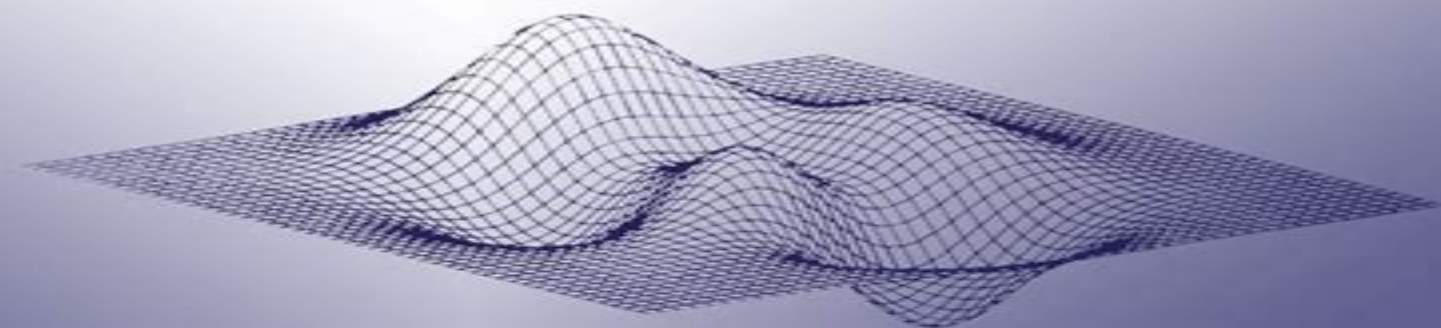


NONCONVEX OPTIMIZATION AND ITS APPLICATIONS

Optimization on Low Rank Nonconvex Structures

Hiroshi Konno, Phan Thien Thach and Hoang Tuy



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Optimization On Low Rank Nonconvex Structures

**Jonas Mockus, William Eddy, Gintaras
Reklaitis**



Optimization On Low Rank Nonconvex Structures:

Optimization on Low Rank Nonconvex Structures Hiroshi Konno, Phan Thien Thach, Hoang Tuy, 2013-12-01 Global optimization is one of the fastest developing fields in mathematical optimization. In fact, an increasing number of remarkably efficient deterministic algorithms have been proposed in the last ten years for solving several classes of large scale specially structured problems encountered in such areas as chemical engineering, financial engineering, location and network optimization, production and inventory control, engineering design, computational geometry, and multi objective and multi level optimization. These new developments motivated the authors to write a new book devoted to global optimization problems with special structures. Most of these problems though highly nonconvex can be characterized by the property that they reduce to convex minimization problems when some of the variables are fixed. A number of recently developed algorithms have been proved surprisingly efficient for handling typical classes of problems exhibiting such structures, namely low rank nonconvex structures. Audience: The book will serve as a fundamental reference book for all those who are interested in mathematical optimization. Generalized Convexity and Optimization Alberto Cambini, Laura Martein, 2008-10-14 The authors have written a rigorous yet elementary and self contained book to present in a unified framework generalized convex functions. The book also includes numerous exercises and two appendices which list the findings consulted. Duality for Nonconvex Approximation and Optimization Ivan Singer, 2007-03-12 The theory of convex optimization has been constantly developing over the past 30 years. Most recently many researchers have been studying more complicated classes of problems that still can be studied by means of convex analysis, so called anticonvex and convex anticonvex optimization problems. This manuscript contains an exhaustive presentation of the duality for these classes of problems and some of its generalization in the framework of abstract convexity. This manuscript will be of great interest for experts in this and related fields. **Global Optimization with Non-Convex Constraints** Roman G. Strongin, Yaroslav D. Sergeyev, 2000-10-31 This book presents a new approach to global non convex constrained optimization. Problem dimensionality is reduced via space filling curves. To economize the search, constraint is accounted separately, penalties are not employed. The multicriteria case is also considered. All techniques are generalized for non redundant execution on multiprocessor systems. Audience: Researchers and students working in optimization, applied mathematics and computer science. Nonlinear Optimization in Finite Dimensions Hubertus Th. Jongen, P. Jonker, F. Twilt, 2013-12-11 At the heart of the topology of global optimization lies Morse Theory. The study of the behaviour of lower level sets of functions as the level varies. Roughly speaking, the topology of lower level sets only may change when passing a level which corresponds to a stationary point or Karush Kuhn Tucker point. We study elements of Morse Theory both in the unconstrained and constrained case. Special attention is paid to the degree of differentiability of the functions under consideration. The reader will become motivated to discuss the possible shapes and forms of functions that may possibly arise within a given problem framework. In a separate chapter we show how certain

ideas may be carried over to nonsmooth items such as problems of Chebyshev approximation type We made this choice in order to show that a good understanding of regular smooth problems may lead to a straightforward treatment of just continuous problems by means of suitable perturbation techniques taking a priori nonsmoothness into account Moreover we make a focal point analysis in order to emphasize the difference between inner product norms and for example the maximum norm Then specific tools from algebraic topology in particular homology theory are treated in some detail However this development is carried out only as far as it is needed to understand the relation between critical points of a function on a manifold with structured boundary Then we pay attention to three important subjects in nonlinear optimization

