

Johannes Jahn

Vector Optimization

Theory,
Applications,
and Extensions

Second Edition



Springer

Vector Optimization Theory Applications And Extensions

Johannes Jahn



Vector Optimization Theory Applications And Extensions:

Vector Optimization Johannes Jahn, 2013-06-05 In vector optimization one investigates optimal elements such as minimal strongly minimal properly minimal or weakly minimal elements of a nonempty subset of a partially ordered linear space. The problem of determining at least one of these optimal elements if they exist at all is also called a vector optimization problem. Problems of this type can be found not only in mathematics but also in engineering and economics. Vector optimization problems arise for example in functional analysis, the Hahn-Banach theorem, the lemma of Bishop-Phelps, Ekeland's variational principle, multiobjective programming, multi-criteria decision making, statistics, Bayes solutions, theory of tests, minimal covariance matrices, approximation theory, location theory, simultaneous approximation, solution of boundary value problems, and cooperative game theory, cooperative n -player differential games, and as a special case, optimal control problems. In the last decade, vector optimization has been extended to problems with set-valued maps. This new field of research, called set optimization, seems to have important applications to variational inequalities and optimization problems with multivalued data. The roots of vector optimization go back to F. Y. Edgeworth (1881) and V. Pareto (1896), who has already given the definition of the standard optimality concept in multiobjective optimization. But in mathematics, this branch of optimization has started with the legendary paper of H. W. Kuhn and A. W. Tucker (1951). Since about the end of the 60's, research is intensively made in vector optimization.

Convex Optimization—Theory, Algorithms and Applications
Balendu Bhooshan Upadhyay, Shashi Kant Mishra, Pierre Maréchal, 2025-04-25 This volume includes chapters on topics presented at the conference on Recent Trends in Convex Optimization Theory Algorithms and Applications RTCOTAA 2020 held at the Department of Mathematics, Indian Institute of Technology Patna, Bihar, India, from 29-31 October 2020. It discusses a comprehensive exploration of the realm of optimization encompassing both the theoretical underpinnings and the multifaceted real-life implementations of the optimization theory. It meticulously features essential optimization concepts such as convex analysis, generalized convexity, monotonicity, etc., elucidating their theoretical advancements and significance in the optimization sphere. Multiobjective optimization is a pivotal topic which addresses the inherent difficulties faced in conflicting objectives. The book delves into various theoretical concepts and covers some practical algorithmic approaches to solve multiobjective optimization, such as the line search and the enhanced non-monotone quasi-Newton algorithms. It also deliberates on several other significant topics in optimization, such as the perturbation approach for vector optimization and solution methods for set-valued optimization. Nonsmooth optimization is extensively covered with in-depth discussions on various well-known tools of nonsmooth analysis, such as convexifiers, limiting subdifferentials, tangential subdifferentials, quasi-differentials, etc. Notable optimization algorithms, such as the interior point algorithm and Lemke's algorithm, are dissected in detail, offering insights into their applicability and effectiveness. The book explores modern applications of optimization theory, for instance, optimized image encryption, resource allocation, target tracking problems, deep learning,

entropy optimization etc Ranging from gradient based optimization algorithms to metaheuristic approaches such as particle swarm optimization the book navigates through the intersection of optimization theory and deep learning thereby unravelling new research perspectives in artificial intelligence machine learning and other fields of modern science Designed primarily for graduate students and researchers across a variety of disciplines such as mathematics operations research electrical and electronics engineering computer science robotics deep learning image processing and artificial intelligence this book serves as a comprehensive resource for someone interested in exploring the multifaceted domain of mathematical optimization and its myriad applications

Vector Optimization Guang-ya Chen,Xuexiang Huang,Xiaogi Yang,2005-07-13 This book is devoted to vector or multiple criteria approaches in optimization Topics covered include vector optimization vector variational inequalities vector variational principles vector minmax inequalities and vector equilibrium problems In particular problems with variable ordering relations and set valued mappings are treated The nonlinear scalarization method is extensively used throughout the book to deal with various vector related problems The results presented are original and should be interesting to researchers and graduates in applied mathematics and operations research Readers will benefit from new methods and ideas for handling multiple criteria decision problems

Recent Developments in Vector Optimization Qamrul Hasan Ansari,Jen-Chih Yao,2011-09-21 We always come cross several decision making problems in our daily life Such problems are always conflicting in which many different view points should be satisfied In politics business industrial systems management science networks etc one often encounters such kind of problems The most important and difficult part in such problems is the conflict between various objectives and goals In these problems one has to find the minimum or maximum for several objective functions Such problems are called vector optimization problems VOP multi criteria optimization problems or multi objective optimization problems This volume deals with several different topics aspects of vector optimization theory ranging from the very beginning to the most recent one It contains fourteen chapters written by different experts in the field of vector optimization

