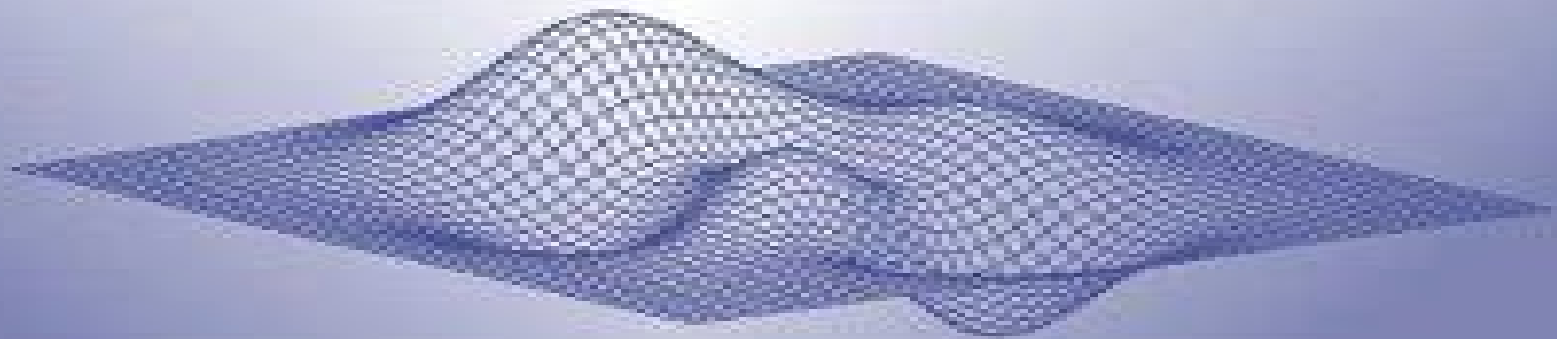


NONCONVEX OPTIMIZATION AND ITS APPLICATIONS

Multiscale Optimization Methods and Applications

Edited by William W. Hager, Shu-Jen Huang,
Panos M. Pardalos and Oleg A. Prokopyev



Springer

Multiscale Optimization Methods Apps

Jun Yan, Gengdong Cheng



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Multiscale Optimization Methods and Applications William W. Hager, Shu-Jen Huang, Panos M. Pardalos, Oleg A. Prokopyev, 2006-06-18 As optimization researchers tackle larger and larger problems scale interactions play an increasingly important role One general strategy for dealing with a large or difficult problem is to partition it into smaller ones which are hopefully much easier to solve and then work backwards towards the solution of original problem using a solution from a previous level as a starting guess at the next level This volume contains 22 chapters highlighting some recent research The topics of the chapters selected for this volume are focused on the development of new solution methodologies including general multilevel solution techniques for tackling difficult large scale optimization problems that arise in science and industry Applications presented in the book include but are not limited to the circuit placement problem in VLSI design a wireless sensor location problem optimal dosages in the treatment of cancer by radiation therapy and facility location

Multiscale Optimization And Materials Design Jun Yan, Gengdong Cheng, 2020-12-29 The book presents a set of novel efficient and systematic concurrent multiscale optimization methods by considering the distribution of the material in macro scale and the unit cell configuration design in micro scale simultaneously Different from the traditional optimization method that is performed in a single scale the proposed methods could generate a great deal of improvements in structural performance through the multiscale structure material concurrent optimum design The proposed theory and methods are related to statics dynamics thermoelastics and the coupling of different physical fields Therefore it provides a comprehensive designing scheme when multiple factors are taken into account For example the designing scheme can have a great significance on enhancing the structural performances under coupled multi physical fields such as load bearing capacity vibration resistance ability and safety under thermal stress and so on Several numerical examples are highlighted in this unique volume based on practical engineering applications The examples collectively demonstrate drastically improved designs featuring excellent unit cell configuration and highly regular macroscale material distribution in a variety of industrial applications

