Selected Applications Of Convex Optimization Springer Optimization And Its Applications

Encyclopedia of Biomedical Engineering is a unique source for rapidly evolving updates on topics that are at the interface of the biological sciences and engineering. Biomaterials, biomedical devices and techniques play a significant role in improving the quality of health care in the developed world. The book covers an extensive range of topics related to biomedical engineering, including biomaterials, sensors, medical devices, imaging modalities and imaging processing. In addition, applications of biomedical engineering, advances in cardiology, drug delivery, gene therapy, orthopedics, ophthalmology, sensing and tissue engineering are explored. This important reference work serves many groups working at the interface of the biological sciences and engineering, including engineering students, biological science students, clinicians, and industrial researchers. Provides students with a concise description of the technologies at the interface of the biological sciences and engineering Covers all aspects of biomedical engineering, also incorporating perspectives from experts working within the domains of biomedicine, medical engineering, biology, chemistry, physics, electrical engineering, and more Contains reputable, multidisciplinary content from domain experts Presents a 'one-stop' resource for access to information written by world-leading scholars in the field

This book constitutes the refereed conference proceedings of the 18th International Conference on the Applications of Evolutionary Computation, EvoApplications 2015, held in Copenhagen, Spain, in April 2015, colocated with the Evo 2015 events EuroGP, EvoCOP, and EvoMUSART. The 72 revised full papers presented were carefully reviewed and selected from 125 submissions. EvoApplications 2015 consisted of the following 13 tracks: EvoBIO (evolutionary computation, machine learning and data mining in computational biology), EvoCOMNET (nature-inspired techniques for telecommunication networks and other parallel and distributed systems), EvoCOMPLEX (evolutionary algorithms and complex systems), EvoENERGY (evolutionary computation in energy applications), EvoFIN (evolutionary and natural computation in finance and economics), EvoGAMES (bio-inspired algorithms in games), EvoIASP (evolutionary computation in image analysis, signal processing, and pattern recognition), EvoINDUSTRY (nature-inspired techniques in industrial settings), EvoNUM (bio-inspired algorithms for continuous parameter optimization), EvoPAR (parallel implementation of evolutionary algorithms), EvoRISK (computational intelligence for risk management, security and defence applications), EvoROBOT (evolutionary computation in robotics), and EvoSTOC (evolutionary algorithms in stochastic and dynamic environments).

This book provides easy access to the basic principles and methods for solving constrained and unconstrained convex optimization problems. Included are sections that cover: basic methods for solving constrained and unconstrained optimization problems with differentiable objective functions; convex sets and their properties; convex functions and their properties and generalizations; and basic principles of sub-differential calculus and convex programming problems. Convex Optimization provides detailed proofs for most of the results presented in the book and also includes many figures and exercises for a better understanding of the material. Exercises are given at the end of each chapter, with solutions and hints to selected exercises given at the end of the book. Undergraduate and graduate students, researchers in different disciplines, as well as practitioners will all benefit from this accessible approach to convex optimization methods.

Semidefinite programming has been described as linear programming for the year 2000. It is an exciting new branch of mathematical programming, due to important applications in control theory, combinatorial optimization and other fields. Moreover, the successful interior point algorithms for linear programming can be extended to semidefinite programming. In this monograph the basic theory of interior point algorithms is explained. This includes the latest results on the properties of the central path as well as the analysis of the most important classes of algorithms. Several "classic" applications of semidefinite programming are also described in detail. These include the Lovász theta function and the MAX-CUT approximation algorithm by Goemans and Williamson. Audience: Researchers or graduate students in optimization or related fields, who wish to learn more about the theory and applications of semidefinite programming.

This textbook on nonlinear optimization focuses on model building, real world problems, and applications of optimization models to natural and social sciences. Organized into two parts, this book may be used as a primary text for courses on convex optimization and non-convex optimization. Definitions, proofs, and numerical methods are well illustrated and all chapters contain compelling exercises. The exercises emphasize fundamental theoretical results on optimality and duality theorems, numerical methods with or without constraints, and derivative-free optimization. Selected solutions are given. Applications to theoretical results and numerical methods are highlighted to help students comprehend methods and techniques.

