Modeling And Analysis Of Stochastic Systems By Vidyadhar G Kulkarni

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LAP Lambert Academic Publishing
The markets for electricity, gas and temperature have distinctive features, which provide the focus for countless studies. For instance, electricity and gas prices may soar several magnitudes above their normal levels within a short time due to imbalances in supply and demand, yielding what is known as spikes in the spot prices. The markets are also largely influenced by seasons, since power demand for heating and cooling varies over the year. The incompleteness of the markets, due to nonstorability of electricity and temperature as well as limited storage capacity of gas, makes spot-forward hedging impossible. Moreover, futures contracts are typically settled over a time period rather than at a fixed date. All these aspects of the markets create new challenges when analyzing price dynamics of spot, futures and other derivatives.This book provides a concise and rigorous treatment on the stochastic modeling of energy markets. Ornstein?Uhlenbeck processes are described as the basic modeling tool for spot price dynamics, where innovations are driven by time-inhomogeneous jump processes. Temperature futures are studied based on a continuous higher-order autoregressive model for the temperature dynamics. The theory presented here pays special attention to the seasonality of volatility and the Samuelson effect. Empirical studies using data from electricity, temperature and gas markets are given to link theory to practice.

Stochastic Modeling Academic Press
Stochastic Models in Biology describes the usefulness of the theory of stochastic process in studying biological phenomena. The book describes analysis of biological systems and experiments though probabilistic models rather than deterministic methods. The text reviews the mathematical analyses for modeling different biological systems such as the random processes continuous in time and discrete in state space. The book also discusses population growth and extinction through Malthus' law and the work of MacArthur and Wilson. The text then explains the dynamics of a population of interacting species. The book also addresses population genetics under systematic evolutionary pressures known as deterministic equations and genetic changes in a finite population known as stochastic equations. The text then turns to stochastic modeling of biological systems at the molecular level, particularly the kinetics of biochemical reactions. The book also presents various useful equations such as the differential equation for generating functions for birth and death processes. The text can prove valuable for biochemists, cellular biologists, and researchers in the medical and chemical field who are tasked to perform data analysis.

Stochastic Models, Statistics and Their Applications World Scientific
A First Course in Probability with an Emphasis on Stochastic Modeling Probability and Stochastic Modeling not only covers all the topics found in a traditional introductory probability course, but also emphasizes stochastic modeling, including Markov chains, birth-death processes, and reliability models. Unlike most undergraduate-level probability texts, the book also focuses on increasingly important areas, such as martingales, classification of dependency structures, and risk evaluation. Numerous examples, exercises, and models using real-world data demonstrate the practical possibilities and restrictions of different approaches and help students grasp general concepts and theoretical results. The text is suitable for majors in mathematics and statistics as well as majors in computer science, economics, finance, and physics. The author offers two explicit options to teaching the material, which is reflected in "routes" designated by special "roadside" markers. The first route contains basic, self-contained material for a one-semester course. The second provides a more complete exposition for a two-semester course or self-study.

Handbook of Stochastic Models and Analysis of Manufacturing System Operations World Scientific
This book is a collective volume authored by leading scientists in the field of stochastic modelling, associated statistical topics and corresponding applications. The main classes of stochastic processes for dependent data investigated throughout this book are Markov, semi-Markov, autoregressive and piecewise deterministic Markov models. The material is divided into three parts corresponding to: (i) Markov and semi-Markov processes, (ii) autoregressive processes and (iii) techniques based on divergence measures and entropies. A special attention is payed to applications in reliability, survival analysis and related fields.

Principles, Methods, and Case Studies, Vol. II, AAPG Computer Applications in Geology 5 CRC Press
An integrated treatment of models and computational methods for stochastic design and stochastic optimization problems. Through many realistic examples, stochastic models and algorithmic solution methods are explored in a wide variety of application areas. These include inventory/production control, reliability, maintenance, queueing, and computer and communication systems. Includes many problems, a significant number of which require the writing of a computer program.