Multiscale Modeling for Process Safety Applications Arnab Chakrabarty, Sam Mannan, Tahir Cagin, 2015-11-29 Multiscale Modeling for Process Safety Applications is a new reference demonstrating the implementation of multiscale modeling techniques on process safety applications It is a valuable resource for readers interested in theoretical simulations and or computer simulations of hazardous scenarios As multi scale modeling is a computational technique for solving problems involving multiple scales such as how a flammable vapor cloud might behave if ignited this book provides information on the fundamental topics of toxic fire and air explosion modeling as well as modeling jet and pool fires using computational fluid dynamics The book goes on to cover nanomaterial toxicity QPSR analysis on relation of chemical structure to flash point molecular structure and burning velocity first principle studies of reactive chemicals water and air reactive chemicals and dust explosions Chemical and process safety professionals as well as faculty and graduate researchers

will benefit from the detailed coverage provided in this book Provides the only comprehensive source addressing the use of multiscale modeling in the context of process safety Bridges multiscale modeling with process safety enabling the reader to understand mapping between problem detail and effective usage of resources Presents an overall picture of addressing safety problems in all levels of modeling and the latest approaches to each in the field Features worked out examples case studies and a question bank to aid understanding and involvement for the reader

Numerical Analysis of Multiscale Problems Ivan G. Graham, Thomas Y. Hou, Omar Lakkis, Robert Scheichl, 2012-01-05 The 91st London Mathematical Society Durham Symposium took place from July 5th to 15th 2010 with more than 100 international participants attending The Symposium focused on Numerical Analysis of Multiscale Problems and this book contains 10 invited articles from some of the meeting's key speakers covering a range of topics of contemporary interest in this area Articles cover the analysis of forward and inverse PDE problems in heterogeneous media high frequency wave propagation atomistic continuum modeling and high dimensional problems arising in modeling uncertainty Novel upscaling and preconditioning techniques as well as applications to turbulent multi phase flow and to problems of current interest in materials science are all addressed As such this book presents the current state of the art in the numerical analysis of multiscale problems and will be of interest to both practitioners and mathematicians working in those fields

Optimization Under Uncertainty with Applications to Aerospace Engineering Massimiliano Vasile, 2021-02-15 In an expanding world with limited resources optimization and uncertainty quantification have become a necessity when handling complex systems and processes This book provides the foundational material necessary for those who wish to embark on advanced research at the limits of computability collecting together lecture material from leading experts across the topics of optimization uncertainty quantification and aerospace engineering The aerospace sector in particular has stringent performance requirements on highly complex systems for which solutions are expected to be optimal and reliable at the same time The text covers a wide range of techniques and methods from polynomial chaos expansions for uncertainty quantification to Bayesian and Imprecise Probability theories and from Markov chains to surrogate models based on Gaussian processes The book will serve as a valuable tool for practitioners researchers and PhD students

Isogeometric Topology Optimization Jie Gao, Liang Gao, Mi Xiao, 2022-04-26 This book provides a systematic description about the development of Isogeometric Topology Optimization ITO method using the density and then addresses the effectiveness and efficiency of the ITO method on several design problems including multi material structures stress minimization structures piezoelectric structures and also with the uniform manufacturability ultra lightweight architected materials with extreme bulk shear moduli auxetic metamaterials and auxetic meta composites with the NPRs behavior in microstructures A detailed MATLAB implementation of the ITO method with an in house code IgaTop is also presented

Algorithms and Theory of Computation Handbook, Volume 2 Mikhail J. Atallah, Marina Blanton, 2009-11-20 Algorithms and Theory of Computation Handbook Second Edition Special Topics and Techniques

provides an up to date compendium of fundamental computer science topics and techniques It also illustrates how the topics and techniques come together to deliver efficient solutions to important practical problems Along with updating and revising many of

Blind Source Separation Xianchuan Yu,Dan Hu,Jindong Xu,2013-12-13 A systematic exploration of both classic and contemporary algorithms in blind source separation with practical case studies The book presents an overview of Blind Source Separation a relatively new signal processing method Due to the multidisciplinary nature of the subject the book has been written so as to appeal to an audience from very different backgrounds Basic mathematical skills e g on matrix algebra and foundations of probability theory are essential in order to understand the algorithms although the book is written in an introductory accessible style This book offers a general overview of the basics of Blind Source Separation important solutions and algorithms and in depth coverage of applications in image feature extraction remote sensing image fusion mixed pixel decomposition of SAR images image object recognition fMRI medical image processing geochemical and geophysical data mining mineral resources prediction and geoanomalies information recognition Firstly the background and theory basics of blind source separation are introduced which provides the foundation for the following work Matrix operation foundations of probability theory and information theory basics are included here There follows the fundamental mathematical model and fairly new but relatively established blind source separation algorithms such as Independent Component Analysis ICA and its improved algorithms Fast ICA Maximum Likelihood ICA Overcomplete ICA Kernel ICA Flexible ICA Non negative ICA Constrained ICA Optimised ICA The last part of the book considers the very recent algorithms in BSS e g Sparse Component Analysis SCA and Non negative Matrix Factorization NMF Meanwhile in depth cases are presented for each algorithm in order to help the reader understand the algorithm and its application field A systematic exploration of both classic and contemporary algorithms in blind source separation with practical case studies Presents new improved algorithms aimed at different applications such as image feature extraction remote sensing image fusion mixed pixel decomposition of SAR images image object recognition and MRI medical image processing With applications in geochemical and geophysical data mining mineral resources prediction and geoanomalies information recognition Written by an expert team with accredited innovations in blind source separation and its applications in natural science Accompanying website includes a software system providing codes for most of the algorithms mentioned in the book enhancing the learning experience Essential reading for postgraduate students and researchers engaged in the area of signal processing data mining image processing and recognition information geosciences life sciences