Selected Applications of Convex OptimizationSpringer

?This textbook on Linear and Nonlinear Optimization is intended for graduate and advanced undergraduate students in operations research and related fields. It is both literate and mathematically strong, yet requires no prior course in optimization. As suggested by its title, the book is divided into two parts covering in their individual chapters LP Models and Applications; Linear Equations and Inequalities; The Simplex Algorithm; Simplex Algorithm Continued; Duality and the Dual Simplex Algorithm; Postoptimality Analyses; Computational Considerations; Nonlinear (NLP) Models and Applications; Unconstrained Optimization; Descent Methods; Optimality Conditions; Problems with Linear Constraints; Problems with Nonlinear Constraints; Interior-Point Methods; and an Appendix covering Mathematical Concepts. Each chapter ends with a set of exercises. The book is based on lecture notes the authors have used in numerous optimization courses the authors have taught at Stanford University. It emphasizes modeling and numerical algorithms for optimization with continuous (not integer) variables. The discussion presents the underlying theory without always focusing on formal mathematical proofs (which can be found in cited references). Another feature of this book is its inclusion of cultural and historical matters, most often appearing among the footnotes. "This book is a real gem. The authors do a masterful job of rigorously presenting all of the relevant theory clearly and concisely while managing to avoid unnecessary tedious mathematical details. This is an ideal book for teaching a one or two semester masters-level course in optimization – it broadly covers linear and nonlinear programming effectively balancing modeling, algorithmic theory, computation, implementation, illuminating historical facts, and numerous interesting examples and exercises. Due to the clarity of the exposition, this book also serves as a valuable reference for self-study." Professor Ilan Adler, IEOR Department, UC Berkeley "A carefully crafted introduction to the main elements and applications of mathematical optimization. This volume presents the essential concepts of linear and nonlinear programming in an accessible format filled with anecdotes,

examples, and exercises that bring the topic to life. The authors plumb their decades of experience in optimization to provide an enriching layer of historical context. Suitable for advanced undergraduates and masters students in management science, operations research, and related fields." Michael P. Friedlander, IBM Professor of Computer Science, Professor of Mathematics, University of British Columbia

A mathematically rigorous guide to convex optimization for power systems engineering.

Integrates theory, algorithms, modeling, and computer implementation while solved examples show realistic engineering optimization problems.

The 21 self-contained chapters in this book, include recent developments in several optimization-related topics such as decision theory, linear programming, turnpike theory, duality theory, convex analysis, and queueing theory. This work will be a valuable tool not only to specialists interested in the technical detail and various applications presented, but also to researchers interested in building upon the book's theoretical results.

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".

This book brings together research articles and state-of-the-art surveys in broad areas of optimization and numerical analysis with particular emphasis on algorithms. The discussion also focuses on advances in monotone operator theory and other topics from variational analysis and nonsmooth optimization, especially as they pertain to algorithms and concrete, implementable methods. The theory of monotone operators is a central framework for understanding and analyzing splitting algorithms. Topics discussed in the volume were presented at the interdisciplinary workshop titled Splitting Algorithms, Modern Operator Theory, and Applications held in Oaxaca, Mexico in September, 2017. Dedicated to Jonathan M. Borwein, one of the most versatile mathematicians in contemporary history, this compilation brings theory together with applications in novel and insightful ways.

This book constitutes revised selected papers from the 7th Conference on Theory of Quantum Computation, Communication, and Cryptography, TQC 2012, held in Tokyo, Japan, in May 2012. The 12 papers presented were carefully reviewed and selected for inclusion in this book. They contain original research on the rapidly growing, interdisciplinary field of quantum computation, communication and cryptography. Topics addressed are such as quantum algorithms, quantum computation models, quantum complexity theory, simulation of quantum systems, quantum programming languages, quantum cryptography, quantum communication, quantum estimation, quantum measurement, quantum tomography, completely positive maps, decoherence, quantum noise, quantum coding theory, fault-tolerant quantum computing, entanglement theory, and quantum teleportation.

