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Jiongmin Yong
Xun Yu Zhou

Stochastic Controls

Hamiltonian Systems and HJB Equations

Springer

Stochastic Controls Hamiltonian Systems And Hjb Equations

Paul Embrechts,Claudia Klüppelberg,Thomas Mikosch

Stochastic Controls Hamiltonian Systems And Hjb Equations:

   Stochastic Controls Jiongmin Yong,Xun Yu Zhou,1999-06-22   **Stochastic Controls** Jiongmin Yong,Xun Yu Zhou,2012-12-06 As is well known Pontryagin s maximum principle and Bellman s dynamic programming are the two principal and most commonly used approaches in solving stochastic optimal control problems An interesting phenomenon one can observe from the literature is that these two approaches have been developed separately and independently Since both methods are used to investigate the same problems a natural question one will ask is the fol lowing Q What is the relationship betwccn the maximum principlc and dy namic programming in stochastic optimal controls There did exist some researches prior to the 1980s on the relationship between these two Nevertheless the results usually werestated in heuristic terms and proved under rather restrictive assumptions which were not satisfied in most cases In the statement of a Pontryagin type maximum principle there is an adjoint equation which is an ordinary differential equation ODE in the finite dimensional deterministic case and a stochastic differential equation SDE in the stochastic case The system consisting of the adjoint equa tion the original state equation and the maximum condition is referred to as an extended Hamiltonian system On the other hand in Bellman s dynamic programming there is a partial differential equation PDE of first order in the finite dimensional deterministic case and of second or der in the stochastic case This is known as a Hamilton Jacobi Bellman HJB equation   **Lectures on BSDEs, Stochastic Control, and Stochastic Differential Games with Financial Applications** Rene Carmona,2016-02-18 The goal of this textbook is to introduce students to the stochastic analysis tools that play an increasing role in the probabilistic approach to optimization problems including stochastic control and stochastic differential games While optimal control is taught in many graduate programs in applied mathematics and operations research the author was intrigued by the lack of coverage of the theory of stochastic differential games This is the first title in SIAM s Financial Mathematics book series and is based on the author s lecture notes It will be helpful to students who are interested in stochastic differential equations forward backward forward backward the probabilistic approach to stochastic control dynamic programming and the stochastic maximum principle and mean field games and control of McKean Vlasov dynamics The theory is illustrated by applications to models of systemic risk macroeconomic growth flocking schooling crowd behavior and predatory trading among others   **Stochastic Optimal Control of Structures** Yongbo Peng,Jie Li,2019-06-27 This book proposes for the first time a basic formulation for structural control that takes into account the stochastic dynamics induced by engineering excitations in the nature of non stationary and non Gaussian processes Further it establishes the theory of and methods for stochastic optimal control of randomly excited engineering structures in the context of probability density evolution methods such as physically based stochastic optimal PSO control By logically integrating randomness into control gain the book helps readers design elegant control systems mitigate risks in civil engineering structures and avoid the dilemmas posed by the methods predominantly applied in current practice such as

deterministic control and classical linear quadratic Gaussian LQG control associated with nominal white noises

Continuous-Time Markov Jump Linear Systems Oswaldo Luiz do Valle Costa,Marcelo D. Fragoso,Marcos G. Todorov,2012-12-18 It has been widely recognized nowadays the importance of introducing mathematical models that take into account possible sudden changes in the dynamical behavior of a high integrity systems or a safety critical system Such systems can be found in aircraft control nuclear power stations robotic manipulator systems integrated communication networks and large scale flexible structures for space stations and are inherently vulnerable to abrupt changes in their structures caused by component or interconnection failures In this regard a particularly interesting class of models is the so called Markov jump linear systems MJLS which have been used in numerous applications including robotics economics and wireless communication Combining probability and operator theory the present volume provides a unified and rigorous treatment of recent results in control theory of continuous time MJLS This unique approach is of great interest to experts working in the field of linear systems with Markovian jump parameters or in stochastic control The volume focuses on one of the few cases of stochastic control problems with an actual explicit solution and offers material well suited to coursework introducing students to an interesting and active research area The book is addressed to researchers working in control and signal processing engineering Prerequisites include a solid background in classical linear control theory basic familiarity with continuous time Markov chains and probability theory and some elementary knowledge of operator theory *Machine Learning and Intelligent Communications* Xiangping Bryce Zhai,Bing Chen,Kun Zhu,2019-10-27 This volume constitutes the refereed post conference proceedings of the Fourth International Conference on Machine Learning and Intelligent Communications MLICOM 2019 held in Nanjing China in August 2019 The 65 revised full papers were carefully selected from 114 submissions The papers are organized thematically in machine learning intelligent positioning and navigation intelligent multimedia processing and security wireless mobile network and security cognitive radio and intelligent networking IoT intelligent satellite communications and networking green communication and intelligent networking ad hoc and sensor networks resource allocation in wireless and cloud networks signal processing in wireless and optical communications and intelligent cooperative communications and networking *Computational Financial Mathematics using MATHEMATICA®* Srdjan Stojanovic,2012-12-06 Given the explosion of interest in mathematical methods for solving problems in finance and trading a great deal of research and development is taking place in universities large brokerage firms and in the supporting trading software industry Mathematical advances have been made both analytically and numerically in finding practical solutions This book provides a comprehensive overview of existing and original material about what mathematics when allied with Mathematica can do for finance Sophisticated theories are presented systematically in a user friendly style and a powerful combination of mathematical rigor and Mathematica programming Three kinds of solution methods are emphasized symbolic numerical and Monte Carlo Nowadays only good personal