Engineering and Applied Sciences Optimization Nikos D. Lagaros,Manolis Papadrakakis,2015-05-22 The chapters which appear in this volume are selected studies presented at the First International Conference on Engineering and Applied Sciences Optimization OPT i Kos Greece 4 6 June 2014 and works written by friends former colleagues and students of the late Professor M G Karlaftis all in the area of optimization that he loved and published so much in himself The subject areas represented here range from structural optimization logistics

transportation traffic and telecommunication networks to operational research metaheuristics multidisciplinary and multiphysics design optimization etc This volume is dedicated to the life and the memory of Professor Matthew G Karlaftis who passed away a few hours before he was to give the opening speech at OPT i All contributions reflect the warmth and genuine friendship which he enjoyed from his associates and show how much his scientific contribution has been appreciated He will be greatly missed and it is hoped that this volume will be received as a suitable memorial to his life and achievements

Metaheuristics for Finding Multiple Solutions Mike Preuss, Michael G. Epitropakis, Xiaodong Li, Jonathan E. Fieldsend, 2021-10-22 This book presents the latest trends and developments in multimodal optimization and niching techniques Most existing optimization methods are designed for locating a single global solution However in real world settings many problems are multimodal by nature i e multiple satisfactory solutions exist It may be desirable to locate several such solutions before deciding which one to use Multimodal optimization has been the subject of intense study in the field of population based meta heuristic algorithms e g evolutionary algorithms EAs for the past few decades These multimodal optimization techniques are commonly referred to as niching methods because of the nature inspired niching effect that is induced to the solution population targeting at multiple optima Many niching methods have been developed in the EA community Some classic examples include crowding fitness sharing clearing derating restricted tournament selection speciation etc Nevertheless applying these niching methods to real world multimodal problems often encounters significant challenges To facilitate the advance of niching methods in facing these challenges this edited book highlights the latest developments in niching methods The included chapters touch on algorithmic improvements and developments representation and visualization issues as well as new research directions such as preference incorporation in decision making and new application areas This edited book is a first of this kind specifically on the topic of niching techniques This book will serve as a valuable reference book both for researchers and practitioners Although chapters are written in a mutually independent way Chapter 1 will help novice readers get an overview of the field It describes the development of the field and its current state and provides a comparative analysis of the IEEE CEC and ACM GECCO niching competitions of recent years followed by a collection of open research questions and possible research directions that may be tackled in the future Presented at the Conference on Multiscale Optimization, Methods and Applications Conference on Multiscale Optimization Methods and Applications (2004, Gainesville, Fla.), 2006 *Statistical and Algorithm Aspects of Optimal Portfolios* Howard Howan Stephen Shek, 2011 We address three key aspects of optimal portfolio construction expected return variance covariance modeling and optimization in presence of cardinality constraints On expected return modeling we extend the self excited point process framework to model conditional arrival intensities of bid and ask side market orders of listed stocks The cross excitation of market orders is modeled explicitly such that the ask side market order size and bid side probability weighted order book cumulative volume can affect the ask side order intensity and vice versa Different variations

