematical programming but to all scientists in various disciplines who use optimization methods in solving problems in computational chemistry and biology   A Collection of Test Problems for Constrained Global Optimization Algorithms Christodoulos A. Floudas,Panos M. Pardalos,1990-09-15 Significant research activity has occurred in the area of global optimization in recent years Many new theoretical algorithmic and computational contributions have resulted Despite the major importance of test problems for researchers there has been a lack of representative nonconvex test problems for constrained global optimization algorithms This book is motivated by the scarcity of global optimization test problems and represents the first systematic collection of test problems for evaluating and testing constrained global optimization algorithms This collection includes problems arising in a variety of engineering applications and test problems from published computational reports   **Advances in Differential Evolution** Uday K. Chakraborty,2008-07-23 Differential evolution is arguably one of the hottest topics in today s computational intelligence research This book seeks to present a comprehensive study of the state of the art in this technology and also directions for future research The fourteen chapters of this book have been written by leading experts in the area The first seven chapters focus on algorithm design while the last seven describe real world applications Chapter 1 introduces the basic differential evolution DE algorithm and presents a broad overview of the field Chapter 2 presents a new rotationally invariant DE algorithm The role of self adaptive control parameters in DE is investigated in Chapter 3 Chapters 4 and 5 address constrained optimization the former develops suitable stopping conditions for the DE run and the latter presents an improved DE algorithm for problems with very small feasible regions A novel DE algorithm based on the concept of opposite points is the topic of Chapter 6 Chapter 7 provides a survey of multi objective differential evolution algorithms A review of the major application areas of differential evolution is presented in Chapter 8 Chapter 9 discusses the application of differential evolution in two important areas of applied electromagnetics Chapters 10 and 11 focus on applications of hybrid DE algorithms to problems in power system optimization Chapter 12 applies the DE algorithm to computer chess The use of DE to solve a problem in bioprocess engineering is discussed in Chapter 13 Chapter 14 describes the application of hybrid differential evolution to a problem in control engineering   Frontiers in Global Optimization Christodoulos A. Floudas,Panos M. Pardalos,2013-12-01 Global Optimization has emerged as one of the most exciting new areas of mathematical programming Global optimization has received a wide attraction from many fields in the past few years due to the success of new algorithms for addressing

previously intractable problems from diverse areas such as computational chemistry and biology biomedicine structural optimization computer sciences operations research economics and engineering design and control This book contains refereed invited papers submitted at the 4th international confer ence on Frontiers in Global Optimization held at Santorini Greece during June 8 12 2003 Santorini is one of the few sites of Greece with wild beauty created by the explosion of a volcano which is in the middle of the gulf of the island The mystic landscape with its numerous mult extrema was an inspiring location particularly for researchers working on global optimization The three previous conferences on Recent Advances in Global Opti mization State of the Art in Global Optimization and Optimization in Computational Chemistry and Molecular Biology Local and Global approaches took place at Princeton University in 1991 1995 and 1999 respectively The papers in this volume focus on de terministic methods for global optimization stochastic methods for global optimization distributed computing methods in global optimization and applications of global optimiza tion in several branches of applied science and engineering computer science computational chemistry structural biology and bio informatics

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