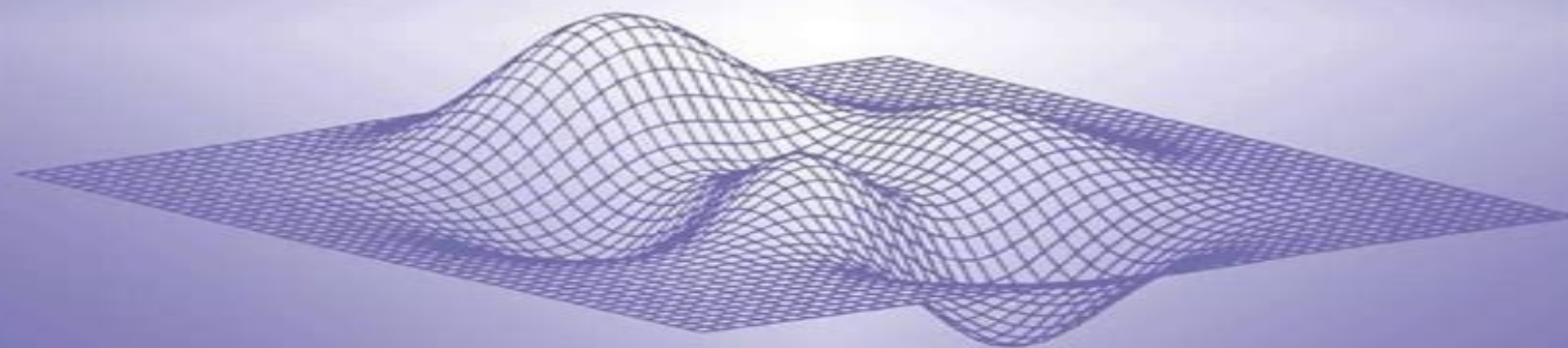


NONCONVEX OPTIMIZATION AND ITS APPLICATIONS

Robust Discrete Optimization and Its Applications

Panos Kouvelis and Gang Yu



Springer-Science+Business Media, B.V.

Robust Discrete Optimization And Its Applications

Michael Hoelscher



Robust Discrete Optimization And Its Applications:

Robust Discrete Optimization and Its Applications Panos Kouvelis, Gang Yu, 2013-03-09 This book deals with decision making in environments of significant data uncertainty with particular emphasis on operations and production management applications. For such environments we suggest the use of the robustness approach to decision making which assumes inadequate knowledge of the decision maker about the random state of nature and develops a decision that hedges against the worst contingency that may arise. The main motivating factors for a decision maker to use the robustness approach are that it does not ignore uncertainty and takes a proactive step in response to the fact that forecasted values of uncertain parameters will not occur in most environments. It applies to decisions of unique non repetitive nature which are common in many fast and dynamically changing environments. It accounts for the risk averse nature of decision makers and it recognizes that even though decision environments are fraught with data uncertainties decisions are evaluated ex post with the realized data. For all of the above reasons robust decisions are dear to the heart of operational decision makers. This book takes a giant first step in presenting decision support tools and solution methods for generating robust decisions in a variety of interesting application environments. Robust Discrete Optimization is a comprehensive mathematical programming framework for robust decision making.

Vector Variational Inequalities and Vector Equilibria F. Giannessi, 2013-12-01 The book deals with the mathematical theory of vector variational inequalities with special reference to equilibrium problems. Such models have been introduced recently to study new problems from mechanics, structural engineering, networks and industrial management and to revisit old ones. The common feature of these problems is that given by the presence of concurrent objectives and by the difficulty of identifying a global functional like energy to be extremized. The vector variational inequalities have the advantage of both the variational ones and vector optimization which are found as special cases. Among several applications the equilibrium flows on a network receive special attention. Audience: The book is addressed to academic researchers as well as industrial ones in the fields of mathematics, engineering, mathematical programming, control theory, operations research, computer science and economics.