The study of Euclidean distance matrices (EDMs) fundamentally asks what can be known geometrically given onlydistance information between points in Euclidean space. Each point may represent simply locationor, abstractly, any entity expressible as a vector in finite-dimensional Euclidean space.The answer to the question posed is that very much can be known about the points;the mathematics of this combined study of geometry and optimization is rich and deep.Throughout we cite beacons of historical accomplishment.The application of EDMs has already proven invaluable in discerning biological molecular conformation.The emerging practice of localization in wireless sensor networks, the global positioning system (GPS), and distance-based pattern recognitionwill certainly simplify and benefit from this theory.We study the pervasive convex Euclidean bodies and their various representations.In particular, we make convex polyhedra, cones, and dual cones more visceral through illustration, andwe study the geometric relation of polyhedral cones to nonorthogonal bases biorthogonal expansion.We explain conversion between halfspace- and vertex-descriptions of convex cones,we provide formulae for determining dual cones,and we show how classic alternative systems of linear inequalities or linear matrix inequalities and optimality conditions can be explained by generalized inequalities in terms of convex cones and their duals.The conic analogue to linear independence, called conic independence, is introducedas a new tool in the study of classical cone theory; the logical next step in the progression:linear, affine, conic.Any convex optimization problem has geometric interpretation.This is a powerful attraction: the ability to visualize geometry of an optimization problem.We provide tools to make visualization easier.The concept of faces, extreme points, and extreme directions of convex Euclidean bodiesis explained here, crucial to understanding convex optimization.The convex cone of positive semidefinite matrices, in particular, is studied in depth.We mathematically interpret, for example,its inverse image under affine transformation, and we explainhow higher-rank subsets of its boundary united with its interior are convex.The Chapter on "Geometry of convex functions",observes analogies between convex sets and functions:The set of all vector-valued convex functions is a closed convex cone.Included among the examples in this chapter, we show how the real affinefunction relates to convex functions as the hyperplane relates to convex sets.Here, also, pertinent results formultidimensional convex functions are presented that are largely ignored in the literature;tricks and tips for determining their convexityand discerning their geometry, particularly with regard to matrix calculus which remains largely unsystematizedwhen compared with the traditional practice of ordinary calculus.Consequently, we collect some results of matrix differentiation in the appendices.The Euclidean distance matrix (EDM) is studied,its properties and relationship to both positive semidefinite and Gram matrices.We relate the EDM to the four classical axioms of the Euclidean metric;thereby, observing the existence of an infinity of axioms of the Euclidean metric beyondthe triangle inequality. We proceed byderiving the fifth Euclidean axiom and then explain why furthering this endeavoris inefficient because the ensuing criteria (while describing polyhedra)grow linearly in complexity and number.Some geometrical problems solvable via EDMs,EDM problems posed as convex optimization, and methods of solution arepresented;\eg, we generate a recognizable isotonic map of the United States usingonly comparative distance information (no distance information, only distance inequalities).We offer a new proof of the classic Schoenberg criterion, that determines whether a candidate matrix is an EDM. Our proofrelies on fundamental geometry; assuming, any EDM must correspond to a list of points contained in some polyhedron(possibly at its vertices) and vice versa.It is not widely known that the Schoenberg criterion implies nonnegativity of the EDM entries; proved here.We characterize the eigenvalues of an EDM matrix and then devisea polyhedral cone required for determining membership of a candidate matrix(in Cayley-Menger form) to the convex cone of Euclidean distance matrices (EDM cone); \ie,a candidate is an EDM if and only if its eigenspectrum belongs to a spectral cone for EDM^N.We will see spectral cones are not unique.In the chapter "EDM cone", we explain the geometric relationship betweenthe EDM cone, two positive semidefinite cones, and the elliptope.We illustrate geometric requirements, in particular, for projection of a candidate matrixon a positive semidefinite cone that establish its membership to the EDM cone. The faces of the EDM cone are described,but still open is the question whether all its faces are exposed as they are for the positive semidefinite cone.The classic Schoenberg criterion, relating EDM and positive semidefinite cones, isrevealed to be a discretized membership relation (a generalized inequality, a new Farkas'''''''-like lemma)between the EDM cone and its ordinary dual. A matrix criterion for membership to the dual EDM cone is derived thatis simpler than the Schoenberg criterion.We derive a new concise expression for the EDM cone and its dual involvingtwo subspaces and a positive semidefinite cone."Semidefinite programming" is reviewedwith particular attention to optimality conditionsof prototypical primal and dual conic programs,their interplay, and the perturbation method of rank reduction of

