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1/21

Selected Applications of Convex Optimization

2015-03-26

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

An Easy Path to Convex Analysis and Applications

2022-05-31

convex optimization has an increasing impact on many areas of mathematics applied sciences and practical applications it is now being taught at many universities and being used by researchers of different fields as convex analysis is the mathematical foundation for convex optimization having deep knowledge of convex analysis helps students and researchers apply its tools more effectively the main goal of this book is to provide an easy access to the most fundamental parts of convex analysis and its applications to optimization modern techniques of variational analysis are employed to clarify and simplify some basic proofs in convex analysis and build the theory of generalized differentiation for convex functions and sets in finite dimensions we also present new applications of convex analysis to location problems in connection with many interesting geometric problems such as the fermat torricelli problem the heron problem the sylvester problem and their generalizations of course we do not expect to touch every aspect of convex analysis but the book consists of sufficient material for a first course on this subject it can also serve as supplemental reading material for a course on convex optimization and applications

Convex Functions and Their Applications

2018-06-08

thorough introduction to an important area of mathematics contains recent results includes many exercises

An Easy Path to Convex Analysis and Applications

2023-06-16

this book examines the most fundamental parts of convex analysis and its applications to optimization and location problems accessible techniques of variational analysis are employed to clarify and simplify some basic proofs in convex analysis and to build a theory of generalized differentiation for convex functions and sets in finite dimensions the book serves as a bridge for the readers who have just started using convex analysis to reach deeper topics in the field detailed proofs are presented for most of the results in the book and also included are many figures and exercises for better understanding the material applications provided include both the classical topics of convex optimization and important problems of modern convex optimization convex geometry and facility location

Convex Sets and Their Applications

2007-01-01

suitable for advanced undergraduates and graduate students this text introduces the broad scope of convexity it leads students to open questions and unsolved problems and it highlights diverse applications author steven r lay professor of mathematics at lee university in tennessee reinforces his teachings with numerous examples plus exercises with hints and answers the first three chapters form the foundation for all that follows starting with a review of the fundamentals of linear algebra and topology they also survey the development and applications of relationships between hyperplanes and convex sets subsequent chapters are relatively self contained each focusing on a particular aspect or application of convex sets topics include characterizations of convex sets polytopes duality optimization and convex functions hints solutions and references for the exercises appear at the back of the book

Convex Optimization for Signal Processing and

Communications

2017-01-24

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

Convex Analysis

2019

this book is an introduction to convex analysis and some of its applications it starts with basis theory which is explained within the framework of finite dimensional spaces the only prerequisites are basic analysis and simple geometry the second chapter presents some applications of convex analysis including problems of linear programming geometry and approximation special attention is paid to applications of convex analysis to kolmogorov type inequalities for derivatives of functions is one variable chapter 3 collects some results on geometry and convex analysis in infinite dimensional spaces a comprehensive introduction written for beginners illustrates the fundamentals of convex analysis in finite dimensional spaces the book can be used for an advanced undergraduate or graduate level course on convex analysis and its applications it is also suitable for independent study of this extremely important area of mathematics

Convex Optimization

2013-11-11

over the past two decades it has been recognized that advanced image processing techniques provide valuable information to physicians for the diagnosis image guided therapy and surgery and monitoring of human diseases convex optimization theory methods and applications introduces novel and sophisticated mathematical problems which encourage the development of advanced optimization and computing methods especially convex optimization the authors go on to study steffensen king type methods of convergence to approximate a locally unique solution of a nonlinear equation and also in problems of convex optimization real world applications are also provided the following study is focused on the design and testing of a matlab code of the frank wolfe algorithm the nesterov step is proposed in order to accelerate the algorithm and the results of some numerical experiments of constraint optimization are also provided lagrangian methods for numerical solutions to constrained convex programs are also explored for enhanced algorithms the traditional lagrange multiplier update is modified to take a soft reflection across the zero boundary this coupled with a modified drift expression is shown to yield improved performance next newton s mesh independence principle was used to solve a certain class of optimal design problems from earlier studies motivated by optimization considerations the authors show that under the same computational cost a finer mesh independence principle can be given than before this compilation closes with a presentation on a local convergence analysis for eighth order variants of hansen patrick s family for approximating a locally unique solution of a nonlinear equation the radius of convergence and computable error bounds on the distances involved