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 emphasis 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 **Topological Methods in Complementarity Theory** G. Isac, 2013-04-17 Complementarity theory is a new domain in applied mathematics and is concerned with the study of complementarity problems These problems represent a wide class of mathematical models related to optimization game theory economic engineering mechanics fluid mechanics stochastic optimal control etc The book is dedicated to the study of nonlinear complementarity problems by topological methods Audience Mathematicians engineers economists specialists working in operations research and anybody interested in applied mathematics or in mathematical modeling *Handbook on Project Management and Scheduling Vol. 2* Christoph Schwindt, Jürgen Zimmermann, 2015-01-13 Due to the increasing importance of product differentiation and collapsing product life cycles a growing number of value adding activities in the industry and service sector are organized in projects Projects come in many forms often taking considerable time and consuming a large amount of resources The management and scheduling of projects represents a challenging task and project performance may have a considerable impact on an organization's competitiveness This handbook presents state of the art approaches to project management and scheduling More than sixty contributions written by leading experts in the field provide an authoritative survey of recent developments The book serves as a comprehensive reference both for researchers and project management professionals The handbook consists of two volumes Volume 1 is devoted to single modal and multi modal project scheduling Volume 2 presents multi project problems project scheduling under uncertainty and vagueness managerial approaches and a separate part on applications case studies and information systems Algorithm Engineering Lasse Kliemann, Peter Sanders, 2016-11-10 Algorithm Engineering is a methodology for algorithmic research that combines theory with implementation and experimentation in order to obtain better algorithms with high practical impact Traditionally the study of algorithms was dominated by mathematical worst case analysis In Algorithm Engineering algorithms are also implemented and experiments conducted in a systematic way sometimes resembling the experimentation processes known from fields such as biology chemistry or physics This helps in counteracting an otherwise growing gap between theory and practice **Operations Research Proceedings 2015** Karl Franz Dörner, Ivana Ljubic, Georg Pflug, Gernot Tragler, 2017-03-07 This book gathers a selection of refereed papers presented at the International Conference on Operations Research OR2015 which was held at the University of Vienna Austria September 1-4 2015 Over 900 scientists and students from 50 countries attended this conference and presented more than 600 papers in parallel topic streams as well as special award sessions Though the guiding theme of the conference was Optimal Decision and Big Data this volume also includes papers addressing practically all aspects of modern Operations Research **Robust Manufacturing Control** Katja

Windt,2012-12-14 This contributed volume collects research papers presented at the CIRP Sponsored Conference Robust Manufacturing Control Innovative and Interdisciplinary Approaches for Global Networks RoMaC 2012 Jacobs University Bremen Germany June 18th 20th 2012 These research papers present the latest developments and new ideas focusing on robust manufacturing control for global networks Today Global Production Networks i e the nexus of interconnected material and information flows through which products and services are manufactured assembled and distributed are confronted with and expected to adapt to sudden and unpredictable large scale changes of important parameters which are occurring more and more frequently event propagation in networks with high degree of interconnectivity which leads to unforeseen fluctuations and non equilibrium states which increasingly characterize daily business These multi scale changes deeply influence logistic target achievement and call for robust planning and control strategies Therefore understanding the cause and effects of multi scale changes in production networks is of major interest New methodological approaches from different science disciplines are promising to contribute to a new level comprehension of network processes Unconventional methods from biology perturbation ecology or auditory display are gaining increasing importance as they are confronted with similar challenges Advancements from the classical disciplines such as mathematics physics and engineering are also becoming of continuing importance

Handbook of Multicriteria Analysis Constantin Zopounidis,Panos M. Pardalos,2010-05-25

Multicriteria analysis is a rapidly growing aspect of operations research and management science with numerous practical applications in a wide range of fields This book presents all the recent advances in multicriteria analysis including multicriteria optimization goal programming outranking methods and disaggregation techniques The latest developments on robustness analysis preference elicitation and decision making when faced with incomplete information are also discussed together with applications in business performance evaluation finance and marketing Finally the interactions of multicriteria analysis with other disciplines are also explored including among others data mining artificial intelligence and evolutionary methods

Multiobjective Optimization Jürgen Branke,2008-10-15

Multiobjective optimization deals with solving problems having not only one but multiple often conflicting criteria Such problems can arise in practically every field of science engineering and business and the need for efficient and reliable solution methods is increasing The task is challenging due to the fact that instead of a single optimal solution multiobjective optimization results in a number of solutions with different trade offs among criteria also known as Pareto optimal or efficient solutions Hence a decision maker is needed to provide additional preference information and to identify the most satisfactory solution Depending on the paradigm used such information may be introduced before during or after the optimization process Clearly research and application in multiobjective optimization involve expertise in optimization as well as in decision support This state of the art survey originates from the International Seminar on Practical Approaches to Multiobjective Optimization held in Dagstuhl Castle Germany in December 2006 which brought together leading experts from various contemporary multiobjective

optimization fields including evolutionary multiobjective optimization EMO multiple criteria decision making MCDM and multiple criteria decision aiding MCDA This book gives a unique and detailed account of the current status of research and applications in the field of multiobjective optimization It contains 16 chapters grouped in the following 5 thematic sections Basics on Multiobjective Optimization Recent Interactive and Preference Based Approaches Visualization of Solutions Modelling Implementation and Applications and Quality Assessment Learning and Future Challenges