optimal solutions(extant but not well-known).We show how to solve a ubiquitous platonic combinatorial optimization problem from linear algebra(the optimal Boolean solution x to Ax=b)via semidefinite program relaxation.A three-dimensional polyhedral analogue for the positive semidefinite cone of 3X3 symmetricmatrices is introduced; a tool for visualizing in 6 dimensions.In "EDM proximity"we explore methods of solution to a few fundamental and prevalentEuclidean distance matrix proximity problems; the problem of finding that Euclidean distance matrix closestto a given matrix in the Euclidean sense.We pay particular attention to the problem when compounded with rank minimization.We offer a new geometrical proof of a famous result discovered by Eckart \& Young in 1936 regarding Euclideanprojection of a point on a subset of the positive semidefinite cone comprising all positive semidefinite matriceshaving rank not exceeding a prescribed limit rho.We explain how this problem is transformed to a convex optimization for any rank rho.

This volume presents selected contributions by top researchers in the field of operations research, originating from the XVI Congress of APDIO. It provides interesting findings and applications of operations research methods and techniques in a wide variety of problems. The contributions address complex real-world problems, including inventory management with lateral transshipments, sectors and routes in solid-waste collection and production planning for perishable food products. It also discusses the latest techniques, making the volume a valuable tool for researchers, students and practitioners who wish to learn about current trends. Of particular interest are the applications of nonlinear and mixed-integer programming, data envelopment analysis, clustering techniques, hybrid heuristics, supply chain management and lot sizing, as well as job scheduling problems. This biennial conference, organized by APDIO, the Portuguese Association of Operational Research, held in Bragança, Portugal, in June 2013, presented a perfect opportunity to discuss the latest development in this field and to narrow the gap between academic researchers and practitioners.

This work is intended to serve as a guide for graduate students and researchers who wish to get acquainted with the main theoretical and practical tools for the numerical minimization of convex functions on Hilbert spaces. Therefore, it contains the main tools that are necessary to conduct independent research on the topic. It is also a concise, easy-to-follow and self-contained textbook, which may be useful for any researcher working on related fields, as well as teachers giving graduate-level courses on the topic. It will contain a thorough revision of the extant literature including both classical and state-of-the-art references.

Convex optimization is widely used, in many fields, but is nearly always constrained to problems solved in a few minutes or seconds, and even then, nearly always with a human in the loop. The advent of parser-solvers has made convex optimization simpler and more accessible, and greatly increased the number of people using convex optimization. Most current applications, however, are for the design of systems or analysis of data. It is possible to use convex optimization for real-time or embedded applications, where the optimization solver is a part of a larger system. Here, the optimization algorithm must find solutions much faster than a generic solver, and often has a hard, real-time deadline. Use in embedded applications additionally means that the solver cannot fail, and must be robust even in the presence of relatively poor quality data. For ease of embedding, the solver should be simple, and have minimal dependencies on external libraries. Convex optimization has been successfully applied in such settings in the past. However, they have usually necessitated a custom, hand-written solver. This requires signficant time and expertise, and has been a major factor preventing the adoption of convex optimization in embedded applications. This work describes the implementation and use of a prototype code generator for convex optimization, CVXGEN, that creates high-speed solvers automatically. Using the principles of disciplined convex programming, CVXGEN allows the user to describe an optimization problem in a convenient, high-level language, then receive code for compilation into an extremely fast, robust, embeddable solver.