computers are required to handle the symbolic and numerical methods that are developed in this book Key features No previous knowledge of Mathematica programming is required The symbolic numeric data management and graphic capabilities of Mathematica are fully utilized Monte Carlo solutions of scalar and multivariable SDEs are developed and utilized heavily in discussing trading issues such as Black Scholes hedging Black Scholes and Dupire PDEs are solved symbolically and numerically Fast numerical solutions to free boundary problems with details of their Mathematica realizations are provided Comprehensive study of optimal portfolio diversification including an original theory of optimal portfolio hedging under non Log Normal asset price dynamics is presented The book is designed for the academic community of instructors and students and most importantly will meet the everyday trading needs of quantitatively inclined professional and individual investors **The Future of Urban Living: Smart Cities and Sustainable Infrastructure Technologies** Chakib El Mokhi,Hanaa Hachimi,Anand Nayyar,2025-08-18 This book provides a comprehensive manual for researchers practitioners policymakers as well as students striving to achieve environmental sustainment It is exploring advanced developments in smart cities infrastructure and sustainability engineering In addition this book delivers advanced methodologies emerging and innovative technologies that shape sustainable urban technologies Including the renewable energy systems of tomorrow to low impact manufacturing procedures today every section provides insight and real world implementation The book bridges the gap between theory and practice making it an essential tool to turn sustainability challenges into opportunities Salient characteristics comprise 1 Global perspective Allows for flexibility in solutions given a multitude of successful examples around the world from different cultural and geographic locations 2 Multidisciplinary approach Integrating perspectives from engineering environmental science economics and policy studies for holistic problem solving 3 Financial sustainability Innovative business models to make sustainable solutions good for the environment and even better economically This provoking literature questions conventional wisdom and promotes adventurous visions of sustainability By highlighting emerging trends in cloud computing cybersecurity and big data for urban development readers are prepared to lead the next paradigm shift in sustainable innovation *Modeling, Stochastic Control, Optimization, and Applications* George Yin,Qing Zhang,2019-07-16 This volume collects papers based on invited talks given at the IMA workshop in Modeling Stochastic Control Optimization and Related Applications held at the Institute for Mathematics and Its Applications University of Minnesota during May and June 2018 There were four week long workshops during the conference They are 1 stochastic control computation methods and applications 2 queueing theory and networked systems 3 ecological and biological applications and 4 finance and economics applications For broader impacts researchers from different fields covering both theoretically oriented and application intensive areas were invited to participate in the conference It brought together researchers from multi disciplinary communities in applied mathematics applied probability engineering biology ecology and networked science to review and substantially update most recent progress As an archive this volume presents

some of the highlights of the workshops and collect papers covering a broad range of topics **Contract Theory in Continuous-Time Models** Jakša Cvitanic,Jianfeng Zhang,2012-09-26 In recent years there has been a significant increase of interest in continuous time Principal Agent models or contract theory and their applications Continuous time models provide a powerful and elegant framework for solving stochastic optimization problems of finding the optimal contracts between two parties under various assumptions on the information they have access to and the effect they have on the underlying profit loss values This monograph surveys recent results of the theory in a systematic way using the approach of the so called Stochastic Maximum Principle in models driven by Brownian Motion Optimal contracts are characterized via a system of Forward Backward Stochastic Differential Equations In a number of interesting special cases these can be solved explicitly enabling derivation of many qualitative economic conclusions **Optimal Control Theory** Suresh P. Sethi,2022-01-03 This new 4th edition offers an introduction to optimal control theory and its diverse applications in management science and economics It introduces students to the concept of the maximum principle in continuous as well as discrete time by combining dynamic programming and Kuhn Tucker theory While some mathematical background is needed the emphasis of the book is not on mathematical rigor but on modeling realistic situations encountered in business and economics It applies optimal control theory to the functional areas of management including finance production and marketing as well as the economics of growth and of natural resources In addition it features material on stochastic Nash and Stackelberg differential games and an adverse selection model in the principal agent framework Exercises are included in each chapter while the answers to selected exercises help deepen readers understanding of the material covered Also included are appendices of supplementary material on the solution of differential equations the calculus of variations and its ties to the maximum principle and special topics including the Kalman filter certainty equivalence singular control a global saddle point theorem Sethi Skiba points and distributed parameter systems Optimal control methods are used to determine optimal ways to control a dynamic system The theoretical work in this field serves as the foundation for the book in which the author applies it to business management problems developed from his own research and classroom instruction The new edition has been refined and updated making it a valuable resource for graduate courses on applied optimal control theory but also for financial and industrial engineers economists and operational researchers interested in applying dynamic optimization in their fields **Modelling Extremal Events** Paul Embrechts,Claudia Klüppelberg,Thomas Mikosch,2013-01-02 A reader s first impression on leafing through this book is of the large number of graphs and diagrams used to illustrate shapes of distributions and to show real data examples in various ways A closer reading reveals a nice mix of theory and applications with the copious graphical illustrations alluded to Such a mixture is of course dear to the heart of the applied probabilist statistician and should impress even the most ardent theorists MATHEMATICAL REVIEWS *Stochastic Linear-Quadratic Optimal Control Theory: Open-Loop and Closed-Loop Solutions* Jingrui Sun,Jiongmin Yong,2020-06-29 This book gathers the