Quasidifferentiability and Related Topics Vladimir F. Demyanov, Alexander M. Rubinov, 2013-03-14 2 Radiant sets 236 3 Co radiant sets 239 4 Radiative and co radiative sets 241 5 Radiant sets with Lipschitz continuous Minkowski gauges 245 6 Star shaped sets and their kernels 249 7 Separation 251 8 Abstract convex star shaped sets 255 References 260 11 DIFFERENCES OF CONVEX COMPACTA AND METRIC SPACES OF CONVEX COMPACTA WITH APPLICATIONS A SURVEY A M Rubinov A A Vladimirov 1 Introduction 264 2 Preliminaries 264 3 Differences of convex compact sets general approach 266 4 Metric projections and corresponding differences one dimensional case 267 5 The difference 269 6 The Demyanov difference 271 7 Geometric and inductive definitions of the D difference 273 8 Applications to DC and quasidifferentiable functions 276 9 Differences of pairs of set valued mappings with applications to quasidifferentiability 278 10 Applications to approximate subdifferentials 280 11 Applications to the approximation of linear set valued mappings 281 12 The Demyanov metric 282 13 The Bartels Pallaschke metric 284 14 Hierarchy of the three norms on Q_n 285 15 Derivatives 287 16 Distances from convex polyhedra and convergence of convex polyhedra 289 17 Normality of convex sets 290 18 D regular sets 291 19 Variable D regular sets 292 20 Optimization 293 References 294 12 CONVEX APPROXIMATORS *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 Optimum Design 2000 Anthony Atkinson, Barbara Bogacka, Anatoly A. Zhigljavsky, 2013-03-09 This volume contains many of the papers presented at the conference Optimum Design 2000 Prospects for the New Millennium held in Cardiff UK on April 12th 14th 2000 The majority of the papers consider aspects of optimum experimental design from the theoretical to applications Many of the optimisation problems arising in the optimum design theory in general and the

articles in this volume in particular fall into the category of nonconvex including global optimization The papers are organised in two sections Since we are at the beginning of a new millennium the first paper starts by looking back at the beginnings of optimum experimental design in 1917 and sketches the development up to Kiefer's paper read to the Royal Statistical Society in 1959 This is the first in a group of papers which we have labelled Theory which cover the more general aspects such as the properties and methods of construction of designs In the Applications section there are papers on sequential design problems arising in the pharmaceutical industry and on the designs with discrete factors which occur in agriculture There are also papers on training neural networks on the efficient design of sampling methods on design problems in mixtures arising from a study of glass manufacturing and on the resistance of Brazilian weeds to herbicides The number attending the meeting was deliberately limited to 50 in order to encourage a workshop atmosphere and the exchange of ideas

Generalized Convexity, Generalized Monotonicity: Recent Results Jean-Pierre Crouzeix, Juan Enrique Martinez Legaz, Michel Volle, 2013-12-01 A function is convex if its epigraph is convex This geometrical structure has very strong implications in terms of continuity and differentiability Separation theorems lead to optimality conditions and duality for convex problems A function is quasiconvex if its lower level sets are convex Here again the geometrical structure of the level sets implies some continuity and differentiability properties for quasiconvex functions Optimality conditions and duality can be derived for optimization problems involving such functions as well Over a period of about fifty years quasiconvex and other generalized convex functions have been considered in a variety of fields including economics management science engineering probability and applied sciences in accordance with the need of particular applications During the last twenty five years an increase of research activities in this field has been witnessed More recently generalized monotonicity of maps has been studied It relates to generalized convexity of functions as monotonicity relates to convexity Generalized monotonicity plays a role in variational inequality problems complementarity problems and more generally in equilibrium problems

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 during 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 exposition 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 topological 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

Semi-Infinite Programming Rembert Reemtsen, Jan-J. Rückmann, 2013-03-14 Semi infinite programming briefly SIP is an exciting part of mathematical programming SIP problems include finitely many variables and in contrast to finite optimization problems infinitely many inequality constraints Problems of this type naturally arise in approximation theory optimal control and at numerous engineering applications where the model contains at least one inequality constraint for each value of a parameter and the parameter representing time space frequency etc varies in a given domain The treatment of such problems requires particular theoretical and numerical techniques The theory in SIP as well as the number of numerical SIP methods and applications have expanded very fast during the last years Therefore the main goal of this monograph is to provide a collection of tutorial and survey type articles which represent a substantial part of the contemporary body of knowledge in SIP We are glad that leading researchers have contributed to this volume and that their articles are covering a wide range of important topics in this subject It is our hope that both experienced students and scientists will be well advised to consult this volume We got the idea for this volume when we were organizing the semi infinite programming workshop which was held in Cottbus Germany in September 1996