The overall goal of this book is to introduce algorithms for improving the economic posture of a utility company in a restructured power system by promoting cost-effective maintenance schedules. Today, cutting operations and maintenance (O&M) costs and preserving service reliability) are among the top priorities for managers ofutility companies. Preventive maintenance is perhaps the single largest controllable cost ofa utility2 operation. It is perceived that a careful planning and a good coordination among self-interested entities in a restructured power system are essential to achieving an optimal trade-off between the cost ofmaintenance and the service reliability. Traditional maintenance programs in verticall/ integrated utilities relied heavily on time-directed maintenance and manufacturer recommendations. This book offers a logical alternative to traditional electric utility maintenance practices and a basis for maintenance decisions. The book is organized as follows. Chapter I reviews various issues related to the power system operation and presents the role of restructuring in maintenance scheduling. In Chapter II, fundamental topics related to linear and nonlinear systems are reviewed. The duality in linear programming is discussed and integer programming is reviewed. Benders decomposition, Lagrangian relaxation, and Dantzig-Wolfe decomposition are presented. Several examples are given to demonstrate the applications ofdifferent methods. The formulation ofreactive power optimization is discussed which will be used again in Chapter VII.

Convex Optimization for Signal Processing and Communications: From Fundamentals to Applications provides fundamental background knowledge of convex optimization, while striking a balance between mathematical theory and applications in signal processing and communications. In addition to comprehensive proofs and perspective interpretations for core convex optimization theory, this book also provides many insightful figures, remarks, illustrative examples, and guided journeys from theory to cutting-edge research explorations, for efficient and in-depth learning, especially for engineering students and professionals. With the powerful convex optimization theory and tools, this book provides you with a new degree of freedom and the capability of solving challenging real-world scientific and engineering problems.

This book constitutes the refereed proceedings of the 9th International Conference on Optimization and Applications, OPTIMA 2018, held in Petrovac, Montenegro, in October 2018.The 35 revised full papers and the one short paper presented were carefully reviewed and selected from 103 submissions. The papers are organized in topical sections on mathematical programming; combinatorial and discrete optimization; optimal control; optimization in economy, finance and social sciences; applications.

This book presents a structured approach to develop mathematical optimization formulations for several variants of facility layout. The range of layout problems covered includes row layouts, floor layouts, multi-floor layouts, and dynamic layouts. The optimization techniques used to formulate the problems are primarily mixed-integer linear programming,

second-order conic programming, and semidefinite programming. The book also covers important practical considerations for solving the formulations. The breadth of approaches presented help the reader to learn how to formulate a variety of problems using mathematical optimization techniques. The book also illustrates the use of layout formulations in selected engineering applications, including manufacturing, building design, automotive, and hospital layout.

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.

Cancer continues to be a growing problem as it is the foremost cause of death worldwide, killing millions of people each year. The number of people battling cancer continues to increase, owing to different reasons, such as lifestyle choices. Clinically, determining the cause of cancer is very challenging and often inaccurate. Incorporating efficient and accurate algorithms to detect cancer cases is becoming increasingly beneficial for scientists in computer science and healthcare, as well as a long-term benefit for doctors, patients, clinic practitioners, and more. Specifically, an automation of computation in machine learning could be a solution in the next generation of big data science technology. Machine Learning in Cancer Research With Applications in Colon Cancer and Big Data Analysis presents algorithms that have been developed to evaluate big data approaches and cancer research. The chapters include artificial intelligence and machine learning approaches, as well as case studies to solve the predictive issues in colon cancer research. This book includes concepts and techniques used to run tasks in an automated manner with the intent to improve better accuracy in comparison with previous studies and methods. This book also covers the processes of research design, development, and outcome analytics in this field. Doctors, IT consultants, IT specialists, medical software professionals, data scientists, researchers, computer scientists, healthcare practitioners, academicians, and students can benefit from this critical resource.

This SpringerBrief focuses mainly on the basic theory and applications of massive MIMO in 5G networks. The significance of massive MIMO for 5G or future communications is first briefly discussed. Then, the basic theory of massive MIMO technology is comprehensively analyzed, i.e., a variety of 5G scenarios and their improvements are described when massive MIMO is taken into account. Art physical-layer techniques and various networking techniques for interference mitigation and resource scheduling are introduced as well. This SpringerBrief also examines the selected applications of massive MIMO in 5G networks, i.e., massive MIMO-aided millimeter communications and energy transfer. The physical-layer design, multiple access control (MAC) mechanism and networking techniques are discussed for millimeter-wave communications aided by massive MIMO technology. Then, massive MIMO is covered for hybrid information and energy transfer. A downlink precoder and a uplink pilot scheme is proposed for single cell networks, and both non-cooperative and cooperative energy transfer in multi-cell are presented. Communication researchers in the area of MIMO technology, as well as researchers and practitioners working in millimeter communications and energy transfer seeking new research topics, and topic areas with communication system design, centralized and distributed algorithms, will find this brief useful as a reference. Advanced-level students studying communication engineering will also find this book useful as a secondary text.

