

NONLINEAR OPTIMIZATION AND ITS APPLICATIONS

# Deterministic Global Optimization Theory, Methods and Applications

Christodoulos A. Floudas



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# Deterministic Global Optimization Theory Methods And Applications 1st Edition

**Yaroslav D. Sergeyev, Roman G.  
Strongin, Daniela Lera**



## **Deterministic Global Optimization Theory Methods And Applications 1st Edition:**

Deterministic Global Optimization Christodoulos A. Floudas, 2000 This book provides a unified and insightful treatment of deterministic global optimization It introduces theoretical and algorithmic advances that address the computation and characterization of global optima determine valid lower and upper bounds on the global minima and maxima and enclose all solutions of nonlinear constrained systems of equations Among its special features the book Introduces the fundamentals of deterministic global optimization Provides a thorough treatment of decomposition based global optimization approaches for biconvex and bilinear problems Covers global optimization methods for generalized geometric programming problems Presents in depth global optimization algorithms for general twice continuously differentiable nonlinear problems Provides a detailed treatment of global optimization methods for mixed integer nonlinear problems Develops global optimization approaches for the enclosure of all solutions of nonlinear constrained systems of equations Includes many important applications from process design synthesis control and operations phase equilibrium design under uncertainty parameter estimation azeotrope prediction structure prediction in clusters and molecules protein folding and peptide docking Audience This book can be used as a textbook in graduate level courses and as a desk reference for researchers in all branches of engineering and applied science applied mathematics industrial engineering operations research computer science economics computational chemistry and molecular biology Deterministic Global Optimization Christodoulos a Floudas, 2014-01-15

**Simplicial Global Optimization** Remigijus Paulavičius, Julius Žilinskas, 2013-10-09 Simplicial Global Optimization is centered on deterministic covering methods partitioning feasible region by simplices This book looks into the advantages of simplicial partitioning in global optimization through applications where the search space may be significantly reduced while taking into account symmetries of the objective function by setting linear inequality constraints that are managed by initial partitioning The authors provide an extensive experimental investigation and illustrates the impact of various bounds types of subdivision strategies of candidate selection on the performance of algorithms A comparison of various Lipschitz bounds over simplices and an extension of Lipschitz global optimization with out the Lipschitz constant to the case of simplicial partitioning is also depicted in this text Applications benefiting from simplicial partitioning are examined in detail such as nonlinear least squares regression and pile placement optimization in grillage type foundations Researchers and engineers will benefit from simplicial partitioning algorithms such as Lipschitz branch and bound Lipschitz optimization without the Lipschitz constant heuristic partitioning presented This book will leave readers inspired to develop simplicial versions of other algorithms for global optimization and even use other non rectangular partitions for special applications *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 conference 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 Optimization 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 deterministic methods for global optimization stochastic methods for global optimization distributed computing methods in global optimization and applications of global optimization in several branches of applied science and engineering computer science computational chemistry structural biology and bioinformatics

**Large-Scale Optimization with Applications** Lorenz T. Biegler, 1997-08-07 A three week workshop on Large Scale Optimization was held at the IMA from July 10 to July 28, 1995 as part of its summer program These workshops brought together some of the world's leading experts in the areas of optimization inverse problems optimal design optimal control and molecular structures The content of these volumes represent a majority of the presentations at the three workshops The presentations and the subsequent articles published here are intended to be useful and accessible to both the mathematical programmers and those working in the applications Perhaps somewhat optimistically the hope is that the workshops and the proceedings will also initiate some long term research projects and impart to new researchers the excitement vitality and importance of this kind of cooperation to the applications and to applied mathematics

**Multi-Objective Optimization in Chemical Engineering** Gade Pandu Rangaiah, Adrian Bonilla-Petriciolet, 2013-03-20 For reasons both financial and environmental there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance energy efficiency profitability safety and reliability However with most chemical engineering application problems having many variables with complex inter relationships meeting these optimization objectives can be challenging This is where Multi Objective Optimization MOO is useful to find the optimal trade offs among two or more conflicting objectives This book provides an overview of the recent developments and applications of MOO for modeling design and operation of chemical petrochemical pharmaceutical energy and related processes It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks chromatographic systems CO<sub>2</sub> emissions targeting for petroleum refining units ecodesign of chemical processes ethanol purification and cumene process design Multi Objective Optimization in Chemical Engineering Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers

involved in process design modeling and optimization      *Chemical Process Design and Integration* Robin Smith,2016-09-26  
Written by a highly regarded author with industrial and academic experience this new edition of an established bestselling book provides practical guidance for students researchers and those in chemical engineering The book includes a new section on sustainable energy with sections on carbon capture and sequestration as a result of increasing environmental awareness and a companion website that includes problems worked solutions and Excel spreadsheets to enable students to carry out complex calculations      **Handbook of Global Optimization** R. Horst,Panos M. Pardalos,2013-12-11 Global optimization is concerned with the computation and characterization of global optima of nonlinear functions During the past three decades the field of global optimization has been growing at a rapid pace and the number of publications on all aspects of global optimization has been increasing steadily Many applications as well as new theoretical algorithmic and computational contributions have resulted The Handbook of Global Optimization is the first comprehensive book to cover recent developments in global optimization Each contribution in the Handbook is essentially expository in nature but scholarly in its treatment The chapters cover optimality conditions complexity results concave minimization DC programming general quadratic programming nonlinear complementarity minimax problems multiplicative programming Lipschitz optimization fractional programming network problems trajectory methods homotopy methods interval methods and stochastic approaches The Handbook of Global Optimization is addressed to researchers in mathematical programming as well as all scientists who use optimization methods to model and solve problems      **Optimization and Optimal Control** Altannar Chinchuluun,Panos M. Pardalos,Rentsen Enkhbat,Idar Tseveendorj,2010-07-07 Optimization and optimal control are the main tools in decision making Because of their numerous applications in various disciplines research in these areas is accelerating at a rapid pace Optimization and Optimal Control Theory and Applications brings together the latest developments in these areas of research as well as presents applications of these results to a wide range of real world problems This volume can serve as a useful resource for researchers practitioners and advanced graduate students of mathematics and engineering working in research areas where results in optimization and optimal control can be applied  
*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

**Chemical Process** Robin Smith, 2005-06-10 This book deals with the design and integration of chemical processes emphasizing the conceptual issues that are fundamental to the creation of the process Chemical process design requires the selection of a series of processing steps and their integration to form a complete manufacturing system The text emphasizes both the design and selection of the steps as individual operations and their integration Also the process will normally operate as part of an integrated manufacturing site consisting of a number of processes serviced by a common utility system The design of utility systems has been dealt with in the text so that the interactions between processes and the utility system and interactions between different processes through the utility system can be exploited to maximize the performance of the site as a whole Chemical processing should form part of a sustainable industrial activity For chemical processing this means that processes should use raw materials as efficiently as is economic and practicable both to prevent the production of waste that can be environmentally harmful and to preserve the reserves of raw materials as much as possible Processes should use as little energy as economic and practicable both to prevent the build up of carbon dioxide in the atmosphere from burning fossil fuels and to preserve reserves of fossil fuels Water must also be consumed in sustainable quantities that do not cause deterioration in the quality of the water source and the long term quantity of the reserves Aqueous and atmospheric emissions must not be environmentally harmful and solid waste to landfill must be avoided Finally all aspects of chemical processing must feature good health and safety practice It is important for the designer to understand the limitations of the methods used in chemical process design The best way to understand the limitations is to understand the derivations of the equations used and the assumptions on which the equations are based Where practical the derivation of the design equations has been included in the text The book is intended to provide a practical guide to chemical process design and integration for undergraduate and postgraduate students of chemical engineering practicing process designers and chemical engineers and applied chemists working in process development Examples have been included throughout the text Most of these examples do not require specialist software and can be performed on spreadsheet software Finally a number of exercises have been added at the end of each chapter to allow the reader to practice the calculation procedures

**Fuzzy Sets and Their Extensions: Representation, Aggregation and Models** Humberto Bustince, Francisco Herrera, Javier Montero, 2007-10-30 This carefully edited book presents an up to date state of current research in the use of fuzzy sets and their extensions It pays particular attention to foundation issues and to their application to four important areas where fuzzy sets are seen to be an important tool for modeling and solving problems The book's 34 chapters deal with the subject with clarity and effectiveness They include four review papers introducing some non standard representations

**Технические системы в условиях неопределенности. Анализ гибкости и оптимизация** Юрий Волин, Геннадий Островский, 2021-11-10

**Optimization Theory** F. Giannessi, Panos M. Pardalos, Tamás Rapcsák, 2013-12-01 This volume contains refereed papers based on the lectures presented at the XIV International Conference on Mathematical Programming held at Matrahaza Hungary between 27-31 March 1999. This conference was organized by the Laboratory of Operations Research and Decision Systems at the Computer and Automation Institute Hungarian Academy of Sciences. The editors hope this volume will contribute to the theory and applications of mathematical programming. As a tradition of these events the main purpose of the conference was to review and discuss recent advances and promising research trends concerning theory, algorithms and applications in different fields of Optimization Theory and related areas such as Convex Analysis, Complementarity Systems and Variational Inequalities. The conference is traditionally held in the Matra Mountains and housed by the resort house of the Hungarian Academy of Sciences. This was the 14th event of the long lasting series of conferences started in 1973. The organizers wish to express their thanks to the authors for their contributions in this volume and the anonymous referees for their valuable comments. Special thanks are directed to our sponsors: the Hungarian Academy of Sciences, the National Committee for Technological Development, the Hungarian National Science Foundation and last but not least the Hungarian Operational Research Society. We would like to thank John Martindale from Kluwer Academic Publishers for helping us produce this volume, Eva Nora Nagy for corrections and proof readings and Peter Dombi for his excellent work on typesetting and editing the manuscript.

