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Projection Methods in Constrained Optimisation and Applications to Optimal Policy Decisions McGraw-Hill Publishing Company

This third edition of the classic textbook in Optimization has been fully revised and updated. It comprehensively covers modern theoretical insights in this crucial computing area, and will be required reading for analysts and operations researchers in a variety of fields. The book connects the purely analytical character of an optimization problem, and the behavior of algorithms used to solve it. Now, the third edition has been completely updated with recent Optimization Methods. The book also has a new co-author, Yinyu Ye of California ' s Stanford University, who has written lots of

extra material including some on Interior Point Methods.

An Invitation to Statistics in Wasserstein Space

Springer

In the early fifties, applied mathematicians, engineers and economists started to pay c10se attention to the optimization problems in which another (lower-Ievel) optimization problem arises as a side constraint. One of the motivating factors was the concept of the Stackelberg solution in game theory, together with its economic applications. Other problems have been encountered in the seventies in natural sciences and engineering. Many of them are of practical importance and have been extensively studied, mainly from the theoretical point of view. Later, applications to mechanics and network design have lead to an extension of the problem formulation: Constraints in form of variation al inequalities and complementarity problems were also admitted. The term "generalized bi level programming problems" was used at first but later, probably in Harker and Pang, 1988, a different terminology was introduced: Mathematical programs with equilibrium constraints, or simply, MPECs. In this book we adhere to MPEC terminology. A large number of papers deals with MPECs but, to our knowledge, there is only one monograph (Luo et al. , 1997). This monograph

concentrates on optimality conditions and numerical methods. Our book is oriented similarly, but we focus on those MPECs which can be treated by the implicit programming approach: the equilibrium constraint locally defines a certain implicit function and allows to convert the problem into a mathematical program with a nonsmooth objective.

Nonsmooth Approach to Optimization Problems with Equilibrium Constraints Butterworth-Heinemann

Multiplicative noise appears in systems where the process or measurement noise levels depend on the system state vector. Such systems are relevant, for example, in radar measurements where larger ranges involve higher noise level. This monograph embodies a comprehensive survey of the relevant literature with basic problems being formulated and solved by applying various techniques including game theory, linear matrix inequalities and Lyapunov parameter-dependent functions. Topics covered include: convex H2 and H-infinity norms analysis of systems with multiplicative noise; state feedback control and state estimation of systems with multiplicative noise; dynamic and static output feedback of stochastic bilinear systems; tracking controllers for stochastic bilinear systems utilizing preview information.

Various examples which demonstrate the applicability of the theory to practical control engineering problems are considered; two such examples are taken from the aerospace and guidance control areas.

Convex Optimization Springer Science & Business Media Mathematical optimization is used in nearly all computer graphics applications, from computer vision to animation. This book teaches readers the core set of techniques that every computer graphics professional should understand in order to envision and expand the boundaries of what is possible in their work. Study of this authoritative reference will help readers develop a very powerful tool- the ability to create and decipher mathematical models that can better realize solutions to even the toughest problems confronting computer graphics community today. *Distills down a vast and complex world of information on optimization into one short, self-contained volume especially for computer graphics *Helps CG professionals identify the best technique for solving particular problems quickly, by categorizing the most effective algorithms by application *Keeps readers current by supplementing the focus on key, classic methods with special end-of-chapter sections on cutting-edge developments

Generation of Feasible Descent Directions in Continuous Time Linear Programming Springer

Science & Business Media
The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

Investment in Energy Assets Under Uncertainty John Wiley & Sons
The focus of the book

is the construction of optimal investment strategies in a security market model where the prices follow diffusion processes. It begins by presenting the complete Black-Scholes type model and then moves on to incomplete models and models including constraints and transaction costs. The models and methods presented will include the stochastic control method of Merton, the martingale method of Cox-Huang and Karatzas et al., the log optimal method of Cover and Jamshidian, the value-preserving model of Hellwig etc. Stress is laid on rigorous mathematical presentation and clear economic interpretations while technicalities are kept to the minimum. The underlying mathematical concepts will be provided. No a priori knowledge of stochastic calculus, stochastic control or partial differential equations is necessary (however some knowledge in stochastics and calculus is needed).

Discrete Inverse and State Estimation Problems

Springer

The third edition of this well known text continues to provide a solid foundation in mathematical analysis for undergraduate and first-year graduate students. The text begins with a discussion of the real number system as a complete ordered field. (Dedekind's construction is

now treated in an appendix to Chapter I.) The topological background needed for the development of convergence, continuity, differentiation and integration is provided in Chapter 2. There is a new section on the gamma function, and many new and interesting exercises are included. This text is part of the Walter Rudin Student Series in Advanced Mathematics.