This volume collects the expanded notes of four series of lectures given on the occasion of the CIME course on Nonlinear Optimization held in Cetraro, Italy, from July 1 to 7, 2007. The Nonlinear Optimization problem of main concern here is the problem n of determining a vector of decision variables $x \in R$ that minimizes (ma- n mizes) an objective function $f(\cdot): R \to R$, when x is restricted to belong n to some feasible set $F \subseteq R$, usually described by a set of equality and - n n m equality constraints: $F = \{x \in R : h(x)=0, h(\cdot): R \to R ; g(x) \geq 0, n p g(\cdot): R \to R \}$; of course it is intended that at least one of the functions f,h,g is nonlinear. Although the problem canbe stated in verysimpleterms, its solution may result very di?cult due to the analytical properties of the functions involved and/or to the number n,m,p of variables and constraints. On the other hand, the problem has been recognized to be of main relevance in engineering, economics, and other applied sciences, so that a great lot of e?ort has been devoted to develop methods and algorithms able to solve the problem even in its more di?cult and large instances. The lectures have been given by eminent scholars, who contributed to a great extent to the development of Nonlinear Optimization theory, methods and algorithms. Namely, they are: – Professor Immanuel M.

This volume contains a selection of contributions that were presented at the Modeling and Optimization: Theory and Applications Conference (MOPTA) held at Lehigh University in Bethlehem, Pennsylvania, USA on August 18-20, 2010. The conference brought together a diverse group of researchers and practitioners, working on both theoretical and practical aspects of continuous or discrete optimization. Topics presented included algorithms for solving convex, network, mixed-integer, nonlinear, and global optimization problems, and addressed the application of optimization techniques in finance, logistics, health, and other important fields. The contributions contained in this volume represent a

sample of these topics and applications and illustrate the broad diversity of ideas discussed at the meeting.

With the aim to sequentially determine optimal allocations across a set of assets, Online Portfolio Selection (OLPS) has significantly reshaped the financial investment landscape. Online Portfolio Selection: Principles and Algorithms supplies a comprehensive survey of existing OLPS principles and presents a collection of innovative strategies that leverage machine learning techniques for financial investment. The book presents four new algorithms based on machine learning techniques that were designed by the authors, as well as a new back-test system they developed for evaluating trading strategy effectiveness. The book uses simulations with real market data to illustrate the trading strategies in action and to provide readers with the confidence to deploy the strategies themselves. The book is presented in five sections that: Introduce OLPS and formulate OLPS as a sequential decision task Present key OLPS principles, including benchmarks, follow the winner, follow the loser, pattern matching, and meta-learning Detail four innovative OLPS algorithms based on cutting-edge machine learning techniques Provide a toolbox for evaluating the OLPS algorithms and present empirical studies comparing the proposed algorithms with the state of the art Investigate possible future directions Complete with a back-test system that uses historical data to evaluate the performance of trading strategies, as well as MATLAB® code for the back-test systems, this book is an ideal resource for graduate students in finance, computer science, and statistics. It is also suitable for researchers and engineers interested in computational investment. Readers are encouraged to visit the authors' website for updates: http://olps.stevenhoi.org. Hardware computational capabilities continue to increase dramatically enabling ever more sophisticated signal processing at digital transmitters and receivers. The work presented in this manuscript will cover two similar applications of convex optimization methods to important physical layer signal processing problems. The first work formulates relaxations of the tone injection method for PAPR reduction of linearly precoded systems, including as special cases OFDM, OFDMA, and SC-FDMA. A semi-definite programming approach and a sparse signal recovery-inspired approach are presented. Performance in terms of PAPR reduction and effects on power amplifier efficiency at lower PAPR back-off are given are given for several systems. The second work is a convex joint linear equalization and decoding algorithm that requires fewer pilot symbols than traditional methods for QAM transmissions over multi-path channels. The convex optimization framework developed takes into account both signal constellation and LDPC FEC coding information. The integration of FEC coding constraints applies recent developments in linear programming-based decoding. The BER performance of this algorithm is tested over several simulated channel and system configurations.

