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Continuous-Time Markov Decision Processes

Theory and Applications



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Continuous-Time Markov Decision Processes Alexey Piunovskiy, Yi Zhang, 2020-11-09 This book offers a systematic and rigorous treatment of continuous time Markov decision processes covering both theory and possible applications to queueing systems epidemiology finance and other fields Unlike most books on the subject much attention is paid to problems with functional constraints and the realizability of strategies Three major methods of investigations are presented based on dynamic programming linear programming and reduction to discrete time problems Although the main focus is on models with total discounted or undiscounted cost criteria models with average cost criteria and with impulsive controls are also discussed in depth The book is self contained A separate chapter is devoted to Markov pure jump processes and the appendices collect the requisite background on real analysis and applied probability All the statements in the main text are proved in detail Researchers and graduate students in applied probability operational research statistics and engineering will find this monograph interesting useful and valuable

Finite State Continuous-time Markov Decision Processes, with Applications to a Class of Optimization Problems in Queueing Theory Bruce L. Miller, 1967 Markov Decision Processes with Applications to Finance Nicole Bäuerle, Ulrich Rieder, 2011-06-06 The theory of Markov decision processes focuses on controlled Markov chains in discrete time The authors establish the theory for general state and action spaces and at the same time show its application by means of numerous examples mostly taken from the fields of finance and operations research By using a structural approach many technicalities concerning measure theory are avoided They cover problems

with finite and infinite horizons as well as partially observable Markov decision processes piecewise deterministic Markov decision processes and stopping problems The book presents Markov decision processes in action and includes various state of the art applications with a particular view towards finance It is useful for upper level undergraduates Master s students and researchers in both applied probability and finance and provides exercises without solutions

Stochastic Analysis, Filtering, and Stochastic Optimization George Yin,Thaleia Zariphopoulou,2022-04-22 This volume is a collection of research works to honor the late Professor Mark H A Davis whose pioneering work in the areas of Stochastic Processes Filtering and Stochastic Optimization spans more than five decades Invited authors include his dissertation advisor past collaborators colleagues mentees and graduate students of Professor Davis as well as scholars who have worked in the above areas Their contributions may expand upon topics in piecewise deterministic processes pathwise stochastic calculus martingale methods in stochastic optimization filtering mean field games time inconsistency as well as impulse singular risk sensitive and robust stochastic control

An Introduction to Optimal Control Theory Onésimo

Hernández-Lerma,Leonardo R. Laura-Guarachi,Saul Mendoza-Palacios,David González-Sánchez,2023-02-21 This book introduces optimal control problems for large families of deterministic and stochastic systems with discrete or continuous time parameter These families include most of the systems studied in many disciplines including Economics Engineering Operations Research and Management Science among many others The main objective is to give a concise systematic and reasonably self contained presentation of some key topics in optimal control theory To this end most of the analyses are based on the dynamic programming DP technique This technique is applicable to almost all control problems that appear in theory and applications They include for instance finite and infinite horizon control problems in which the underlying dynamic system follows either a deterministic or stochastic difference or differential equation In the infinite horizon case it also uses DP to study undiscounted problems such as the ergodic or long run average cost After a general introduction to control problems the book covers the topic dividing into four parts with different dynamical systems control of discrete time deterministic systems discrete time stochastic systems ordinary differential equations and finally a general continuous time MCP with applications for stochastic differential equations The first and second part should be accessible to undergraduate students with some knowledge of elementary calculus linear algebra and some concepts from probability theory random variables expectations and so forth Whereas the third and fourth part would be appropriate for advanced undergraduates or graduate students who have a working knowledge of mathematical analysis derivatives integrals and stochastic processes

Modern Trends in Controlled Stochastic Processes Alexey B. Piunovskiy,2010-09 World leading experts give their accounts of the modern mathematical models in the field Markov Decision Processes controlled diffusions piece wise deterministic processes etc with a wide range of performance functionals One of the aims is to give a general view on the state of the art The authors use Dynamic Programming Convex Analytic Approach several numerical methods index based

approach and so on Most chapters either contain well developed examples or are entirely devoted to the application of the mathematical control theory to real life problems from such fields as Insurance Portfolio Optimization and Information Transmission The book will enable researchers academics and research students to get a sense of novel results concepts models methods and applications of controlled stochastic processes

Continuous-Time Markov Chains and Applications George G. Yin, Qing Zhang, 2012-12-06 This book is concerned with continuous time Markov chains It develops an integrated approach to singularly perturbed Markovian systems and reveals interrelations of stochastic processes and singular perturbations In recent years Markovian formulations have been used routinely for numerous real world systems under uncertainties Quite often the underlying Markov chain is subject to rather frequent fluctuations and the corresponding states are naturally divisible to a number of groups such that the chain fluctuates very rapidly among different states within a group but jumps less frequently from one group to another Various applications in engineering economics and biological and physical sciences have posed increasing demands on an in depth study of such systems A basic issue common to many different fields is the understanding of the distribution and the structure of the underlying uncertainty Such needs become even more pressing when we deal with complex and or large scale Markovian models whose closed form solutions are usually very difficult to obtain Markov chain a well known subject has been studied by a host of researchers for many years While nonstationary cases have been treated in the literature much emphasis has been on stationary Markov chains and their basic properties such as ergodicity recurrence and stability In contrast this book focuses on singularly perturbed nonstationary Markov chains and their asymptotic properties Singular perturbation theory has a long history and is a powerful tool for a wide variety of applications

