Convex Analysis By R Tyrrell Rockafellar

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Convexity and Duality in Optimization

KENDAL SILAS

Investment Risk Management Princeton University Press
This book presents functional analytic methods in a unified manner with applications to economics, social sciences, and engineering. Ideal for those without an extensive background in the area, it develops topology, convexity, Banach lattices, integration, correspondences, and the analytic approach to Markov processes. Many of the results were previously available only in esoteric monographs and will interest researchers and students who will find the material readily applicable to problems in control theory and economics.
Convex Functions, Partial Orderings, and Statistical Applications Cambridge University Press
Nonsmooth Optimization contains the proceedings of a workshop on non-smooth optimization (NSO) held from March 28 to April 8,1977 in Austria under the auspices of the International Institute for Applied Systems Analysis. The papers explore the techniques and theory of NSO and cover topics ranging from systems of inequalities to smooth approximation of non-smooth functions, as well as quadratic programming and line searches. Comprised of nine chapters, this volume begins with a survey of Soviet research on subgradient optimization carried out since 1962, followed by a discussion on rates of convergence in subgradient optimization. The reader is then introduced to the method of subgradient optimization in an abstract setting and the minimal hypotheses required to ensure convergence; NSO and nonlinear programming; and bundle methods in NSO. A feasible descent algorithm for linearly constrained least squares problems is described. The book also considers sufficient minimization of piecewise-linear univariate functions before concluding with a description of the method of parametric decomposition in mathematical programming. This monograph will be of interest to mathematicians and mathematics students.
Nonsmooth Optimization Elsevier
From its origins in the minimization of integral functionals, the notion of variations has evolved greatly in connection with applications in optimization, equilibrium, and control. This book develops a unified framework and provides a detailed exposition of variational geometry and subdifferential calculus in their current forms beyond classical and convex analysis. Also covered are set-convergence, set-valued mappings, epi-convergence, duality, and normal integrands.
Convex Analysis SIAM
The theory of duality in problems of optimization is developed in a setting of finite and infinite dimensional spaces using convex analysis. Applications to convex and nonconvex problems. Expository account containing many new results. (Author).
Statistical Inference Via Convex Optimization SIAM
This authoritative book draws on the latest research to explore the interplay of high-dimensional statistics with optimization. Through an accessible analysis of fundamental problems of hypothesis testing and signal recovery, Anatoli Juditsky and Arkadi Nemirovski show how convex optimization theory can be used to devise and analyze near-optimal statistical inferences. Statistical

Inference via Convex Optimization is an essential resource for optimization specialists who are new to statistics and its applications, and for data scientists who want to improve their optimization methods. Juditsky and Nemirovski provide the first systematic treatment of the statistical techniques that have arisen from advances in the theory of optimization. They focus on four well-known statistical problems—sparse recovery, hypothesis testing, and recovery from indirect observations of both signals and functions of signals—demonstrating how they can be solved more efficiently as convex optimization problems. The emphasis throughout is on achieving the best possible statistical performance. The construction of inference routines and the quantification of their statistical performance are given by efficient computation rather than by analytical derivation typical of more conventional statistical approaches. In addition to being computation-friendly, the methods described in this book enable practitioners to handle numerous situations too difficult for closed analytical form analysis, such as composite hypothesis testing and signal recovery in inverse problems. Statistical Inference via Convex Optimization features exercises with solutions along with extensive appendixes, making it ideal for use as a graduate text.

Positive Definite Matrices Springer Science & Business Media

All investments carry with them some degree of risk. In the financial world, individuals, professional money managers, financial institutions and many others encounter and must deal with risk. The main purpose of 'Investment Risk Management' is to provide an overview of developments in risk management and a synthesis of research involving the latest developments in the field--

The Theory of Subgradients and Its Applications to Problems of Optimization Cambridge University Press

The analysis and optimization of convex functions have re ceived a great deal of attention during the last two decades. If we had to choose two key-words from these developments, we would retain the concept of ubdi66 e and the duality theo y. As it usual in the development of mathematical theories, people had since tried to extend the known defi nitions and properties to new classes of functions, including the convex ones. For what concerns the generalization of the notion of subdifferential, tremendous achievements have been carried out in the past decade and any rna.. thematician who is faced with a nondifferentiable nonconvex function has now a panoply of generalized subdifferentials or derivatives at his disposal. A lot remains to be done in this area, especially concerning vecto - valued functions; however we think the golden age for these researches is behind us. Duality theory has also fascinated many mathematicians since the underlying mathematical framework has been laid down in the context of Convex Analysis. The various duality schemes which have emerged in the re cent years, despite of their mathematical elegance, have not always proved as powerful as expected."