The research of Jonathan Borwein has had a profound impact on optimization, functional analysis, operations research, mathematical programming, number theory, and experimental mathematics. Having authored more than a dozen books and more than 300 publications, Jonathan Borwein is one of the most productive Canadian mathematicians ever. His research spans pure, applied, and computational mathematics as well as high performance computing, and continues to have an enormous impact: MathSciNet lists more than 2500 citations by more than 1250 authors, and Borwein is one of the 250 most cited mathematicians of the period 1980-1999. He has served the Canadian Mathematics Community through his presidency (2000–02) as well as his 15 years of editing the CMS book series. Jonathan Borwein's vision and initiative have been crucial in initiating and developing several institutions that provide support for researchers with a wide range of scientific interests. A few notable examples include the Centre for Experimental and Constructive Mathematics and the IRMACS Centre at Simon Fraser University, the Dalhousie Distributed Research Institute at Dalhousie University, the Western Canada Research Grid, and the Centre for Computer Assisted Research Mathematics and its Applications, University of Newcastle. The workshops that were held over the years in Dr. Borwein's honor attracted high-caliber scientists from a wide range of mathematical fields. This present volume is an outgrowth of the workshop on 'Computational and Analytical Mathematics' held in May 2011 in celebration of Dr. Borwein's 60th Birthday. The collection contains various state-of-the-art research manuscripts and surveys presenting contributions that have risen from the conference, and is an excellent opportunity to survey state-of-the-art research and discuss promising research directions and approaches.

This textbook provides an introduction to convex duality for optimization problems in Banach spaces, integration theory, and their application to stochastic programming problems in a static or dynamic setting. It introduces and analyses the main algorithms for stochastic programs, while the theoretical aspects are carefully dealt with. The reader is shown how these tools can be applied to various fields, including approximation theory, semidefinite and second-order cone programming and linear decision rules. This textbook is recommended for students, engineers and researchers who are willing to take a rigorous approach to the mathematics involved in the application of duality theory to optimization with uncertainty.

"This book concerns matter that is intrinsically difficult: convex optimization, complementarity and duality, nonsmooth analysis, linear and nonlinear programming, etc. The author has skillfully introduced these and many more concepts, and woven them into a seamless whole by retaining an easy and consistent style throughout. The book is not all theory: There are many real-life applications in structural engineering, cable networks, frictional contact problems, and plasticity... I recommend it to any reader who desires a modern, authoritative account of nonsmooth mechanics and convex optimization." — Prof. Graham M.L. Gladwell, Distinguished Professor Emeritus, University of Waterloo, Fellow of the Royal Society of Canada "... reads very well—the structure is good, the language and style are clear and fluent, and the material is rendered accessible by a careful presentation that contains many concrete examples. The range of applications, particularly to problems in mechanics, is admirable and a valuable complement to theoretical and computational investigations that are at the forefront of the areas concerned." — Prof. B. Daya Reddy, Department of Mathematics and Applied Mathematics, Director of Centre

for Research in Computational and Applied Mechanics, University of Cape Town, South Africa "Many materials and structures (e.g., cable networks, membrane) involved in practical engineering applications have complex responses that cannot be described by smooth constitutive relations. ... The author shows how these difficult problems can be tackled in the framework of convex analysis by arranging the carefully chosen materials in an elegant way. Most of the contents of the book are from the original contributions of the author. They are both mathematically rigorous and readable. This book is a must-read for anyone who intends to get an authoritative and state-of-art description for the analysis of nonsmooth mechanics problems with theory and tools from convex analysis." — Prof. Xu Guo, State Key Laboratory of Structural Analysis for Industrial Equipment, Department of Engineering Mechanics, Dalian University of Technology

In the last few years, Algorithms for Convex Optimization have revolutionized algorithm design, both for discrete and continuous optimization problems. For problems like maximum flow, maximum matching, and submodular function minimization, the fastest algorithms involve essential methods such as gradient descent, mirror descent, interior point methods, and ellipsoid methods. The goal of this self-contained book is to enable researchers and professionals in computer science, data science, and machine learning to gain an in-depth understanding of these algorithms. The text emphasizes how to derive key algorithms for convex optimization from first principles and how to establish precise running time bounds. This modern text explains the success of these algorithms in problems of discrete optimization, as well as how these methods have significantly pushed the state of the art of convex optimization itself.