Stochastic Model Checking Anne Remke, Mariëlle Stoelinga, 2014-11-03 The use of stochastic models in computer science is wide spread for instance in performance modeling analysis of randomized algorithms and communication protocols which form the structure of the Internet Stochastic model checking is an important field in stochastic analysis It has rapidly gained popularity due to its powerful and systematic methods to model and analyze stochastic systems This book presents 7 tutorial lectures given by leading scientists at the ROCKS Autumn School on Stochastic Model Checking held in Vahrn Italy in October 2012 The 7 chapters of this tutorial went through two rounds of reviewing and improvement and are summarizing the state of the art in the field centered around the three areas of stochastic models abstraction techniques and stochastic model checking

Optimization Under Uncertainty with Applications to Aerospace Engineering Massimiliano Vasile, 2021-02-15 In an expanding world with limited resources optimization and uncertainty quantification have become a necessity when handling complex systems and processes This book provides the foundational material necessary for those who wish to embark on advanced research at the limits of computability collecting together lecture material from leading experts across the topics of optimization uncertainty quantification and aerospace engineering The aerospace sector in particular has stringent performance requirements on highly complex systems for which

solutions are expected to be optimal and reliable at the same time The text covers a wide range of techniques and methods from polynomial chaos expansions for uncertainty quantification to Bayesian and Imprecise Probability theories and from Markov chains to surrogate models based on Gaussian processes The book will serve as a valuable tool for practitioners researchers and PhD students

Markov Decision Processes Martin L. Puterman, 2014-08-28 The Wiley Interscience Paperback Series consists of selected books that have been made more accessible to consumers in an effort to increase global appeal and general circulation With these new unabridged softcover volumes Wiley hopes to extend the lives of these works by making them available to future generations of statisticians mathematicians and scientists This text is unique in bringing together so many results hitherto found only in part in other texts and papers The text is fairly self contained inclusive of some basic mathematical results needed and provides a rich diet of examples applications and exercises The bibliographical material at the end of each chapter is excellent not only from a historical perspective but because it is valuable for researchers in acquiring a good perspective of the MDP research potential Zentralblatt fur Mathematik it is of great value to advanced level students researchers and professional practitioners of this field to have now a complete volume with more than 600 pages devoted to this topic

Markov Decision Processes Discrete Stochastic Dynamic Programming represents an up to date unified and rigorous treatment of theoretical and computational aspects of discrete time Markov decision processes Journal of the American Statistical Association

INFORMS Annual Meeting Institute for Operations Research and the Management Sciences. National Meeting, 2009

Finite State Continuous-time Markov Decision Processes Bruce Leonard Miller, 1967 *Discrete Dynamic Programming with Sensitive Discount Optimality Criteria* Stanford University. Department of Operations Research, 1968 Stationary discrete and continuous time parameter finite state and action Markovian decision processes with substochastic transition matrices are studied where the future rewards are discounted The methods of successive approximations and policy improvement are shown to converge to the maximal expected discounted reward when the interest rate is negative provided the expected discounted time until the process stops is finite under every stationary policy A family of discount optimality criteria of varying degrees of sensitivity is introduced The family includes and unifies the discount criteria studied by Blackwell The existence of stationary optimal policies is established constructively and the class of such policies is characterized The algorithms are essentially specializations and refinements of a policy improvement method recently devised by Miller and the author for finding stationary policies having maximal expected discounted reward for all small enough positive interest rates The results exploit the fact that the Laurent expansion in ρ the interest rate about the origin of the discounted return under a stationary policy has a simple form

Author *Management of Production* Martin Kenneth Starr, 1970 [Markov Decision Processes with Their Applications](#) Qiyong Hu, Wuyi Yue, 2007-09-14 Markov decision processes MDPs also called stochastic dynamic programming were first studied in the 1960s MDPs can be used to model and solve dynamic decision making problems that are multi period and

occur in stochastic circumstances There are three basic branches in MDPs discrete time MDPs continuous time MDPs and semi Markov decision processes Starting from these three branches many generalized MDPs models have been applied to various practical problems These models include partially observable MDPs adaptive MDPs MDPs in stochastic environments and MDPs with multiple objectives constraints or imprecise parameters Markov Decision Processes With Their Applications examines MDPs and their applications in the optimal control of discrete event systems DESs optimal replacement and optimal allocations in sequential online auctions The book presents four main topics that are used to study optimal control problems a new methodology for MDPs with discounted total reward criterion transformation of continuous time MDPs and semi Markov decision processes into a discrete time MDPs model thereby simplifying the application of MDPs MDPs in stochastic environments which greatly extends the area where MDPs can be applied applications of MDPs in optimal control of discrete event systems optimal replacement and optimal allocation in sequential online auctions This book is intended for researchers mathematicians advanced graduate students and engineers who are interested in optimal control operation research communications manufacturing economics and electronic commerce Current Index to Statistics, Applications, Methods and Theory ,1999 The Current Index to Statistics CIS is a bibliographic index of publications in statistics probability and related fields **The Annals of Mathematical Statistics** ,1971 **Comprehensive Dissertation Index** ,1989

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