Numerical Solution of Optimal Control Problems with State Constraints by Sequential Quadratic Programming in Function Space Springer Science & Business Media

This book aims to provide a rigorous yet pragmatic approach to the valuation and management of investments in the energy sector. Time and uncertainty pervade most if not all issues relevant to energy assets. They run from the early stage of prototype and demonstration to the ultimate abandonment and decommissioning. Risk in particular appears in several areas; thus, one can distinguish technical risk from financial risk. Furthermore, the extent to which one can react to them is different (just think of price risk and regulation risk). Markets in general, and financial markets in particular, regularly put a price on a number of assets which differ in their return/risk characteristics. And academia has developed sound financial principles for valuation purposes in a number of contexts. Nonetheless, the physical characteristics of the assets involved also play a key role in their valuation if only because of the restrictions that they entail. There are some instances in which the practitioner/researcher is able to come up with an analytical solution to the valuation problem.

Typically, however, these instances are limited because of their relying on stylized facts or idealized frameworks. Unfortunately, many relevant instances lack analytical solutions, so one must resort to numerical methods. The book clearly explains how to implement them in a meaningful way. Their usefulness is further enhanced when numerical estimates of relevant parameters are derived from actual market prices (as long as these are available and reliable). The book starts from the basics of valuation in a dynamic, certain context. The second part then considers uncertainty and introduces a number of useful results and tools to grapple effectively with it. The last part applies these tools to the valuation of energy assets in a sequential manner, i.e. by considering one, two and three sources of risk. The last chapter provides examples of joint optimal management and value maximization in conventional power plants.

Numerical Solution of Systems of Simultaneous Polynomial Equations

Springer Science & Business Media

In a systems theoretic context, the terms 'consensus' and 'synchronization' both describe the property that all individual systems in a group behave asymptotically identical, i.e., output or state trajectories asymptotically converge to a common trajectory. The objective of the present thesis is an improved understanding of some of the diverse coupling mechanisms leading to consensus and synchronization. A starting point is the observation that classical consensus and synchronization results commonly deal with two distinct facets of the problem: Consensus has

regularly a strong focus on the interconnections and related constraints while synchronization typically addresses questions about complex individual dynamical systems. Very few results exist that address both facets simultaneously. A thorough analysis of static couplings in consensus algorithms provides explanations for this observation by unveiling limitations inherent to this type of couplings. Novel dynamic coupling mechanisms are proposed to overcome these limitations. These methods essentially rely on an internal model principle for consensus and synchronization derived in the thesis. This principle provides necessary conditions for consensus and synchronization in groups of non-identical systems, and it establishes a link to the output regulation problem. The fresh point of view revealed by this link eventually leads to a new hierarchical mechanism for consensus and synchronization among complex non-identical systems with weak assumptions on the interconnections. Applications include synchronization of linear systems and phase synchronization of nonlinear oscillators.

Flexible Robot Dynamics and Controls Logos Verlag Berlin GmbH

This book is the result of over ten (10) years of research and development in flexible robots and structures at Sandia National Laboratories. The authors de cided to collect this wealth of knowledge into a set of viewgraphs in order to teach a graduate class in Flexible Robot Dynamics and Controls within the Mechanical En gineering Department at the University of New Mexico (UNM). These

viewgraphs, encouragement structures which, in turn, from several students, and many late nights have produced a book that should provide an upper-level undergraduate and graduate textbook and a reference for experienced professionals. The content of this book spans several disciplines including structural dynam ics, system identification, optimization, and linear, digital, and nonlinear control theory which are developed from several points of view including electrical, me chanical, and aerospace engineering as well as engineering mechanics. As a result, the authors believe that this book demonstrates the value of solid applied theory when developing hardware solutions to real world problems. The reader will find many real world applications in this book and will be shown the applicability of these techniques beyond flexible shows the value of mul tidisciplinary education and teaming.

True Digital Control

Springer Nature

The problems of making inferences about the natural world from noisy observations and imperfect theories occur in almost all scientific disciplines. This 2006 book addresses these problems using examples taken from geophysical fluid dynamics. It focuses on discrete formulations, both static and time-varying, known variously as inverse, state estimation or data assimilation problems. Starting with fundamental algebraic and statistical ideas, the book guides the reader through a range of inference tools including the singular value decomposition, Gauss-Markov and minimum variance estimates, Kalman filters and related smoothers, and adjoint (Lagrange multiplier)

methods. The final chapters discuss a variety of practical applications to geophysical flow problems. Discrete Inverse and State Estimation Problems is an ideal introduction to the topic for graduate students and researchers in oceanography, meteorology, climate dynamics, and geophysical fluid dynamics. It is also accessible to a wider scientific audience; the only prerequisite is an understanding of linear algebra.

Principles of Mathematical Analysis

John Wiley & Sons

As long as a branch of knowledge offers an abundance of problems, it is full of vitality. David Hilbert Over the last 15 years I have given lectures on a variety of problems in nonlinear functional analysis and its applications. In doing this, I have recommended to my students a number of excellent monographs devoted to specialized topics, but there was no complete survey-type exposition of nonlinear functional analysis making available a quick survey to the wide range of readers including mathematicians, natural scientists, and engineers who have only an elementary knowledge of linear functional analysis. I have tried to close this gap with my five-part lecture notes, the first three parts of which have been published in the Teubner-Texte series by Teubner-Verlag, Leipzig, 1976, 1977, and 1978. The present English edition was translated from a completely rewritten manuscript which is significantly longer than the original

version in the Teubner-Texte series. The material is organized in the following way: Part I: Fixed Point Theorems. Part II: Monotone Operators. Part III: Variational Methods and Optimization. Parts IV jV: Applications to Mathematical Physics. The exposition is guided by the following considerations: (a) What are the supporting basic ideas and what intrinsic interrelations exist between them? (/3) In what relation do the basic ideas stand to the known propositions of classical analysis and linear functional analysis? (y) What typical applications are there? Vll Preface viii Special emphasis is placed on motivation.