On the Use of Stochastic Processes in Modeling Reliability Problems Introduction to Modeling and Analysis of Stochastic Systems
Building on the author’s more than 35 years of teaching experience, Modeling and Analysis of Stochastic Systems, Third Edition, covers the most important classes of stochastic processes used in the modeling of diverse systems. For each

class of stochastic process, the text includes its definition, characterization, applications, transient and limiting behavior, first passage times, and cost/reward models. The third edition has been updated with several new applications, including the Google search algorithm in discrete time Markov chains, several examples from health care and finance in continuous time Markov chains, and square root staffing rule in Queuing models. More than 50 new exercises have been added to enhance its use as a course text or for self-study. The sequence of chapters and exercises has been maintained between editions, to enable those now teaching from the second edition to use the third edition. Rather than offer special tricks that work in specific problems, this book provides thorough coverage of general tools that enable the solution and analysis of stochastic models. After mastering the material in the text, readers will be well-equipped to build and analyze useful stochastic models for real-life situations.
Modeling, Analysis, Design, and Control of Stochastic Systems Cambridge University Press
Hydrological extremes have become a major concern because of their devastating consequences and their increased risk as a result of climate change and the growing concentration of people and infrastructure in high-risk zones. The analysis of hydrological extremes is challenging due to their rarity and small sample size, and the interconnections between different types of extremes and becomes further complicated by the untrustworthy representation of meso-scale processes involved in extreme events by coarse spatial and temporal scale models as well as biased or missing observations due to technical difficulties during extreme conditions. The complexity of analyzing hydrological extremes calls for robust statistical methods for the treatment of such events. This Special Issue is motivated by the need to apply and develop innovative stochastic and statistical approaches to analyze hydrological extremes under current and future climate conditions. The papers of this Special Issue focus on six topics associated with hydrological extremes: Historical changes in hydrological extremes; Projected changes in hydrological extremes; Downscaling of hydrological extremes; Early warning and forecasting systems for drought and flood; Interconnections of hydrological extremes; Applicability of satellite data for hydrological studies.
Bayesian Analysis of Stochastic Process Models Springer
This monograph contains authors results of a few last years in a modeling and an analysis of stochastic networks. Considered problems origin mainly in reliability and risk analysis and their applications are actual now. The monograph concerns: an estimation of queueing networks parameters, an analysis of cooperative effects in queuing networks, a construction of algorithms for a calculation of random networks reliability and ruin probabilities in classical risk models. These problems are solved by some special asymptotic and algebraic methods which allow to construct sufficiently fast and efficiency numerical algorithms. This monograph may be suggested to researchers and post graduate students who deal with queuing, reliability and risk theories and their applications.
An Introduction to Stochastic Modeling New Age International
Three coherent parts form the material covered in this text, portions of which have not been widely covered in traditional textbooks. In this coverage the reader is quickly introduced to several different topics enriched with 175 exercises which focus on real-world problems. Exercises range from the classics of probability theory to more exotic research-oriented problems based on numerical simulations. Intended for graduate students in mathematics and applied sciences, the text provides the tools and training needed to write and use programs for research purposes. The first part of the text begins with a brief review of measure theory and revisits the main concepts of probability theory, from random variables to the standard limit theorems. The second part covers traditional material on stochastic processes, including martingales, discrete-time Markov chains, Poisson processes, and continuous-time Markov chains. The theory developed is illustrated by a variety of examples surrounding applications such as the gambler's ruin chain, branching processes, symmetric random walks, and queueing systems. The third, more research-oriented part of the text, discusses special stochastic processes of interest in physics, biology, and sociology. Additional emphasis is placed on minimal models that have been used historically to develop new mathematical techniques in the field of stochastic processes: the logistic growth process, the Wright –Fisher model, Kingman's coalescent, percolation models, the contact process, and the voter model. Further treatment of the material explains how these special processes are connected to each other from a modeling perspective as well as their simulation capabilities in C and MatlabTM.
Stochastic Modeling IGI Global
This book provides a self-contained review of all the relevant topics in probability theory. A software package called MAXIM, which runs on MATLAB, is made available for downloading. Vidyadhar G. Kulkarni is Professor of Operations Research at the University of North Carolina at Chapel Hill.
Stochastic Modeling and Analysis AAPG
This handbook surveys important stochastic problems and models in manufacturing system operations and their stochastic analysis. Using analytical models to design and control manufacturing systems and their operations entail critical stochastic performance analysis as well as integrated optimization models of these systems. Topics deal with the areas of facilities planning, transportation, and material handling systems, logistics and supply chain management, and integrated productivity and quality models covering: • Stochastic modeling and analysis of manufacturing systems • Design, analysis, and optimization of manufacturing systems • Facilities planning, transportation, and material handling systems analysis • Production planning, scheduling systems, management, and control • Analytical approaches to logistics and supply chain management • Integrated productivity and quality models, and their analysis • Literature surveys of issues relevant in manufacturing systems • Case studies of manufacturing system operations and analysis Today's manufacturing system operations are becoming increasingly complex. Advanced knowledge of best practices for treating these problems is not always well known. The purpose of the book is to create a foundation for the development of stochastic models and their analysis in manufacturing system operations. Given the handbook nature of the volume, introducing basic principles, concepts, and algorithms for treating these problems and their solutions is the main intent of this handbook. Readers unfamiliar with these research areas will be able to find a research foundation for studying these problems and systems.
Introduction to Modeling and Analysis of Stochastic Systems Springer Science & Business Media
Bayesian analysis of complex models based on stochastic processes has in recent years become a growing area. This book provides a unified treatment of Bayesian analysis of models based on stochastic processes, covering the main classes of stochastic processing including modeling, computational, inference, forecasting, decision making and important applied models. Key features: Explores Bayesian analysis of models based on stochastic processes, providing a unified treatment.