Convexity and Its Applications

2019-07-08

this collection of surveys consists in part of extensions of papers presented at the conferences on convexity at the technische universitat wien july 1981 and at the universitat siegen july 1982 and in part of articles written at the invitation of the editors this volume together with the earlier volume contributions to geometry edited by tolke and wills and published by birkhauser in 1979 should give a fairly good account of many of the more important facets of convexity and its applications besides being an up to date reference work this volume can be used as an advanced treatise on convexity and related fields we sincerely hope that it will inspire future research fenchel in his paper gives an historical account of convexity showing many important but not so well known facets the articles of papini and phelps relate convexity to problems of functional analysis on nearest points nonexpansive maps and the extremal structure of convex sets a bridge to mathematical physics in the sense of polya and szego is provided by the survey of bandle on isoperimetric inequalities and bachem s paper illustrates the importance of convexity for optimization the contribution of coxeter deals with a classical topic in geometry the lines on the cubic surface whereas leichtweiss shows the close connections between convexity and differential geometry the exhaustive survey of chalk on point lattices is related to algebraic number theory a topic important for applications in biology geology etc

Schur-Convex Functions and Inequalities

1992-06-03

this two volume work introduces the theory and applications of schur convex functions the second volume mainly focuses on the application of schur convex functions in sequences inequalities integral inequalities mean value inequalities for two variables mean value

Convex Functions, Partial Orderings, and Statistical Applications

2013-01-02

this research level book presents up to date information concerning recent developments in convex functions and partial orderings and some applications in mathematics statistics and reliability theory the book will serve researchers in mathematical and statistical theory and theoretical and applied reliabilists presents classical and newly published results on convex functions and related inequalities explains partial ordering based on arrangement and their applications in mathematics probability statsitics and reliability demonstrates the connection of partial ordering with other well known orderings such as majorization and schur functions will generate further research and applications

Convexity and Optimization in Banach Spaces

2016-08-01

an updated and revised edition of the 1986 title convexity and optimization in banach spaces this book provides a self contained presentation of basic results of the theory of convex sets and functions in infinite dimensional spaces the main emphasis is on applications to convex optimization and convex optimal control problems in banach spaces a distinctive feature is a strong emphasis on the connection between theory and application this edition has been updated to include new results pertaining to advanced concepts of subdifferential for convex functions and new duality results in convex programming the last chapter concerned with convex control problems has been rewritten and completed with new research concerning boundary control systems the dynamic programming equations in optimal control theory and periodic optimal control problems finally the structure of the book has been modified to highlight the most recent progression in the field including fundamental results on the theory of infinite dimensional convex analysis and includes helpful bibliographical notes at the end of each chapter

Real and Convex Analysis

2022-04-24

real analysis is an area of mathematics that deals with sets and sequences of real numbers as well as functions of one or more real variables as one of the main branches of analysis it can be seen as a subset of complex analysis many results of the former being special cases of results in the latter real analysis deals with the real numbers and real valued functions of a real variable in particular it deals with the analytic properties of real functions and sequences including convergence and limits of sequences of real numbers the calculus of the real numbers and continuity smoothness and related properties of real valued functions convex analysis is devoted to the study of properties of convex functions and convex sets often with applications in convex minimization a subdomain of optimization theory one of the fields of application of convex analysis is optimization meaning the search for maxima or minima of some functions and for points at which such extrema are reached real analysis is necessary for probability theory which is the foundation for all of statistics operations research queuing theory and the mathematical finance convex analysis is the mathematical foundation for convex optimization having deep knowledge of real and convex analysis helps students and researchers apply its tools more effectively real and convex analysis aims to provide a concise accessible account of real and convex analysis and its applications and extensions for a broad audience it will be of valuable tool for professors researchers scientists and engineers it can also be used for the advanced undergraduate level students

Convex Analysis and Beyond

2001-01-01

this book presents a unified theory of convex functions sets and set valued mappings in topological vector spaces with its specifications to locally convex banach and finite dimensional settings these developments and expositions are based on the powerful geometric approach of variational analysis which resides on set extremality with its characterizations and specifications in the presence of convexity using this approach the text consolidates the device of fundamental facts of generalized differential calculus to obtain novel results for convex sets functions and set valued mappings in finite and infinite dimensions it also explores topics beyond convexity using the fundamental machinery of convex analysis to develop nonconvex generalized differentiation and its applications the text utilizes an adaptable framework designed with researchers as well as multiple levels of students in mind it includes many exercises and figures suited to graduate classes in mathematical sciences that are also accessible to advanced students in economics engineering and other applications in addition it includes chapters on convex analysis and optimization in finite dimensional spaces that will be useful to upper undergraduate students whereas the work as a whole provides an ample resource to mathematicians and applied scientists particularly experts in convex and variational analysis optimization and their applications