Analysis and Design of Descriptor Linear Systems Springer Science & Business Media

This textbook provides students, researchers, and engineers in the area of electrical engineering with advanced mathematical optimization methods. Presented in a readable format, this book highlights fundamental concepts of advanced optimization used in electrical engineering. Chapters provide a collection that ranges from simple yet important concepts such as unconstrained optimization to highly advanced topics such as linear matrix inequalities and artificial intelligence-based optimization methodologies. The reader is motivated to

engage with the content via numerous application examples of optimization in the area of electrical engineering. The book begins with an extended review of linear algebra that is a prerequisite to mathematical optimization. It then precedes with unconstrained optimization, convex programming, duality, linear matrix inequality, and intelligent optimization methods. This book can be used as the main text in courses such as Engineering Optimization, Convex Engineering Optimization, Advanced Engineering Mathematics and Robust Optimization and will be useful for practicing design engineers in electrical engineering fields. Author provided cases studies and worked examples are included for student and instructor use.

Linear and Nonlinear Programming Academic Press

This book deals with monitoring and control of biotechnological processes. Different methods are proposed which are based on the nonlinear structure of the process and do not require any a priori knowledge of the fermentation parameters. The theoretical stability and convergence properties of the proposed algorithms are analysed and their

performances are illustrated by simulation results and, in many instances, by real life experiments. The concept of software sensors is introduced; these are algorithms based on the nonlinear model of the process and designed for on-line estimation of the biological variables and/or the fermentation parameters. In order to deal with process nonstationarities and parameter uncertainties, reference is made to adaptive estimation and control techniques. The book is the result of an intensive joint research effort by the authors during the last decade. It is intended as a graduate level text for students of bioengineering as well as a reference text for scientists and engineers involved in the design and optimization of bioprocesses.

Introduction to Modern Economic Growth Cambridge University Press

This book collects together in one volume a number of suggested control engineering solutions which are intended to be representative of solutions applicable to a broad class of control problems. It is neither a control theory book nor a handbook of laboratory experiments, but it does include both the basic theory of control and associated practical laboratory set-ups to illustrate the solutions proposed.

Nonlinear Functional Analysis and its Applications Cambridge University Press

A comprehensive introduction to the tools, techniques and applications of convex optimization.

Deterministic L2/H2 Optimization of Linear Dynamical Systems

SPIE-International Society for Optical Engineering

In this revised and enhanced second edition of Optimization Concepts and Applications in Engineering, the already robust pedagogy has been enhanced with more detailed explanations, an increased number of solved examples and end-of-chapter problems. The source codes are now available free on multiple platforms. It is vitally important to meet or exceed previous quality and reliability standards while at the same time reducing resource consumption. This textbook addresses this critical imperative integrating theory, modeling, the development of numerical methods, and problem solving, thus preparing the student to apply optimization to real-world problems. This text covers a broad variety of optimization problems using: unconstrained, constrained, gradient, and non-gradient techniques; duality concepts; multiobjective optimization; linear, integer, geometric, and

dynamic programming with applications; and finite element-based optimization. It is ideal for advanced undergraduate or graduate courses and for practising engineers in all engineering disciplines, as well as in applied mathematics. H-infinity Control and Estimation of State-multiplicative Linear Systems SIAM Numerical Methods for Linear Control Systems Design and Analysis is an interdisciplinary textbook aimed at systematic descriptions and implementations of numerically-viable algorithms based on well-established, efficient and stable modern numerical linear techniques for mathematical problems arising in the design and analysis of linear control systems both for the first- and second-order models. Unique coverage of modern mathematical concepts such as parallel computations, second-order systems, and large-scale solutions Background material in linear algebra, numerical linear algebra, and control theory included in text Step-by-step explanations of the algorithms and examples Optimization by Vector Space Methods SIAM While the prediction of observations is a forward problem, the use

of actual observations to infer the properties of a model is an inverse problem. Inverse problems are difficult because they may not have a unique solution. The description of uncertainties plays a central role in the theory, which is based on probability theory. This book proposes a general approach that is valid for linear as well as for nonlinear problems. The philosophy is essentially probabilistic and allows the reader to understand the basic difficulties appearing in the resolution of inverse problems. The book attempts to explain how a method of acquisition of information can be applied to actual real-world problems, and many of the arguments are heuristic.

Linear and Nonlinear Programming Cambridge University Press
Engineers must make decisions regarding the distribution of expensive resources in a manner that will be economically beneficial. This problem can be realistically formulated and logically analyzed with optimization theory. This book shows engineers how to use optimization theory to solve complex problems. Unifies the large field of optimization with a few geometric principles. Covers functional analysis with a minimum of mathematics. Contains problems that relate to the applications in the book.