**The Characteristic Method and Its Generalizations for First-Order Nonlinear Partial Differential Equations** Tran Duc Van, Milko Tsuji, Nguyen Duy Thai Son, 1999-06-25 Despite decades of research and progress in the theory of generalized solutions to first order nonlinear partial differential equations, a gap between the local and the global theories remains. The Cauchy characteristic method yields the local theory of classical solutions. Historically the global theory has principally depended on the vanishing viscosity method. The authors of this volume help bridge the gap between the local and global theories by using the characteristic method as a basis for setting a theoretical framework for the study of global generalized solutions. That is they extend the smooth solutions obtained by the characteristic method. The authors offer material previously unpublished in book form including treatments of the life span of classical solutions, the construction of singularities of generalized solutions, new existence and uniqueness theorems on minimax solutions, differential inequalities of Haar type and their application to the uniqueness of global semi-classical solutions and Hopf type explicit formulas for global solutions. These subjects yield interesting relations between purely mathematical theory and the applications of first order nonlinear PDEs. *The Characteristic Method and Its Generalizations for First Order Nonlinear Partial Differential Equations* represents a comprehensive exposition of the authors' works over the last decade. The book is self-contained and assumes only basic measure theory, topology and ordinary differential equations as prerequisites. With its innovative approach, new results and many applications, it will prove valuable to mathematicians, physicists and engineers and especially interesting to researchers in nonlinear PDEs, differential inequalities, multivalued

analysis differential games and related topics in applied analysis      **Parallel Computing Technologies** Victor Malyshkin, 2015-07-24 This book constitutes the proceedings of the 13th International Conference on Parallel Computing Technologies PaCT 2015 held in Petrozavodsk Russia during August September 2015 The 37 full papers and 14 short papers presented were carefully reviewed and selected from 87 submissions The papers are organized in topical sections on parallel models algorithms and programming methods unconventional computing cellular automata distributed computing special processors programming techniques applications      Models, Algorithms, and Technologies for Network Analysis Valery A. Kalyagin, Alexey I. Nikolaev, Panos M. Pardalos, Oleg A. Prokopyev, 2017-06-23 This valuable source for graduate students and researchers provides a comprehensive introduction to current theories and applications in optimization methods and network models Contributions to this book are focused on new efficient algorithms and rigorous mathematical theories which can be used to optimize and analyze mathematical graph structures with massive size and high density induced by natural or artificial complex networks Applications to social networks power transmission grids telecommunication networks stock market networks and human brain networks are presented Chapters in this book cover the following topics Linear max min fairness Heuristic approaches for high quality solutions Efficient approaches for complex multi criteria optimization problems Comparison of heuristic algorithms New heuristic iterative local search Power in network structures Clustering nodes in random graphs Power transmission grid structure Network decomposition problems Homogeneity hypothesis testing Network analysis of international migration Social networks with node attributes Testing hypothesis on degree distribution in the market graphs Machine learning applications to human brain network studies This proceeding is a result of The 6th International Conference on Network Analysis held at the Higher School of Economics Nizhny Novgorod in May 2016 The conference brought together scientists and engineers from industry government and academia to discuss the links between network analysis and a variety of fields      **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      *Numerical Solutions of Realistic Nonlinear Phenomena* J. A. Tenreiro Machado, Necati Özdemir, Dumitru Baleanu, 2020-02-19 This collection covers new aspects of numerical methods in applied mathematics engineering and health sciences It provides recent theoretical developments and new techniques based on optimization theory partial differential equations PDEs mathematical modeling and fractional calculus that can be used to model and understand complex behavior in natural phenomena Specific topics covered in detail include new numerical methods for nonlinear partial differential equations global optimization unconstrained optimization detection of HIV Protease modelling



with new fractional operators analysis of biological models and stochastic modelling      **Introduction to Global**

**Optimization Exploiting Space-Filling Curves** Yaroslav D. Sergeyev, Roman G. Strongin, Daniela Lera, 2013-08-13

Introduction to Global Optimization Exploiting Space Filling Curves provides an overview of classical and new results pertaining to the usage of space filling curves in global optimization The authors look at a family of derivative free numerical algorithms applying space filling curves to reduce the dimensionality of the global optimization problem along with a number of unconventional ideas such as adaptive strategies for estimating Lipschitz constant balancing global and local information to accelerate the search Convergence conditions of the described algorithms are studied in depth and theoretical considerations are illustrated through numerical examples This work also contains a code for implementing space filling curves that can be used for constructing new global optimization algorithms Basic ideas from this text can be applied to a number of problems including problems with multiextremal and partially defined constraints and non redundant parallel computations can be organized Professors students researchers engineers and other professionals in the fields of pure mathematics nonlinear sciences studying fractals operations research management science industrial and applied mathematics computer science engineering economics and the environmental sciences will find this title useful

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