of the framework are estimated by using method of maximum likelihood estimation based on a recursive application of the log likelihood functions derived in this thesis Results indicate that the self excited point process framework is able to capture a significant amount of the underlying trading dynamics of market orders both in sample and out of sample A new framework is introduced Realized GARCH for the joint modeling of returns and realized measures of volatility A key feature is a measurement equation that relates the realized measure to the conditional variance of returns The measurement equation facilitates a simple modeling of the dependence between returns and future volatility Realized GARCH models with a linear or log linear specification have many attractive features They are parsimonious simple to estimate and imply an ARMA structure for the conditional variance and the realized measure An empirical application with DJIA stocks and an exchange traded index fund shows that a simple Realized GARCH structure leads to substantial improvements in the empirical fit over standard GARCH models Finally we describe a novel algorithm to obtain the solution of the optimal portfolio problem with NP hard cardinality constraints The algorithm is based on a local relaxation that exploits the inherent structure of the objective function It solves a sequence of small local quadratic programs by first projecting asset returns onto a reduced metric space followed by clustering in this space to identify sub groups of assets that best accentuate a suitable measure of similarity amongst different assets The algorithm can either be cold started using the centroids of initial clusters or be warm started based on the output of a previous result Empirical result using baskets of up to 3 000 stocks and with different cardinality constraints indicates that the algorithm is able to achieve significant performance gain over a sophisticated branch and cut method One key application of this local relaxation algorithm is in dealing with large scale cardinality constrained portfolio optimization under tight time constraint such as for the purpose of index tracking or index arbitrage at high frequency

Multiscale Entropy Approaches and Their Applications Anne Humeau-Heurtier, 2020-11-06 Multiscale entropy MSE measures to evaluate the complexity of time series by taking into account the multiple time scales in physical systems were proposed in the early 2000s Since then these approaches have received a great deal of attention and have been used in a wide range of applications Multivariate approaches have also been developed The algorithms for an MSE approach are composed of two main steps i a coarse graining procedure to represent the system s dynamics on different scales and ii the entropy computation for the original signal and for the coarse grained time series to evaluate the irregularity for each scale Moreover different entropy measures have been associated with the coarse graining approach each one having its advantages and drawbacks In this Special Issue we gathered 24 papers focusing on either the theory or applications of MSE approaches These papers can be divided into two groups papers that propose new developments in entropy based measures or improve the understanding of existing ones 9 papers and papers that propose new applications of existing entropy based measures 14 papers Moreover one paper presents a review of cross entropy methods and their multiscale approaches

Multiscale Methods Jacob Fish, 2009-10-22 Small scale features and processes occurring at nanometer and

femtosecond scales have a profound impact on what happens at a larger scale and over an extensive period of time The primary objective of this volume is to reflect the state of the art in multiscale mathematics modeling and simulations and to address the following barriers What is the information that needs to be transferred from one model or scale to another and what physical principles must be satisfied during the transfer of information What are the optimal ways to achieve such transfer of information How can variability of physical parameters at multiple scales be quantified and how can it be accounted for to ensure design robustness The multiscale approaches in space and time presented in this volume are grouped into two main categories information passing and concurrent In the concurrent approaches various scales are simultaneously resolved whereas in the information passing methods the fine scale is modeled and its gross response is infused into the continuum scale The issue of reliability of multiscale modeling and simulation tools which focus on a hierarchy of multiscale models and an a posteriori model of error estimation including uncertainty quantification is discussed in several chapters Component software that can be effectively combined to address a wide range of multiscale simulations is also described Applications range from advanced materials to nanoelectromechanical systems NEMS biological systems and nanoporous catalysts where physical phenomena operates across 12 orders of magnitude in time scales and 10 orders of magnitude in spatial scales This volume is a valuable reference book for scientists engineers and graduate students practicing in traditional engineering and science disciplines as well as in emerging fields of nanotechnology biotechnology microelectronics and energy

CONTROLO 2016 Paulo Garrido, Filomena Soares, António Paulo Moreira, 2016-09-03 The biennial CONTROLO conferences are the main events promoted by The CONTROLO 2016 12th Portuguese Conference on Automatic Control Guimarães Portugal September 14th to 16th was organized by Algoritmi School of Engineering University of Minho in partnership with INESC TEC and promoted by the Portuguese Association for Automatic Control APCA national member organization of the International Federation of Automatic Control IFAC The seventy five papers published in this volume cover a wide range of topics Thirty one of them of a more theoretical nature are distributed among the first five parts Control Theory Optimal and Predictive Control Fuzzy Neural and Genetic Control Modeling and Identification Sensing and Estimation The papers go from cutting edge theoretical research to innovative control applications and show expressively how Automatic Control can be used to increase the well being of people the forty four papers of a more applied nature are presented in the following eight parts robotics mechatronics manufacturing systems and scheduling vibration control applications agricultural systems power applications general education go from cutting edge theoretical research to innovative control show expressively how automatic can be used increase well being people