Set Optimization and Applications - The State of the Art Andreas H Hamel, Frank Heyde, Andreas Löhne, Birgit Rudloff, Carola Schrage, 2015-11-21 This volume presents five surveys with extensive bibliographies and six original contributions on set optimization and its applications in mathematical finance and game theory The topics range from more conventional approaches that look for minimal maximal elements with respect to vector orders or set relations to the new complete lattice approach that comprises a coherent solution concept for set optimization problems along with existence results duality theorems optimality conditions variational inequalities and theoretical foundations for algorithms Modern approaches to scalarization methods can be found as well as a fundamental contribution to conditional analysis The theory is tailor made for financial applications in particular risk evaluation and super hedging for market models with transaction costs but it also provides a refreshing new perspective on vector optimization There is no comparable volume on the market making the book an invaluable resource for researchers working in vector optimization and multi criteria decision

making mathematical finance and economics as well as set valued variational analysis

Combinatorial Optimization and Applications Weili Wu, Jianxiong Guo, 2023-12-08 The two volume set LNCS 14461 and LNCS 14462 constitutes the refereed proceedings of the 17th International Conference on Combinatorial Optimization and Applications COCOA 2023 held in Hawaii HI USA during December 15 17 2023 The 73 full papers included in the proceedings were carefully reviewed and selected from 117 submissions They were organized in topical sections as follows Part I Optimization in graphs scheduling set related optimization applied optimization and algorithm Graph planer and others Part II Modeling and algorithms complexity and approximation combinatorics and computing optimization and algorithms extreme graph and others machine learning blockchain and others

Mathematical Optimization Theory and Operations Research Igor Bykadorov, Vitaly Strusevich, Tatiana Tchemisova, 2019-10-26 This book constitutes revised and selected papers from the 18th International Conference on Mathematical Optimization Theory and Operations Research MOTOR 2019 held in Ekaterinburg Russia in July 2019 The 40 full papers and 4 short papers presented in this volume were carefully reviewed and selected from a total of 170 submissions The papers in the volume are organised according to the following topical headings combinatorial optimization game theory and mathematical economics data mining and computational geometry integer programming mathematical programming operations research optimal control and applications

Introduction to the Theory of Nonlinear Optimization Johannes Jahn, 2020-07-02 This book serves as an introductory text to optimization theory in normed spaces and covers all areas of nonlinear optimization It presents fundamentals with particular emphasis on the application to problems in the calculus of variations approximation and optimal control theory The reader is expected to have a basic knowledge of linear functional analysis

Vector Optimization with Infimum and Supremum Andreas Löhne, 2011-05-25 The theory of Vector Optimization is developed by a systematic usage of infimum and supremum In order to get existence and appropriate properties of the infimum the image space of the vector optimization problem is embedded into a larger space which is a subset of the power set in fact the space of self infimal sets Based on this idea we establish solution concepts existence and duality results and algorithms for the linear case The main advantage of this approach is the high degree of analogy to corresponding results of Scalar Optimization The concepts and results are used to explain and to improve practically relevant algorithms for linear vector optimization problems

Applications of Nonlinear Analysis Themistocles M. Rassias, 2018-06-29 New applications research and fundamental theories in nonlinear analysis are presented in this book Each chapter provides a unique insight into a large domain of research focusing on functional equations stability theory approximation theory inequalities nonlinear functional analysis and calculus of variations with applications to optimization theory Topics include Fixed point theory Fixed circle theory Coupled fixed points Nonlinear duality in Banach spaces Jensen s integral inequality and applications Nonlinear differential equations Nonlinear integro differential equations Quasiconvexity Stability of a Cauchy Jensen additive mapping Generalizations of metric spaces Hilbert type integral

inequality Solitons Quadratic functional equations in fuzzy Banach spaces Asymptotic orbits in Hill problem Time domain electromagnetics Inertial Mann algorithms Mathematical modelling Robotics Graduate students and researchers will find this book helpful in comprehending current applications and developments in mathematical analysis Research scientists and engineers studying essential modern methods and techniques to solve a variety of problems will find this book a valuable source filled with examples that illustrate concepts