Lectures on Modern Convex Optimization

2008-10-14

here is a book devoted to well structured and thus efficiently solvable convex optimization problems with emphasis on conic quadratic and semidefinite programming the authors present the basic theory underlying these problems as well as their numerous applications in engineering including synthesis of filters lyapunov stability analysis and structural design the authors also discuss the complexity issues and provide an overview of the basic theory of state of the art polynomial time interior point methods for linear conic quadratic and semidefinite programming the book s focus on well structured convex problems in conic form allows for unified theoretical and algorithmical treatment of a wide spectrum of important optimization problems arising in applications

Generalized Convexity and Optimization

2014-06-28

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

Convexity Theory and its Applications in Functional Analysis

1981

convexity theory appl functional analysis

The Theory of Subgradients and Its Applications to Problems of Optimization

2003

convex analysis is a branch of mathematics that studies convex sets convex functions and convex extremal problems it has surprisingly diverse and fruitful applications in mathematics mathematical physics technology and economics this book is an introduction to convex analysis and some of its applications it starts with basic theory which is explained within the framework of finite dimensional spaces the only prerequisites are basic analysis and simple geometry the second chapter presents some applications of convex analysis including problems of linear programming geometry and approximation special attention is paid to applications of convex analysis to kolmogorov type inequalities for derivatives of functions in one variable chapter 3 collects some results on geometry and convex analysis in infinite dimensional spaces a comprehensive introduction written for beginners illustrates the fundamentals of convex analysis in finite dimensional spaces the book can be used for an advanced undergraduate or graduate level course on convex analysis and its applications it is also suitable for independent study of this extremely important area of mathematics

Convex Analysis

1985-01-01

in a remarkably short time the field of inequality problems has seen considerable development in mathematics and theoretical mechanics applied mechanics and the engineering sciences have also benefitted from these developments in that open problems have been treated and entirely new classes of problems have been formulated and solved this book is an outgrowth of seven years of seminars and courses on inequality problems in mechanics for a variety of audiences in the technical university of aachen the aristotle university of thessaloniki the university of hamburg and the technical university of milan the book is intended for a variety of readers mathematicians and engineers alike as is detailed in the guidelines for the reader it goes without saying that the work of g fichera j l lions g maier j j moreau in originating and developing the theory of inequality problems has considerably influenced the present book i also wish to acknowledge the helpful comments received from c bisbos j haslinger b kawohl h matthies h o may d talaslidis and b werner credit is also due to g kyriakopoulos and t mandopoulou for their exceptionally diligent work in the preparation of the fmal figures many thanks are also due to t finnegan and j gateley for their friendly assistance from the linguistic standpoint i would also like to thank my editors in birkhiiuser verlag for their cooperation and all those who helped in the preparation of the manuscript

Inequality Problems in Mechanics and Applications

2013-06-29

this book provides a concise accessible account of convex analysis and its applications and extensions for a broad audience it can serve as a teaching text at roughly the level of first year graduate students since the main body of the text is self contained with each section rounded off by an often extensive set of optional exercises the new edition adds material on semismooth optimization as well as several new proofs that will make this book even more self contained

Convex Analysis and Nonlinear Optimization

1959

this two volume work introduces the theory and applications of schur convex functions the first volume introduces concepts and properties of schur convex functions including schur geometrically convex functions schur harmonically convex functions schur power convex functions etc and also discusses applications of schur convex functions in symmetric function inequalities

Convex Sets and Their Applications

2019-06-17

discrete convex analysis is a novel paradigm for discrete optimization that combines the ideas in continuous optimization convex analysis and combinatorial optimization matroid submodular function theory to establish a unified theoretical framework for nonlinear discrete optimization the study of this theory is expanding with the development of efficient algorithms and applications to a number of diverse disciplines like matrix theory operations research and economics this self contained book is designed to provide a novel insight into optimization on discrete structures and should reveal unexpected links among different disciplines it is the first and only english language monograph on the theory and applications of discrete convex analysis discrete convex analysis provides the information that professionals in optimization will need to catch up with this new theoretical development it also presents an unexpected connection between matroid theory and mathematical economics and expounds a deeper connection between matrices and matroids than most standard textbooks