Numerical Mathematics and Advanced Applications 2009 Gunilla Kreiss, Per Lötstedt, Axel Målqvist, Maya Neytcheva, 2010-10-19 xxx

Algorithms and Theory of Computation Handbook - 2 Volume Set Mikhail J. Atallah, Marina Blanton, 2022-05-29 Algorithms and Theory of Computation Handbook Second Edition in a two volume set provides an up to date compendium of

fundamental computer science topics and techniques It also illustrates how the topics and techniques come together to deliver efficient solutions to important practical problems New to the Second Edition Along with updating and revising many of the existing chapters this second edition contains more than 20 new chapters This edition now covers external memory parameterized self stabilizing and pricing algorithms as well as the theories of algorithmic coding privacy and anonymity databases computational games and communication networks It also discusses computational topology computational number theory natural language processing and grid computing and explores applications in intensity modulated radiation therapy voting DNA research systems biology and financial derivatives This best selling handbook continues to help computer professionals and engineers find significant information on various algorithmic topics The expert contributors clearly define the terminology present basic results and techniques and offer a number of current references to the in depth literature They also provide a glimpse of the major research issues concerning the relevant topics

Advances in Applied Human Modeling and Simulation Vincent G. Duffy, 2012-07-09 An examination of the various types of human modeled technology *Advances in Applied Human Modeling and Simulation* not only covers the type of models available but how they can be applied to solve specific problems These models provide a representation of some human aspects that can be inserted into simulations or virtual environments and facilitate prediction of safety satisfaction usability performance and sustainability Topics include Anthropometry and human functional data Biomechanics occupational safety comfort and discomfort Biometric authentications Driving safety and human performance Enhancing human capabilities through aids or training Fuzzy systems and neural computing Human behavior and risk assessment modeling Integrating software with humans and systems International cooperation in education and engineering research Intelligent agents in decision training Intelligent data and text mining Machine learning and human factors Modeling physical aspects of work Monitoring systems and human decision Psychophysiological indicators of emotion Resilience engineering and human reliability Scenario based performance in distributed enterprises Special populations Sustainability earth sciences and engineering System of systems architecting and engineering Verification and validation Virtual interactive design and assessment The math and science provides a foundation for visualizations that can facilitate decision making by technical experts management or those responsible for public policy In considering a systems perspective and decisions that affect performance these models provide opportunities for an expanded role of engineers and HF E specialists to meet technical challenges worldwide They can also be used to improve time to market increase safety and ultimately the effectiveness of an organization The book focuses on applications of these newly developed models and predictive capabilities useful to human factors and ergonomics engineers cognitive engineers human computer interaction engineers human performance modeling engineers and students in related fields

Advanced Applications in Heat Exchanger Technologies Sunil Kumar, Kavita Rathore, Debjyoti Banerjee, 2025-08-13 *Advanced Applications in Heat Exchanger Technologies* presents the most recent developments in

enhancing heat exchanger performance reliability and resilience including the implementation of Artificial Intelligence Machine Learning and Additive Manufacturing Covering the essential parts of many commercial endeavors ranging from aerospace to marine applications to oil and gas the book discusses various heat exchanger types and interdisciplinary industry applications It encompasses several different techniques such as nanofluids microchannel heat exchangers computer modeling advanced manufacturing and optimization The book addresses real world concerns that impact long term heat exchanger performance and dependability such as fouling corrosion prevention and maintenance measures This book is intended for researchers and graduate students who are interested in heat exchangers R D and the diverse range of industrial applications of heat exchanger technologies in contemporary practice *Advances in Mechanics: Theoretical, Computational and Interdisciplinary Issues* Michal Kleiber, Tadeusz Burczynski, Krzysztof Wilde, Jaroslaw Gorski, Karol Winkelmann, Lukasz Smakosz, 2016-05-05 *Advances in Mechanics Theoretical Computational and Interdisciplinary Issues* covers the domain of theoretical experimental and computational mechanics as well as interdisciplinary issues such as industrial applications Special attention is paid to the theoretical background and practical applications of computational mechanics This volume

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