Provides a thorough introduction for research students. Computational tools to deal with complex problems are illustrated along with real life case studies Looks at inference, prediction and decision making. Researchers, graduate and advanced undergraduate students interested in stochastic processes in fields such as statistics, operations research (OR), engineering, finance, economics, computer science and Bayesian analysis will benefit from reading this book. With numerous applications included, practitioners of OR, stochastic modelling and applied statistics will also find this book useful.

Stochastic Modelling of Electricity and Related Markets John Wiley & Sons

This volume presents the latest advances and trends in stochastic models and related statistical procedures. Selected peer-reviewed contributions focus on statistical inference, quality control, change-point analysis and detection, empirical processes, time series analysis, survival analysis and reliability, statistics for stochastic processes, big data in technology and the sciences, statistical genetics, experiment design, and stochastic models in engineering. Stochastic models and related statistical procedures play an important part in furthering our understanding of the challenging problems currently arising in areas of application such as the natural sciences, information technology, engineering, image analysis, genetics, energy and finance, to name but a few. This collection arises from the 12th Workshop on Stochastic Models, Statistics and Their Applications, Wroclaw, Poland.

Modeling and Analysis of Stochastic Networks Courier Corporation

Modeling spatial and spatio-temporal continuous processes is an important and challenging problem in spatial statistics. Advanced Spatial Modeling with Stochastic Partial Differential Equations Using R and INLA describes in detail the stochastic partial differential equations (SPDE) approach for modeling continuous spatial processes with a Matérn covariance, which has been implemented using the integrated nested Laplace approximation (INLA) in the R-INLA package. Key concepts about modeling spatial processes and the SPDE approach are explained with examples using simulated data and real applications. This book has been authored by leading experts in spatial statistics, including the main developers of the INLA and SPDE methodologies and the R-INLA package. It also includes a wide range of applications: * Spatial and spatio-temporal models for continuous outcomes * Analysis of spatial and spatio-temporal point patterns * Coregionalization spatial and spatio-temporal models * Measurement error spatial models * Modeling preferential sampling * Spatial and spatio-temporal models with physical barriers * Survival analysis with spatial effects * Dynamic space-time regression * Spatial and spatio-temporal models for extremes * Hurdle models with spatial effects * Penalized Complexity priors for spatial models All the examples in the book are fully reproducible. Further information about this book, as well as the R code and datasets used, is available from the book website at http://www.r-inla.org/spde-book. The tools described in this book will be useful to researchers in many fields such as biostatistics, spatial statistics, environmental sciences, epidemiology, ecology and others. Graduate and Ph.D. students will also find this book and associated files a valuable resource to learn INLA and the SPDE approach for spatial modeling.

Statistical Analysis and Stochastic Modelling of Hydrological Extremes Springer Science & Business Media

Decision-making is an important task no matter the industry. Operations research, as a discipline, helps alleviate decision-making problems through the extraction of reliable information related to the task at hand in order to come to a viable solution. Integrating stochastic processes into operations research and management can further aid in the decision-making process for industrial and management problems. Stochastic Processes and Models in Operations Research emphasizes mathematical tools and equations relevant for solving complex problems within business and industrial settings. This research-based publication aims to assist scholars, researchers, operations managers, and graduate-level students by providing comprehensive exposure to the concepts, trends, and technologies relevant to stochastic process modeling to solve operations research problems.