Schur-Convex Functions and Inequalities

2003-01-01

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

Discrete Convex Analysis

2016-10-17

this important work provides a comprehensive overview of the properties of banachspaces

related to strict convexity and a survey of significant applications uniting a wealthof information previously scattered throughout the mathematical literature in a well organized accessible format after introducing the subject through a discussion of the basic results of linear functionalanalysis this unique book proceeds to investigate the characteristics of strictly convexspaces and related classes including uniformly convex spaces and examine important applicationsregarding approximation theory and fixed point theory following this extensivetreatment the book discusses complex strictly convex spaces and related spaces alsowith applications complete clearly elucidated proofs accompany results throughout thebook and ample references are provided to aid further research of the subject strict convexity and complex strict convexity is essential fot mathematicians and studentsinterested in geometric theory of banach spaces and applications to approximationtheory and fixed point theory and is of great value to engineers working in optimizationstudies in addition this volume serves as an excellent text for a graduate course ingeometric theory of banach spaces

Convex Analysis and Global Optimization

2017-10-19

in recent years there is a growing interest in generalized convex fu tions and generalized monotone mappings among the researchers of plied mathematics and other sciences this is due to the fact that mathematical models with these functions are more suitable to describe problems of the real world than models using conventional convex and monotone functions generalized convexity and monotonicity are now considered as an independent branch of applied mathematics with a wide range of applications in mechanics economics engineering finance and many others the present volume contains 20 full length papers which reflect c rent theoretical studies of generalized convexity and monotonicity and monotonicity and numerous applications in optimization variational inequalities equil rium problems etc all these papers were refereed and carefully selected from invited talks and contributed talks that were presented at the 7th international symposium on generalized convexity monotonicity held in hanoi vietnam august 27 31 2002 this series of symposia is or nized by the working group on generalized convexity

wggc every 3 years and aims to promote and disseminate research on the field the wggc genconv org consists of more than 300 researchers coming from 36 countries

Strict Convexity and Complex Strict Convexity

2006-06-22

leading experts provide the theoretical underpinnings of the subject plus tutorials on a wide range of applications from automatic code generation to robust broadband beamforming emphasis on cutting edge research and formulating problems in convex form make this an ideal textbook for advanced graduate courses and a useful self study guide

Generalized Convexity, Generalized Monotonicity and Applications

2010

this is the first comprehensive monograph to thoroughly investigate constant width bodies which is a classic area of interest within convex geometry it examines bodies of constant width from several points of view and in doing so shows surprising connections between various areas of mathematics concise explanations and detailed proofs demonstrate the many interesting properties and applications of these bodies numerous instructive diagrams are provided throughout to illustrate these concepts an introduction to convexity theory is first provided and the basic properties of constant width bodies are then presented the book then delves into a number of related topics which include constant width bodies in convexity sections and projections complete and reduced sets mixed volumes and further partial fields sets of constant width in non euclidean geometries in real banach spaces and in hyperbolic spherical and further non euclidean spaces the concept of constant width in analysis using fourier series spherical integration and other related methods sets of constant width in differential geometry using systems of lines and discussing notions like curvature evolutes etc

bodies of constant width in topology hyperspaces transnormal manifolds fiber bundles and related topics the notion of constant width in discrete geometry referring to geometric inequalities packings and coverings etc technical applications such as film projectors the square hole drill and rotary engines bodies of constant width an introduction to convex geometry with applications will be a valuable resource for graduate and advanced undergraduate students studying convex geometry and related fields additionally it will appeal to any mathematicians with a general interest in geometry

Convex Optimization in Signal Processing and Communications

2019-03-16

this volume is dedicated to the fundamentals of convex functional analysis it presents those aspects of functional analysis that are extensively used in various applications to mechanics and control theory the purpose of the text is essentially two fold on the one hand a bare minimum of the theory required to understand the principles of functional convex and set valued analysis is presented numerous examples and diagrams provide as intuitive an explanation of the principles as possible on the other hand the volume is largely self contained those with a background in graduate mathematics will find a concise summary of all main definitions and theorems