most essential results including recent ones on linear quadratic optimal control problems which represent an important aspect of stochastic control It presents the results in the context of finite and infinite horizon problems and discusses a number of new and interesting issues Further it precisely identifies for the first time the interconnections between three well known relevant issues the existence of optimal controls solvability of the optimality system and solvability of the associated Riccati equation Although the content is largely self contained readers should have a basic grasp of linear algebra functional analysis and stochastic ordinary differential equations The book is mainly intended for senior undergraduate and graduate students majoring in applied mathematics who are interested in stochastic control theory However it will also appeal to researchers in other related areas such as engineering management finance economics and the social sciences

  Mathematics of Public Health Jummy David,Jianhong Wu,2023-12-30 This volume addresses SDG 3 from a mathematical standpoint sharing novel perspectives of existing communicable disease modelling technologies of the next generation and disseminating new developments in modelling methodologies and simulation techniques These methodologies are important for training and research in communicable diseases and can be applied to other threats to human health The contributions contained in this collection book cover a range of modelling techniques that have been and may be used to support decision making on critical health related issues such as Resource allocation Impact of climate change on communicable diseases Interaction of human behaviour change and disease spread Disease outbreak trajectories projection Public health interventions evaluation Preparedness and mitigation of emerging and re emerging infectious diseases outbreaks Development of vaccines and decisions around vaccine allocation and optimization The diseases and public health issues in this volume include but are not limited to COVID 19 HIV Influenza antimicrobial resistance AMR the opioid epidemic Lyme Disease Zika and Malaria In addition this volume compares compartmental models agent based models machine learning and network Readers have an opportunity to learn from the next generation perspective of evolving methodologies and algorithms in modelling infectious diseases the mathematics behind them the motivation for them and some applications to supporting critical decisions on prevention and control of communicable diseases This volume was compiled from the weekly seminar series organized by the Mathematics for Public Health MfPH Next Generation Network This network brings together the next generation of modellers from across Canada and the world developing the latest mathematical models modeling methodologies and analytical and simulation tools for communicable diseases of global public health concerns The weekly seminar series provides a unique forum for this network and their invited guest speakers to share their perspectives on the status and future directions of mathematics of public health   **Hybrid Switching Diffusions** G. George Yin,Chao Zhu,2009-10-03 This book encompasses the study of hybrid switching di usion processes and their applications The word hybrid signi es the coexistence of c tinuous dynamics and discrete events which is one of the distinct features of the processes under consideration Much of the book is concerned with the interactions of the continuous dynamics and the