Delay-Adaptive Linear Control Princeton University Press

Convex AnalysisPrinceton University Press

Opt Art Princeton University Press

"Hybrid systems are those that-unlike classical systems-exhibit both discrete

changes, or "jumps", and continuous changes, or "flow." The canonical example of a hybrid system is a bouncing ball: the ball's speed changes continuously between bounces, but there is a discrete jump in velocity each time the ball impacts the ground. Hybrid systems feature widely across disciplines, including in biology, computer science, and mechanical engineering; examples range from fireflies to self-driving cars. Although classical control theory provides powerful tools for analyzing systems that exhibit either flow or jumps, it is ill-equipped to handle hybrid systems, which feature both behaviors. In Hybrid Feedback Control, Ricardo Sanfelice presents a self-contained introduction to the control of hybrid systems, and develops new tools for their design and analysis. This monograph uses hybrid systems notation to present a new, unified control theory framework, thus filling an important gap in the control theory literature. In addition to presenting this theoretical framework, the book also includes a variety of examples and exercises, a Matlab toolbox, and a summary at the beginning of each chapter. The book was originally used in a series of lectures on the topic, and will find a modest amount of crossover course use. The book will also find use outside the field of control, particularly in dynamical systems theory, applied mathematics, and computer science"--

Convex Analysis and Nonlinear Optimization Athena Scientific

Optimization is a rich and thriving mathematical discipline, and the underlying theory of current computational optimization techniques grows ever more sophisticated. This book aims to provide a concise, accessible account of convex analysis and its applications and extensions, for a broad audience. Each section concludes with an often extensive set of optional exercises. This new edition adds material on semismooth optimization, as well as several new proofs.

Hybrid Feedback Control Springer Science & Business Media

This book represents the first synthesis of the considerable body of new research into positive definite matrices. These matrices play the same role in noncommutative analysis as positive real numbers do in classical analysis. They have theoretical and computational uses across a broad spectrum of disciplines, including calculus, electrical engineering, statistics, physics, numerical analysis, quantum information theory, and geometry. Through detailed explanations and an authoritative and inspiring writing style, Rajendra Bhatia carefully develops general techniques that have wide applications in the study of such matrices. Bhatia introduces several key topics in functional analysis, operator theory, harmonic analysis, and differential geometry--all built around the central theme of positive definite matrices. He discusses positive and completely positive linear maps, and presents major theorems with simple and direct proofs. He examines matrix means and their applications, and shows how to use positive definite functions to derive operator inequalities that he and others proved in recent years. He guides the reader through the differential geometry of the manifold of positive definite matrices, and explains recent work on the geometric mean of several matrices. Positive Definite Matrices is an informative and useful reference book for mathematicians and other researchers and practitioners. The

numerous exercises and notes at the end of each chapter also make it the ideal textbook for graduate-level courses.

Convex Analysis University-Press.org

Stochastic programming is the study of procedures for decision making under the presence of uncertainties and risks. Stochastic programming approaches have been successfully used in a number of areas such as energy and production planning, telecommunications, and transportation. Recently, the practical experience gained in stochastic programming has been expanded to a much larger spectrum of applications including financial modeling, risk management, and probabilistic risk analysis. Major topics in this volume include: (1) advances in theory and implementation of stochastic programming algorithms; (2) sensitivity analysis of stochastic systems; (3) stochastic programming applications and other related topics. Audience: Researchers and academies working in optimization, computer modeling, operations research and financial engineering. The book is appropriate as supplementary reading in courses on optimization and financial engineering.

Lectures on the Calculus of Variations and Optimal Control Theory Springer Science & Business Media

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 32. Chapters: Bipolar theorem, Characteristic function (convex analysis), Closed convex function, Complex convexity, Concave function, Convex cone, Convex conjugate, Convex hull, Convex optimization, Convex set, Danskin's theorem, Dieudonne's theorem, Dual cone and polar cone, Effective domain, Ekeland's variational principle, Epigraph (mathematics), Farkas' lemma, Fenchel's duality theorem, Fenchel-Moreau theorem, Gauss-Lucas theorem, Hilbert projection theorem, Hypograph (mathematics), Invex function, Kachurovskii's theorem, Karamata's inequality, Legendre transformation, Linear separability, Logarithmically concave function, Minkowski's theorem, Minkowski functional, Modulus and characteristic of convexity, Moreau's theorem, Polyconvex function, Popoviciu's inequality, Proper convex function, Pseudoconvex function, Pseudolinear function, Quasiconvex function, R. Tyrrell Rockafellar, Recession cone, Schur-convex function, Shephard's problem, Strictly convex space, Subderivative, Tonelli's theorem (functional analysis), Uniformly convex space.

Algorithms for Convex Optimization Academic Press

An insightful, concise, and rigorous treatment of the basic theory of convex sets and functions in finite dimensions, and the analytical/geometrical foundations of convex optimization and duality theory. Convexity theory is first developed in a simple accessible manner, using easily visualized proofs. Then the focus shifts to a transparent geometrical line of analysis to develop the fundamental duality between descriptions of convex functions in terms of points, and in terms of hyperplanes. Finally, convexity theory and abstract duality are applied to problems of constrained optimization, Fenchel and conic duality, and game theory to develop the sharpest possible duality results within a highly visual geometric framework. This on-line version of the book, includes an extensive set of theoretical problems with detailed high-quality solutions, which significantly

extend the range and value of the book. The book may be used as a text for a theoretical convex optimization course; the author has taught several variants of such a course at MIT and elsewhere over the last ten years. It may also be used as a supplementary source for nonlinear programming classes, and as a theoretical foundation for classes focused on convex optimization models (rather than theory). It is an excellent supplement to several of our books: Convex Optimization Algorithms (Athena Scientific, 2015), Nonlinear Programming (Athena Scientific, 2017), Network Optimization(Athena Scientific, 1998), Introduction to Linear Optimization (Athena Scientific, 1997), and Network Flows and Monotropic Optimization (Athena Scientific, 1998).