Approximation and Complexity in Numerical Optimization Panos M. Pardalos, 2013-06-29 There has been much recent progress in approximation algorithms for nonconvex continuous and discrete problems from both a theoretical and a practical perspective In discrete or combinatorial optimization many approaches have been developed recently 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 As a result new approximate algorithms have been discovered and many new computational approaches have been developed Similarly for many continuous nonconvex optimization problems new approximate algorithms have been developed based on semidefinite programming and new randomization techniques On the other hand computational complexity originating from the interactions between computer science and numerical optimization is one of the major theories that have revolutionized the approach to solving optimization problems and to analyzing their intrinsic difficulty The main focus of complexity is the study of whether existing algorithms are efficient for the solution of problems and which problems are likely to be tractable The quest for developing efficient algorithms leads also to elegant general approaches for solving optimization problems and reveals surprising connections among problems and their solutions A conference on Approximation and Complexity in Numerical Optimization Continuous and Discrete Problems was held during February 28 to March 2 1999 at the Center for Applied Optimization of the University of Florida

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 **Quasidifferentiability and Related Topics** Vladimir F. Demyanov, Alexander M. Rubinov, 2013-03-14

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12 CONVEX APPROXIMATORS **Nonlinear Equations and Optimisation** L.T. Watson, J.A. Ford, M. Bartholomew-Biggs, 2001-03-14

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In one of the papers in this collection the remark that nothing at all takes place in the universe in which some rule of maximum or minimum does not appear is attributed to no less an authority than Euler. Simplifying the syntax a little we might paraphrase this as: Everything is an optimization problem. While this might be something of an overstatement, the element of exaggeration is certainly reduced if we consider the extended form: Everything is an optimization problem or a system of equations. This observation, even if only partly true, stands as a fitting testimonial to the importance of the work covered by this volume. Since the 1960s much effort has gone into the development and application of numerical algorithms for solving problems in the two areas of optimization and systems of equations. As a result many different ideas have been proposed for dealing efficiently with, for example, severe nonlinearities and/or very large numbers of variables. Libraries of powerful software now embody the most successful of these ideas, and one objective of this volume is to assist potential users in choosing appropriate software for the problems they need to solve. More generally, however, these collected review articles are intended to provide both researchers and practitioners with snapshots of the state of the art with regard to algorithms for particular classes of problem. These snapshots are meant to have the virtues of immediacy through the inclusion of very recent ideas, but they also have sufficient depth of field to show how ideas have developed and how today's research questions have grown out of previous solution attempts. The most efficient methods for local optimization, both unconstrained and constrained, are still derived from the classical Newton approach. As well as dealing in depth with the various classical or neo-classical approaches, the selection of papers on optimization in this volume ensures that newer ideas are also well represented. Solving nonlinear

algebraic systems of equations is closely related to optimization. The two are not completely equivalent however and usually something is lost in the translation. Algorithms for nonlinear equations can be roughly classified as locally convergent or globally convergent. The characterization is not perfect. Locally convergent algorithms include Newton's method, modern quasi-Newton variants of Newton's method and trust region methods. All of these approaches are well represented in this volume.

Deterministic Global Optimization Christodoulos A. Floudas, 2013-03-09. The vast majority of important applications in science, engineering and applied science are characterized by the existence of multiple minima and maxima as well as first, second and higher order saddle points. The area of Deterministic Global Optimization introduces theoretical, algorithmic and computational advances that i) address the computation and characterization of global minima and maxima, ii) determine valid lower and upper bounds on the global minima and maxima and iii) address the enclosure of all solutions of nonlinear constrained systems of equations. Global optimization applications are widespread in all disciplines and they range from atomistic or molecular level to process and product level representations. The primary goal of this book is three fold: first to introduce the reader to the basics of deterministic global optimization, second to present important theoretical and algorithmic advances for several classes of mathematical problems that include biconvex and bilinear problems, signomial problems, general twice differentiable nonlinear problems, mixed integer nonlinear problems and the enclosure of all solutions of nonlinear constrained systems of equations and third to tie the theory and methods together with a variety of important applications.