From Convexity to Nonconvexity R.P. Gilbert, Panagiotis D. Panagiotopoulos, Panos M. Pardalos, 2013-12-01 This collection of papers is dedicated to the memory of Gaetano Fichera a great mathematician and also a good friend to the editors Regrettably it took an unusual amount of time to bring this collection out This was primarily due to the fact that the main editor who had collected all of the materials for this volume P D Panagiotopoulos died unexpectedly during the period when we were editing the manuscript The other two editors in appreciation of Panagiotopoulos contribution to this field believe it is therefore fitting that this collection be dedicated to his memory also The theme of the collection is centered around the seminal research of G Fichera on the Signorini problem Variants on this idea enter in different ways For example by bringing in friction the problem is no longer self adjoint and the minimization formulation is not valid A large portion of this collection is devoted to survey papers concerning hemivariational methods with a main point of its application to nonsmooth mechanics Hemivariational inequalities which are a generalization of variational inequalities were pioneered by Panagiotopoulos There are many applications of this theory to the study of non convex energy functionals occurring in many branches of mechanics An area of concentration concerns contact problems in particular quasistatic and dynamic contact problems with friction and damage Nonsmooth optimization methods which may be divided into the main groups of subgradient methods and bundle methods are also discussed in this collection

Complementarity, Equilibrium, Efficiency and Economics G. Isac, V.A. Bulavsky, Vyacheslav V.

Kalashnikov, 2002-06-30 In complementarity theory which is a relatively new domain of applied mathematics several kinds of mathematical models and problems related to the study of equilibrium are considered from the point of view of physics as well as economics In this book the authors have combined complementarity theory equilibrium of economical systems and efficiency in Pareto's sense The authors discuss the use of complementarity theory in the study of equilibrium of economic systems and present results they have obtained In addition the authors present several new results in complementarity theory and several numerical methods for solving complementarity problems associated with the study of economic equilibrium The most important notions of Pareto efficiency are also presented Audience Researchers and graduate students interested in complementarity theory in economics in optimization and in applied mathematics **STACS 2006** Bruno

Durand, Wolfgang Thomas, 2006-03-01 This book constitutes the refereed proceedings of the 23rd Annual Symposium on Theoretical Aspects of Computer Science held in February 2006 The 54 revised full papers presented together with three invited papers were carefully reviewed and selected from 283 submissions The papers address the whole range of theoretical computer science including algorithms and data structures automata and formal languages complexity theory semantics and logic in computer science Variational Methods in Partially Ordered Spaces Alfred Göpfert, Hassan Riahi, Christiane

Tammer, Constantin Zălinescu, 2023-12-08 In mathematical modeling of processes occurring in logistics management science operations research networks mathematical finance medicine and control theory one often encounters optimization problems involving more than one objective function so that Multiobjective Optimization or Vector Optimization initiated by W Pareto has received new impetus The growing interest in vector optimization problems both from the theoretical point of view and as it concerns applications to real world optimization problems asks for a general scheme which embraces several existing developments and stimulates new ones This book aims to provide the newest results and applications of this quickly growing field Basic tools of partially ordered spaces are discussed and applied to variational methods in nonlinear analysis and to optimization problems The book begins by providing simple examples that illustrate what kind of problems can be handled with the methods presented The book then deals with connections between order structures and topological structures of sets discusses properties of nonlinear scalarization functions and derives corresponding separation theorems for not necessarily convex sets Furthermore characterizations of set relations via scalarization are presented Important topological properties of multifunctions and new results concerning the theory of vector optimization and equilibrium problems are presented in the book These results are applied to construct numerical algorithms especially proximal point algorithms and geometric algorithms based on duality assertions In the second edition new sections about set less relations optimality conditions in set optimization and the asymptotic behavior of multiobjective Pareto equilibrium problems have been incorporated Furthermore a new chapter regarding scalar optimization problems under uncertainty and robust counterpart

problems employing approaches based on vector optimization set optimization and nonlinear scalarization was added. Throughout the entire book there are examples used to illustrate the results and check the stated conditions. This book will be of interest to graduate students and researchers in pure and applied mathematics, economics, and engineering. A sound knowledge of linear algebra and introductory real analysis should provide readers with sufficient background for this book.

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