Linear Programming Cambridge University Press

The Hamiltonian Approach to Dynamic Economics focuses on the application of the Hamiltonian approach to dynamic economics and attempts to provide some unification of the theory of heterogeneous capital. Emphasis is placed on the stability of long-run steady-state equilibrium in models of heterogeneous capital accumulation. Generalizations of the Samuelson-Scheinkman approach are also given. Moreover, conditions are sought on the geometry of the Hamiltonian function (that is, on static technology) that suffice to preserve under (not necessarily small) perturbation the basic properties of the Hamiltonian dynamical system. Comprised of eight essays, this book begins with an introduction to Hamiltonian dynamics in economics, followed by a discussion on optimal steady states of n-sector growth models when utility is discounted. Optimal growth and decentralized or descriptive growth models in both continuous and discrete time are treated as applications of Hamiltonian dynamics. Theproblem of optimal growth with zero discounting is considered, with emphasis on a steepness condition on the Hamiltonian function. The general problem of decentralized growth with instantaneously adjusted expectations about price changes is also analyzed, along with the global asymptotic stability of optimal control systems with applications to the theory of economic growth. This monograph will be of value to mathematicians and economists.

Variational Analysis Financial Markets and Investme

This book is divided into two parts. The first addresses the simpler variational problems in parametric and nonparametric form. The second covers extensions to optimal control theory. The author opens with the study of three classical problems whose solutions led to the theory of calculus of variations. They are the problem of geodesics, the brachistochrone, and the minimal surface of revolution. He gives a detailed discussion of the Hamilton-Jacobi theory, both in the parametric and nonparametric forms. This leads to the development of sufficiency theories describing properties of minimizing extremal arcs. Next, the author addresses existence theorems. He first develops Hilbert's basic existence theorem for parametric problems and studies some of its consequences. Finally, he develops the theory of generalized curves and "automatic" existence theorems. In the second part of the book, the author discusses optimal control problems. He notes that originally these problems were formulated as problems of Lagrange and Mayer in terms of differential

constraints. In the control formulation, these constraints are expressed in a more convenient form in terms of control functions. After pointing out the new phenomenon that may arise, namely, the lack of controllability, the author develops the maximum principle and illustrates this principle by standard examples that show the switching phenomena that may occur. He extends the theory of geodesic coverings to optimal control problems. Finally, he extends the problem to generalized optimal control problems and obtains the corresponding existence theorems.
Convex Analysis Springer Science & Business Media
This Fourth Edition introduces the latest theory and applications in optimization. It emphasizes constrained optimization, beginning with a substantial treatment of linear programming and then proceeding to convex analysis, network flows, integer programming, quadratic programming, and convex optimization. Readers will discover a host of practical business applications as well as non-business applications. Topics are clearly developed with many numerical examples worked out in detail. Specific examples and concrete algorithms precede more abstract topics. With its focus on solving practical problems, the book features free C programs to implement the major algorithms covered, including the two-phase simplex method, primal-dual simplex method, path-following interior-point method, and homogeneous self-dual methods. In addition, the author provides online JAVA applets that illustrate various pivot rules and variants of the simplex method, both for linear programming and for network flows. These C programs and JAVA tools can be found on the book's website. The website also includes new online instructional tools and exercises.
Variational Analysis Meboo Publishing USA
Basic predictor feedback for single-input systems -- Basic idea of adaptive control for single-input systems -- Single-input systems with full relative degree -- Single-input systems with arbitrary relative degree -- Exact predictor feedback for multi-input systems -- Full-state feedback of uncertain multi-input systems -- Output feedback of uncertain multi-input systems -- Output feedback of systems with uncertain delays, parameters and ODE state -- Predictor feedback for uncertainty-free systems -- Predictor feedback of uncertain single-input systems -- Predictor feedback of uncertain multi-input systems.
Springer Science & Business Media
Each chapter in this book describes relevant background theory followed by specialized results. Hundreds of identities, inequalities, and matrix facts are stated clearly with cross references, citations to the literature, and illuminating remarks.
Stochastic Optimization Morgan & Claypool Publishers
From its origins in the minimization of integral functionals, the notion of variations has evolved greatly in connection with applications in optimization, equilibrium, and control. This book develops a unified framework and provides a detailed exposition of variational geometry and subdifferential calculus in their current forms beyond classical and convex analysis. Also covered are set-convergence, set-valued mappings, epi-convergence, duality, and normal integrands.