Fixed Point Theory, Variational Analysis, and Optimization

Saleh Abdullah R. Al-Mezel, Falleh Rajallah M. Al-Solamy, Qamrul Hasan Ansari, 2014-06-03 Fixed Point Theory Variational Analysis and Optimization not only covers three vital branches of nonlinear analysis fixed point theory variational inequalities and vector optimization but also explains the connections between them enabling the study of a general form of variational inequality problems related to the optimality conditions involving differentiable or directionally differentiable functions This essential reference supplies both an introduction to the field and a guideline to the literature progressing from basic concepts to the latest developments Packed with detailed proofs and bibliographies for further reading the text Examines Mann type iterations for nonlinear mappings on some classes of a metric space Outlines recent research in fixed point theory in modular function spaces Discusses key results on the existence of continuous approximations and selections for set valued maps with an emphasis on the nonconvex case Contains definitions properties and characterizations of convex quasiconvex and pseudoconvex functions and of their strict counterparts Discusses variational inequalities and variational like inequalities and their applications Gives an introduction to multi objective optimization and optimality conditions Explores multi objective combinatorial optimization MOCO problems or integer programs with multiple objectives Fixed Point Theory Variational Analysis and Optimization is a beneficial resource for the research and study of nonlinear analysis optimization theory variational inequalities and mathematical economics It provides fundamental knowledge of directional derivatives and monotonicity required in understanding and solving variational inequality problems

Multiobjective Linear

Programming Dinh The Luc, 2015-07-31 This book introduces the reader to the field of multiobjective optimization through problems with simple structures namely those in which the objective function and constraints are linear Fundamental notions as well as state of the art advances are presented in a comprehensive way and illustrated with the help of numerous examples Three of the most popular methods for solving multiobjective linear problems are explained and exercises are provided at the end of each chapter helping students to grasp and apply key concepts and methods to more complex problems The book was motivated by the fact that the majority of the practical problems we encounter in management science engineering or operations research involve conflicting criteria and therefore it is more convenient to formulate them as multicriteria optimization models the solution concepts and methods of which cannot be treated using traditional mathematical programming approaches

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

Moment and Polynomial Optimization Jiawang Nie,2023-06-15 Moment and polynomial optimization is an active research field used to solve difficult questions in many areas including global optimization tensor computation saddle points Nash equilibrium and bilevel programs and it has many applications The author synthesizes current research and applications providing a systematic introduction to theory and methods a comprehensive approach for extracting optimizers and solving truncated moment problems and a creative methodology for using optimality conditions to construct tight Moment SOS relaxations This book is intended for applied mathematicians engineers and researchers entering the field It can be used as a textbook for graduate students in courses on convex optimization polynomial optimization and matrix and tensor optimization

Multicriteria Optimization Matthias Ehrgott,2006-01-16 Collection of results of multicriteria optimization including nonlinear linear and combinatorial optimization problems Includes numerous illustrations examples and problems

Nonsmooth Analysis Winfried Sprotzek,2007-05-26 This book treats various concepts of generalized derivatives and subdifferentials in normed spaces their geometric counterparts and their application to optimization problems It starts with the subdifferential of convex analysis passes to corresponding concepts for locally Lipschitz continuous functions and then presents subdifferentials for general lower semicontinuous functions All basic tools are presented where they are needed this concerns separation theorems variational and extremal principles as well as relevant parts of multifunction theory Each chapter ends with bibliographic notes and exercises

Reduction of the Pareto Set Vladimir D. Noghin,2017-09-26 This book focuses on the issues of decision making with several numerical criteria It introduces an original general approach to solving multicriteria problems given quantitative information about the preference relation of a decision maker It considers the problems with crisp as well as fuzzy preference relations accepting the four axioms of reasonable choice Further it defines the notion of an information quantum about the preference relation of a decision maker and studies the reduction of the Pareto set using a finite collection of information quanta demonstrating that the original approach yields a good approximation for the set of nondominated alternatives in a multicriteria problem Lastly it analyzes a possible combination of the axiomatic approach with other well known methods Intended for a wide range of professionals involved in solving multicriteria problems including researchers design engineers product engineers developers and analysts the book is also a valuable resource for undergraduate and postgraduate students of mathematics economics and engineering

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

Variational Analysis and Generalized Differentiation I Boris S. Mordukhovich,2006-08-08 Variational analysis is a fruitful area in mathematics that on one hand deals with the study of optimization and equilibrium problems and on the other hand applies optimization perturbation and approximation ideas to the analysis of a broad range of problems that may not be of a variational nature This monograph in 2 volumes contains a comprehensive and state of the art study of the basic concepts and principles of variational analysis and generalized differentiation in both finite dimensional and infinite dimensional spaces and presents numerous applications to problems in optimization equilibria stability and sensitivity control theory economics mechanics etc The first volume is devoted to the basic theory of variational analysis and generalized differentiations while the second volume describes various applications Both volumes include abundant bibliographies and extensive commentaries

Variational Analysis and Generalized Differentiation II Boris S. Mordukhovich,2006-03-02 Comprehensive and state of the art study of the basic concepts and principles of variational analysis and generalized differentiation in both finite dimensional and infinite dimensional spaces Presents numerous applications to problems in the optimization equilibria stability and sensitivity control theory economics mechanics etc

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