Bayesian Heuristic Approach to Discrete and Global Optimization Jonas Mockus, William Eddy, Gintaras Reklaitis, 2013-03-09. Bayesian decision theory is known to provide an effective framework for the practical solution of discrete and nonconvex optimization problems. This book is the first to demonstrate that this framework is also well suited for the exploitation of heuristic methods in the solution of such problems, especially those of large scale for which exact optimization approaches can be prohibitively costly. The book covers all aspects ranging from the formal presentation of the Bayesian Approach to its extension to the Bayesian Heuristic Strategy and its utilization within the informal interactive Dynamic Visualization strategy. The developed framework is applied in forecasting, in neural network optimization and in a large number of discrete and continuous optimization problems. Specific application areas which are discussed include scheduling and visualization problems in chemical engineering, manufacturing process control and epidemiology. Computational results and comparisons with a broad range of test examples are presented. The software required for implementation of the Bayesian Heuristic Approach is included. Although some knowledge of mathematical statistics is necessary in order to fathom the theoretical aspects of the development, no specialized mathematical knowledge is required to understand the application of the approach or to utilize the software which is provided.

Audience The book is of interest to both researchers in operations research, systems engineering and optimization methods as well as applications specialists concerned with the solution of large scale discrete and or nonconvex optimization problems in a broad range of engineering

and technological fields It may be used as supplementary material for graduate level courses Convex Analysis and Global Optimization Hoang Tuy,2016-10-17 This book presents state of the art results and methodologies in modern global optimization and has been a staple reference for researchers engineers advanced students also in applied mathematics and practitioners in various fields of engineering The second edition has been brought up to date and continues to develop a coherent and rigorous theory of deterministic global optimization highlighting the essential role of convex analysis The text has been revised and expanded to meet the needs of research education and applications for many years to come Updates for this new edition include Discussion of modern approaches to minimax fixed point and equilibrium theorems and to nonconvex optimization Increased focus on dealing more efficiently with ill posed problems of global optimization particularly those with hard constraints Important discussions of decomposition methods for specially structured problems A complete revision of the chapter on nonconvex quadratic programming in order to encompass the advances made in quadratic optimization since publication of the first edition Additionally this new edition contains entirely new chapters devoted to monotonic optimization polynomial optimization and optimization under equilibrium constraints including bilevel programming multiobjective programming and optimization with variational inequality constraint From the reviews of the first edition The book gives a good review of the topic The text is carefully constructed and well written the exposition is clear It leaves a remarkable impression of the concepts tools and techniques in global optimization It might also be used as a basis and guideline for lectures on this subject Students as well as professionals will profitably read and use it Mathematical Methods of Operations Research 49 3 1999 From Local to Global Optimization A. Migdalas,Panos M. Pardalos,Peter Värbrand,2013-03-09 The book consists of research papers based on results presented at a conference held in Sweden to celebrate Hoang Tuy s achievements in Optimization The collection is dedicated to Professor Tuy on the occasion of his 70th birthday The papers appear in alphabetical order by first author and cover a wide range of recent results in Mathematical Programming The work of Hoang Tuy in particular in Global Optimization has provided directions for new algorithmic developments in the field Audience Faculty graduate students and researchers in mathematical programming computer science and engineering

Handbook of Parallel Computing and Statistics Erricos John Kontoghiorghes,2005-12-21 Technological improvements continue to push back the frontier of processor speed in modern computers Unfortunately the computational intensity demanded by modern research problems grows even faster Parallel computing has emerged as the most successful bridge to this computational gap and many popular solutions have emerged based on its concepts **Progress in Optimization** Andrew Eberhard,Robin Hill,Daniel Ralph,Barney M. Glover,2013-12-01 Although the monograph Progress in Optimization I Contributions from Aus tralasia grew from the idea of publishing a proceedings of the Fourth Optimiza tion Day held in July 1997 at the Royal Melbourne Institute of Technology the focus soon changed to a refereed volume in optimization The intention is to publish a similar book annually following each Optimization Day The idea of having an annual

Optimization Day was conceived by Barney Glover the first of these Optimization Days was held in 1994 at the University of Ballarat Barney hoped that such a yearly event would bring together the many but widely dispersed researchers in Australia who were publishing in optimization and related areas such as control The first Optimization Day event was followed by similar conferences at The University of New South Wales 1995 The University of Melbourne 1996 the Royal Melbourne Institute of Technology 1997 and The University of Western Australia 1998 The 1999 conference will return to Ballarat University being organized by Barney's long time collaborator Alex Rubinov In recent years the Optimization Day has been held in conjunction with other locally held national or international conferences This has widened the scope of the monograph with contributions not only coming from researchers in Australia and neighboring regions but also from their collaborators in Europe and North America