Modeling and Analysis of Stochastic Systems John Wiley & Sons

The advent of high speed computing on the PC provides new possibilities for data based modeling. One key is simulation. Simulation gives us a venue for dealing with parameter estimation in stochastic models not previously tractable. We consider examples from oncology, economics, statistical process control and epidemiology. We essentially consider two realities, the first consisting of random nonparametric interpolations of the data and the second random implementations based on a mathematical model. We use simulation to change the model parameters to bring the reality of the model to consistency with that of the data. Also, high speed computing enables us to carry out nonparametric data analysis in higher dimensions. The key here is to build algebraic rather than geometrical algorithms. We show how nonparametric data analysis in high dimensions (say greater than three) should generally not be treated as one of nonparametric density estimation but rather should start with finding centers of relatively high density and then use parametric approximations in the neighborhoods of these modes.

Interest Rate Models: an Infinite Dimensional Stochastic Analysis Perspective Springer

Uncertainty Quantification (UQ) is a relatively new research area which describes the methods and approaches used to supply quantitative descriptions of the effects of uncertainty, variability and errors in simulation problems and models. It is rapidly becoming a field of increasing importance, with many real-world applications within statistics, mathematics, probability and engineering, but also within the natural sciences. Literature on the topic has up until now been largely based on polynomial chaos, which raises difficulties when considering different types of approximation and does not lead to a unified presentation of the methods. Moreover, this description does not consider either deterministic problems or infinite dimensional ones. This book gives a unified, practical and comprehensive presentation of the main techniques used for the characterization of the effect of uncertainty on numerical models and on their exploitation in numerical problems. In particular, applications to linear and nonlinear systems of equations, differential equations, optimization and reliability are presented. Applications of stochastic methods to deal with deterministic numerical problems are also discussed. Matlab® illustrates the implementation of these methods and makes the book suitable as a textbook and for self-study. Discusses the main ideas of Stochastic Modeling and Uncertainty Quantification using Functional Analysis Details listings of Matlab® programs implementing the main methods which complete the methodological presentation by a practical implementation Construct your own implementations from provided worked examples

Stochastic Processes, Multiscale Modeling, and Numerical Methods for Computational Cellular Biology John Wiley & Sons

This introduction to techniques for modeling dynamic stochastic systems also provides a guide to the mathematical, numerical, and simulation tools used in systems analysis. The text explores Poisson and renewal processes, Markov chains in discrete and continuous time, semi-Markov processes, and queuing processes.

Solution manual available upon request. 1995 edition.
Shocks, Burn-in and Heterogeneous populations Springer
This book was first published in 2004. Many observed phenomena, from the changing health of a patient to values on the stock market, are characterised by quantities that vary over time: stochastic processes are designed to study them. This book introduces practical methods of applying stochastic processes to an audience knowledgeable only in basic statistics. It covers almost all aspects of the subject and presents the theory in an easily accessible form that is highlighted by application to many examples. These examples arise from dozens of areas, from sociology through medicine to engineering. Complementing these are exercise sets making the book suited for introductory courses in stochastic processes. Software (available from www.cambridge.org) is provided for the freely available R system for the reader to apply to all the models presented.
Stochastic Modeling and Geostatistics CRC Press
Stochastic processes are powerful tools for the investigation of reliability and availability of repairable equipment and systems. Because of the involved models, and in order to be mathematically tractable, these processes are generally confined to the class of regenerative stochastic processes with a finite state space, to which belong: renewal processes, Markov processes, semi-Markov processes, and more general regenerative processes with only one (or a few) regeneration staters). The object of this monograph is to review these processes and to use them in solving some reliability problems encountered in practical applications. Emphasis is given to a comprehensive exposition of the analytical procedures, to the limitations in volved, and to the unification and extension of. the models known in the literature. The models investigated here assume. that systems have only one repair crew and that no further failure can occur at system down. Repair and failure rates are general ized step-by-step, up to the case in which the involved process is regenerative with only one (or a few) regeneration state(s). Investigations deal with different kinds of reliabilities and availabilities for series/parallel structures. Preventive main tenance and imperfect switching are considered in some examples.