Stochastic Modeling And Mathematical Statistics A Text For Statisticians And Quantitative Scientists Chapman Hallcrc Texts In Statistical Science

Textile Engineering
Probability and Stochastic Modeling
Stochastic Modeling
Stochastic Modelling of Reaction–Diffusion Processes
A Text for Statisticians and Quantitative Scientists
Statistical Techniques, Design of Experiments and Stochastic Modeling
Stochastic Modeling and Mathematical Statistics
Uncertainty Quantification and Stochastic Modeling with Matlab
Dresden, Germany, March 2019
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An Introduction to Stochastic Modeling
With R Examples
Stationary Stochastic Models
Level Crossing Methods in Stochastic Models
Stochastic Calculus and Stochastic Models
Stochastic Modelling for Systems Biology, Third Edition
Probability, Statistics, and Stochastic Processes
Concepts in Probability and Stochastic Modeling
In Memory of Andrei Yakovlev
Stochastic Modelling of Electricity and Related Markets
Stochastic Models in Reliability
A Computational Approach
Dresden, Germany, March 2019
Analysis and Simulation
Introduction to Probability and Mathematical Statistics
Stochastic Models, Statistics and Their Applications
Simulation and Inference for Stochastic Differential Equations
Introduction to Stochastic Models
Stochastic Models and Mathematical Methods
Stochastic Simulation
A New Foundation for Stochastic Modeling
Stochastic Modeling and Analysis
Stochastic Modeling
Statistical Inference for Stochastic Processes
Applied Stochastic Differential Equations
Insurance Mathematics
Identifiability In Stochastic Models
Statistical Topics and Stochastic Models for Dependent Data with Applications
A Text for Statisticians and Quantitative Scientists

MALIK WEAVER

Textile Engineering Springer
This book provides a comprehensive up-to-date presentation of some of the classical areas of reliability, based on a more advanced probabilistic framework using the modern theory of stochastic processes. This framework allows analysts to formulate general failure models, establish formulae for computing various performance measures, as well as determine how to identify optimal replacement policies in complex situations. In this second edition of the book, two major topics have been added to the original version: copula models which are used to study the effect of structural dependencies on the system reliability; and maintenance optimization which highlights delay time models under safety constraints. Terje Aven is Professor of Reliability and Risk Analysis at University of Stavanger, Norway. Uwe Jensen is working as a Professor at the Institute of Applied Mathematics and Statistics of the University of Hohenheim in Stuttgart, Germany. Review of first edition: "This is an excellent book on mathematical, statistical and stochastic models in reliability. The authors have done an excellent job of unifying some of the stochastic models in reliability. The book is a good reference book but may not be suitable as a textbook for students in professional fields such as engineering. This book may be used for graduate level seminar courses for students who have had at least the first course in stochastic processes and some knowledge of reliability mathematics. It should be a good reference book for researchers in reliability mathematics." --Mathematical Reviews (2000)
Probability and Stochastic Modeling CRC Press

Introductory examples of stochastic models; Special models; General theory; Further approaches.

Stochastic Modeling John Wiley & Sons

An Introduction to Stochastic Modeling provides information pertinent to the standard concepts and methods of stochastic modeling. This book presents the rich diversity of applications of stochastic processes in the sciences. Organized into nine chapters, this book begins with an overview of diverse types of stochastic models, which predicts a set of possible outcomes weighed by their likelihoods or probabilities. This text then provides exercises in the applications of simple stochastic analysis to appropriate problems. Other chapters consider the study of general functions of independent, identically distributed, nonnegative random variables representing the successive intervals between renewals. This book discusses as well the numerous examples of Markov branching processes that arise naturally in various scientific disciplines. The final chapter deals with queueing models, which aid the design process by predicting system performance. This book is a valuable resource for students of engineering and management science. Engineers will also find this book useful.

Stochastic Modelling of Reaction–Diffusion Processes CRC Press

One of the basic problems arising in the stochastic modeling of systems is the existence and uniqueness of stationary (limiting) distributions of system characteristics. This monograph presents the basic methods for treating an equation due to Borovkov, particularly for functions that appear in queueing theory and related topics as well as some results obtained by means of these methods for some stochastic models. Also considered are relationships among the stationary distributions related to continuous time and to certain embedded epochs, model continuity and insensitivity of stationary distributions concerning the form of the distribution functions of certain input characteristics.