Network Scheduling Techniques for Construction Project Management M. Hajdu, 2013-03-09 Industrial financial commercial or any kinds of project have at least one common feature the better organized they are the higher the profit or the lower the cost Project management is the principle of planning different projects and keeping them on track within time cost and resource constraints The need for effective project management is ever increasing The complexity of the environment we live in requires more sophisticated methods than it did just a couple of decades ago Project managers might face insurmountable obstacles in their work if they do not adapt themselves to the changing circumstances On the other hand better knowledge of project management can result in better plans schedules and last but not least more contracts and more profit This knowledge can help individuals and firms to stay alive in this competitive market and in the global sense utilize the finite resources of our planet in a more efficient way

Encyclopedia of Optimization Christodoulos A. Floudas, Panos M. Pardalos, 2008-09-04 The goal of the Encyclopedia of Optimization is to introduce the reader to a complete set of topics that show the spectrum of research the richness of ideas and the breadth of applications that has come from this field The second edition builds on the success of the former edition with more than 150 completely new entries designed to ensure that the reference addresses recent areas where optimization theories and techniques have advanced Particularly heavy attention resulted in health science and transportation with entries such as Algorithms for Genomics Optimization and Radiotherapy Treatment Design and Crew Scheduling

Abstract Convexity and Global Optimization Alexander M. Rubinov, 2013-03-14 Special tools are required for examining and solving optimization problems The main tools in the study of local optimization are classical calculus and its modern generalizations which form nonsmooth analysis The gradient and various kinds of generalized derivatives allow us to accomplish a local approximation of a given function in a neighbourhood of a given point This kind of approximation is very useful in the study of local extrema However local approximation alone cannot help to solve many problems of global optimization so there is a clear need to develop special global tools for solving these problems The simplest and most well known area of global and simultaneously local optimization is convex programming The fundamental tool in the study of convex optimization problems is the

subgradient which actually plays both a local and global role First a subgradient of a convex function f at a point x carries out a local approximation of f in a neighbourhood of x Second the subgradient permits the construction of an affine function which does not exceed f over the entire space and coincides with f at x This affine function h is called a support function Since $f(y) \geq h(y)$ for all y the second role is global In contrast to a local approximation the function h will be called a global affine support

Nonsmooth Equations in Optimization Diethard Klatte, B. Kummer, 2005-12-17 Many questions dealing with solvability stability and solution methods for variational inequalities or equilibrium optimization and complementarity problems lead to the analysis of certain perturbed equations This often requires a formulation of the initial model being under consideration Due to the specificity of the original problem the resulting equation is usually either not differentiable even if the data of the original model are smooth or it does not satisfy the assumptions of the classical implicit function theorem This phenomenon is the main reason why a considerable analytical instrument dealing with generalized equations i.e. with finding zeros of multivalued mappings and nonsmooth equations i.e. the defining functions are not continuously differentiable has been developed during the last 20 years and that under very different viewpoints and assumptions In this theory the classical hypotheses of convex analysis in particular monotonicity and convexity have been weakened or dropped and the scope of possible applications seems to be quite large Briefly this discipline is often called nonsmooth analysis sometimes also variational analysis Our book fits into this discipline however our main intention is to develop the analytical theory in close connection with the needs of applications in optimization and related subjects Main Topics of the Book 1 Extended analysis of Lipschitz functions and their generalized derivatives including Newton maps and regularity of multivalued mappings 2 Principle of successive approximation under metric regularity and its application to implicit functions

Advancement in Business Analytics Tools for Higher Financial Performance Gharioie Ahangar, Reza, Napier, Mark, 2023-08-08 The relentless growth of data in financial markets has boosted the demand for more advanced analytical tools to facilitate and improve financial planning The ability to constructively use this data is limited for managers and investors without the proper theoretical support Within this context there is an unmet demand for combining analytical finance methods with business analytics topics to inform better investment decisions Advancement in Business Analytics Tools for Higher Financial Performance explores the financial applications of business analytics tools that can help financial managers and investors to better understand financial theory and improve institutional investment practices This book explores the value extraction process using more accurate financial data via business analytical tools to help investors and portfolio managers develop more modern financial planning processes Covering topics such as financial markets investment analysis and statistical tools this book is ideal for accountants data analysts researchers students business professionals academicians and more

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