Bodies of Constant Width

1983-10

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

Convexity and Its Applications

1972

the primary aim of this book is to present the conjugate and subdifferential calculus using the method of perturbation functions in order to obtain the most general results in this field the secondary aim is to provide important applications of this calculus and of the properties of convex functions such applications are the study of well conditioned convex functions uniformly convex and uniformly smooth convex functions best approximation problems characterizations of convexity the study of the sets of weak sharp minima well behaved functions and the existence of global error bounds for convex inequalities as well as the study of monotone multifunctions by using convex functions contents preliminary results on functional analysis convex analysis in locally convex spacessome results and applications of convex and functional analysis convex and mathematical economy keywords

Exposed Points of Convex Sets and Weak Sequential Convergence

2012-12-06

although they play a fundamental role in nearly all branches of mathematics inequalities are usually obtained by ad hoc methods rather than as consequences of some underlying theory of inequalities for certain kinds of inequalities the notion of majorization leads to such a theory that is sometimes extremely useful and powerful for deriving inequalities moreover the derivation of an inequality by methods of majorization is often very helpful both for providing a deeper understanding and for suggesting natural generalizations anyone wishing to employ majorization as a tool in applications can make use of the theorems for the most part their statements are easily understood

Convex Analysis and Its Applications

2006-03-30

the object of this book is to present the basic facts of convex functions standard dynamical systems descent numerical algorithms and some computer programs on riemannian manifolds in a form suitable for applied mathematicians scientists and engineers it contains mathematical information on these subjects and applications distributed in seven chapters whose topics are close to my own areas of research metric properties of riemannian manifolds first and second variations of the p energy of a curve convex functions on riemannian manifolds geometric examples of convex functions flows convexity and energies semidefinite hessians and applications minimization of functions on riemannian manifolds all the numerical algorithms computer programs and the appendices riemannian convexity of functions f r r descent methods on the poincare plane descent methods on the sphere completeness and convexity on finsler manifolds constitute an attempt to make accesible to all users of this book some basic computational techniques and implementation of geometric structures to further aid the readers this book also contains a part of the folklore about riemannian geometry convex functions and dynamical systems because it is unfortunately nowhere to be found in the same context existing textbooks on convex functions on euclidean spaces or on dynamical systems do not mention what happens in riemannian geometry while the papers dealing with riemannian manifolds usually avoid discussing elementary facts usually a convex function on a riemannian manifold is a real valued function whose restriction to every geodesic arc is convex

Convex Functional Analysis

2009-06-29

this monograph presents the state of the art of convexity with an emphasis to integral representation the exposition is focused on choquet s theory of function spaces with a link to

compact convex sets an important feature of the book is an interplay between various mathematical subjects such as functional analysis measure theory descriptive set theory banach spaces theory and potential theory a substantial part of the material is of fairly recent origin and many results appear in the book form for the first time the text is self contained and covers a wide range of applications from the contents geometry of convex sets choquet theory of function spaces affine functions on compact convex sets perfect classes of functions and representation of affine functions simplicial function spaces choquet s theory of function cones topologies on boundaries several results on function spaces and compact convex sets continuous and measurable selectors construction of function spaces function spaces in potential theory and dirichlet problem applications

Optimization

2002-07-30

the subject of the present book is sub differential calculus the main source of this branch of functional analysis is the theory of extremal problems for a start we explicate the origin and statement of the principal problems of sub differential calculus to this end consider an abstract minimization problem formulated as follows x e x f x inf here x is a vector space and f x ir is a numeric function taking possibly infinite values in these circumstances we are usually interested in the quantity inf f x the value of the problem and in a solution or an optimum plan of the problem i e such an x that f x inf f x if the latter exists it is a rare occurrence to solve an arbitrary problem explicitly i e to exhibit the value of the problem and one of its solutions in this respect it becomes necessary to simplify the initial problem by reducing it to somewhat more manageable modifications formulated with the details of the structure of the objective function taken in due account the conventional hypothesis presumed in attempts at theoretically approaching the reduction sought is as follows introducing an auxiliary function 1 one considers the next problem x ex f x I x inf furthermore the new problem is assumed to be as complicated as the initial problem provided that 1 is a linear functional over x i e

Convex Analysis in General Vector Spaces

2016-01-22

Inequalities

2013-11-11

Convex Functions and Optimization Methods on Riemannian

Manifolds

1985

Inequality Problems in Mechanics and Applications

2010

Integral Representation Theory

2012-12-06

Subdifferentials

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