Spectral Feature Selection for Data Mining introduces a novel feature selection technique that establishes a general platform for studying existing feature selection algorithms and developing new algorithms for emerging problems in real-world applications. This technique represents a unified framework for supervised, unsupervised, and semisupervise

This book is a slightly augmented version of a set of lec tures on optimization which I held at the University of Got tingen in the winter semester 1983/84. The lectures were in tended to give an introduction to the foundations and an im pression of the applications of optimization theory. Since in finite dimensional problems were also to be treated and one could only assume a minimal knowledge of functional analysis, the necessary tools from functional analysis were almost com pletely developed during the course of the semester. The most important aspects of the course are the duality theory for convex programming and necessary optimality conditions for nonlinear optimization problems; here we strive to make the geometric background particularly clear. For lack of time and space we were not able to go into several important problems in optimization - e. g. vector optimization, geometric program ming and stability theory. I am very grateful to various people for their help in pro ducing this text. R. Schaback encouraged me to publish my lec tures and put me in touch with the Vieweg-Verlag. W. BrUbach and O. Herbst proofread the manuscript; the latter also pro duced the drawings and assembled the index. I am indebted to W. LUck for valuable suggestions for improvement. I am also particularly grateful to R. Switzer, who translated the German text into English. Finally I wish to thank Frau P. Trapp for her Gare and patience in typing the final version.

This volume contains a selection of contributions that were presented at the Modeling and Optimization: Theory and Applications Conference (MOPTA) held at Lehigh University in Bethlehem, Pennsylvania, USA on July 30-August 1, 2012. The conference brought together a diverse group of researchers and practitioners, working on both theoretical and practical aspects of continuous or discrete optimization. Topics presented included algorithms for solving convex, network, mixed-integer, nonlinear, and global optimization problems, and addressed the application of optimization techniques in finance, logistics, health, and other important fields. The contributions contained in this volume represent a sample of these topics and applications and illustrate the broad diversity of ideas discussed at the meeting.

This book focuses on the applications of convex optimization and highlights several topics, including support vector machines, parameter estimation, norm approximation and regularization, semi-definite programming problems, convex relaxation, and geometric problems. All derivation processes are presented in detail to aid in comprehension. The book offers concrete guidance, helping readers recognize and formulate convex optimization problems they might encounter in practice.

This book constitutes the refereed proceedings of the 10th International Conference on Optimization and Applications, OPTIMA 2019, held in Petrovac, Montenegro, in September-October 2019. The 35 revised full papers presented were carefully reviewed and selected from 117 submissions. The papers cover such topics as optimization, operations research, optimal control, game theory, and their numerous applications in practical problems of operations research, data analysis, and software development.

Nonconvex Optimization is a multi-disciplinary research field that deals with the characterization and computation of local/global minima/maxima of nonlinear, nonconvex, nonsmooth, discrete and continuous functions. Nonconvex optimization problems are frequently encountered in modeling real world systems for a very broad range of applications including engineering, mathematical economics, management science, financial engineering, and social science. This contributed volume consists of selected contributions from the Advanced Training Programme on Nonconvex Optimization and Its Applications held at Banaras Hindu University in March 2009. It aims to bring together new concepts, theoretical developments, and applications from these researchers. Both theoretical and applied articles are contained in this volume which adds to the state of the art research in this field. Topics in Nonconvex Optimization is suitable for advanced graduate students and researchers in this area.

Featuring papers from the Third International Conference on Computational Finance and its Applications, the text includes papers that encompass a wide range of topics such as modern financial services technologies, derivatives pricing, portfolio management and asset allocation, and intelligent trading agents.

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