discrete events Our motivations for studying such processes originate from emerging and isting applications in wireless communications signal processing queueing networks production planning biological systems ecosystems nancial engineering and modeling analysis and control and optimization of lar scale systems under the in uence of random environments Displaying mixture distributions switching di usions may be described by the associated operators or by systems of stochastic di erential eq tions together with the probability transition laws of the switching actions We either have Markov modulated switching di usions or processes with continuous state dependent switching The latter turns out to be much more challenging to deal with Viewing the hybrid di usions as a number of di usions joined together by the switching process they may be se ingly not much di erent from their di usion counterpart Nevertheless the underlying problems become more di cult to handle especially when the switching processes depend on continuous states The di culty is due to the interaction of the discrete and continuous processes and the tangled and hybrid information pattern   Mathematical Control Theory and Finance Andrey Sarychev,Albert Shiryaev,Manuel Guerra,Maria do Rosário Grossinho,2009-03-31 Control theory provides a large set of theoretical and computational tools with applications in a wide range of elds running from pure branches of mathematics like geometry to more applied areas where the objective is to nd solutions to real life problems as is the case in robotics control of industrial processes or nance The high tech character of modern business has increased the need for advanced methods These rely heavily on mathematical techniques and seem indispensable for competitiveness of modern enterprises It became essential for the nancial analyst to possess a high level of mathematical skills C versely the complex challenges posed by the problems and models relevant to nance have for a long time been an important source of new research topics for mathematicians The use of techniques from stochastic optimal control constitutes a well established and important branch of mathematical nance Up to now other branches of control theory have found comparatively less application in n cial problems To some extent deterministic and stochastic control theories developed as di erent branches of mathematics However there are many points of contact between them and in recent years the exchange of ideas between these elds has intensi ed Some concepts from stochastic calculus e g rough paths havedrawntheattentionofthedeterministiccontroltheorycommunity Also some ideas and tools usual in deterministic control e g geometric algebraic or functional analytic methods can be successfully applied to stochastic c trol   *Partially Observable Linear Systems Under Dependent Noises* Agamirza E. Bashirov,2012-12-06 Noise is a rich concept playing an underlying role in human activity Consideration of the noise phenomenon in arts and sciences respectively makes the distinction between both domains more obvious Artists create deliberate noise the masterpieces of literature music modern fine art etc are those where a clear idea traditionally related to such concepts as love is presented under a skilful veil of deliberate noise On the contrary sciences fight against noise a scientific discovery is a law of nature extracted from a noisy medium and refined This book discusses the methods of fighting against noise It can be regarded as a mathematical view of specific engineering

problems with known and new methods of control and estimation in noisy media The main feature of this book is the investigation of stochastic optimal control and estimation problems with the noise processes acting dependently on the state or signal and observation systems While multiple early and recent findings on the subject have been obtained and challenging problems remain to be solved this subject has not yet been dealt with systematically nor properly investigated The discussion is given for infinite dimensional systems but within the linear quadratic framework for continuous and finite time horizon In order to make this book self contained some background material is provided Consequently the target readers of this book are both applied mathematicians and theoretically oriented engineers who are designing new technology as well as students of the related branches The book may also be used as a reference manual in that part of functional analysis that is needed for problems of infinite dimensional linear systems theory **Numerical Methods for Stochastic Control Problems in Continuous Time** Harold Kushner,Paul G. Dupuis,2013-11-27 Changes in the second edition The second edition differs from the first in that there is a full development of problems where the variance of the diffusion term and the jump distribution can be controlled Also a great deal of new material concerning deterministic problems has been added including very efficient algorithms for a class of problems of wide current interest This book is concerned with numerical methods for stochastic control and optimal stochastic control problems The random process models of the controlled or uncontrolled stochastic systems are either diffusions or jump diffusions Stochastic control is a very active area of research and new problem formulations and sometimes surprising applications appear regu larly We have chosen forms of the models which cover the great bulk of the formulations of the continuous time stochastic control problems which have appeared to date The standard formats are covered but much emphasis is given to the newer and less well known formulations The controlled process might be either stopped or absorbed on leaving a constraint set or upon first hitting a target set or it might be reflected or projected from the boundary of a constraining set In some of the more recent applications of the reflecting boundary problem for example the so called heavy traffic approximation problems the directions of reflection are actually discontin uous In general the control might be representable as a bounded function or it might be of the so called impulsive or singular control types *Statistics of Random Processes* Robert Liptser,Alʹbert Nikolaevich Shiri︠a︡ev,Albert N. Shiryaev,2001 These volumes cover non linear filtering prediction and smoothing theory and its applications to the problem of optimal estimation control with incomplete data information theory and sequential testing of hypothesis Also presented is the theory of martingales of interest to those who deal with problems in financial mathematics These editions include new material expanded chapters and comments on recent progress in the field **Mathematics Applied to Engineering, Modelling, and Social Issues** Frank T. Smith,Hemen Dutta,John N. Mordeson,2019-03-14 This book presents several aspects of research on mathematics that have significant applications in engineering modelling and social matters discussing a number of current and future social issues and problems in which mathematical tools can be

beneficial Each chapter enhances our understanding of the research problems in a particular an area of study and highlights the latest advances made in that area The self contained contributions make the results and problems discussed accessible to readers and provides references to enable those interested to follow subsequent studies in still developing fields Presenting real world applications the book is a valuable resource for graduate students researchers and educators It appeals to general readers curious about the practical applications of mathematics in diverse scientific areas and social problems

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web she writes and gives regular public talks on the disgusting and dangerous side of science kathryn s first book was the international best seller a is for arsenic the poisons of agatha christie which was shortlisted for a mystery readers international macavity award and a bma book award

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