A Text for Statisticians and Quantitative Scientists Cambridge University Press

Applied Probability and Stochastic Processes, Second Edition presents a self-contained introduction to elementary probability theory and stochastic processes with a special emphasis on their applications in science, engineering, finance, computer science, and operations research. It covers the theoretical foundations for modeling time-dependent random phenomena in these areas and illustrates applications through the analysis of numerous practical examples. The author draws on his 50 years of experience in the field to give your students a better understanding of probability theory and stochastic processes and enable them to use stochastic modeling in their work. New to the Second Edition Completely rewritten part on probability theory—now more than double in size New sections on time series analysis, random walks, branching processes, and spectral analysis of stationary stochastic processes Comprehensive numerical discussions of examples, which replace the more theoretically challenging sections Additional examples, exercises, and figures Presenting the material in a student-friendly, application-oriented manner, this non-measure theoretic text only assumes a mathematical maturity that applied science students acquire during their undergraduate studies in mathematics. Many exercises allow students to assess their understanding of the topics. In addition, the book occasionally describes connections between probabilistic concepts and corresponding statistical approaches to facilitate comprehension. Some important proofs and challenging examples and exercises are also included for more theoretically interested readers.

Statistical Techniques, Design of Experiments and Stochastic Modeling Iste Press - Elsevier

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.

Stochastic Modeling and Mathematical Statistics SIAM

This volume presents selected and peer-reviewed contributions from the 14th Workshop on Stochastic Models, Statistics and Their Applications, held in Dresden, Germany, on March 6-8, 2019. Addressing the needs of theoretical and applied researchers alike, the contributions provide an overview of the latest advances and trends in the areas of mathematical statistics and applied probability, and their applications to high-dimensional statistics, econometrics and time series analysis, statistics for stochastic processes, statistical machine learning, big data and data science, random matrix theory, quality control, change-point analysis and detection, finance, copulas, survival analysis and reliability, sequential experiments, empirical processes, and microsimulations. As the book demonstrates, stochastic models and related statistical procedures and algorithms are essential to more comprehensively understanding and solving present-day problems arising in e.g. the natural sciences, machine learning, data science, engineering, image analysis, genetics, econometrics and finance.

Uncertainty Quantification and Stochastic Modeling with Matlab Springer Science & Business Media

Stochastic Modeling of Scientific Data combines stochastic modeling and statistical inference in a variety of standard and less common models, such as point processes, Markov random fields and hidden Markov models in a clear, thoughtful and succinct manner. The distinguishing feature of this work is that, in addition to probability theory, it contains statistical aspects of model fitting and a variety of data sets that are either analyzed in the text or used as exercises. Markov chain Monte Carlo methods are introduced for evaluating likelihoods in complicated models and the forward backward algorithm for analyzing hidden Markov models is presented. The strength of this text lies in the use of informal language that makes the topic more accessible to non-mathematicians. The combinations of hard science topics with stochastic processes and their statistical inference puts it in a new category of probability textbooks. The numerous examples and exercises are drawn from astronomy, geology, genetics, hydrology, neurophysiology and physics.

Dresden, Germany, March 2019 CreateSpace

This practical introduction to stochastic reaction-diffusion modelling is based on courses taught at the University of Oxford. The authors discuss the essence of mathematical methods which appear (under different names) in a number of interdisciplinary scientific fields bridging mathematics and computations with biology and chemistry. The book can be used both for self-study and as a supporting text for advanced undergraduate or beginning graduate-level courses in applied mathematics. New mathematical approaches are explained using simple examples of biological models, which range in size from simulations of small biomolecules to groups of animals. The book starts with stochastic modelling of chemical reactions, introducing stochastic simulation algorithms and mathematical methods for analysis of stochastic models. Different stochastic spatio-temporal models are then studied, including models of diffusion and stochastic reaction-diffusion modelling. The methods covered include molecular dynamics, Brownian dynamics, velocity jump processes and compartment-based (lattice-based) models.

Stochastic Modeling and Mathematical Statistics MDPI

Probability and Mathematical Statistics: A Series of Monographs and Textbooks: Stochastic Calculus and Stochastic Models focuses on the properties, functions, and applications of stochastic integrals. The publication first ponders on stochastic integrals, existence of stochastic integrals, and continuity, chain rule, and substitution. Discussions focus on differentiation of a composite function, continuity of sample functions, existence and vanishing of stochastic integrals, canonical form, elementary properties of integrals, and the Itô-belated integral. The book then examines stochastic differential equations, including existence of solutions of stochastic differential equations, linear differential equations and their adjoints, approximation lemma, and the Cauchy-Maruyama approximation. The manuscript takes a look at equations in canonical form, as well as justification of the canonical extension in stochastic modeling; rate of convergence of approximations to solutions; comparison of ordinary and stochastic differential equations; and invariance under change of coordinates. The publication is a dependable reference for mathematicians and researchers interested in stochastic integrals.

An Introduction to Stochastic Modeling John Wiley & Sons

Featuring recent advances in the field, this new textbook presents probability and statistics, and their applications in stochastic processes. This book presents key information for understanding the essential aspects of basic probability theory and concepts of reliability as an application. The purpose of this book is to provide an option in this field that combines these areas in one book, balances both theory and practical applications, and also keeps the practitioners in mind. Features Includes numerous examples using current technologies with applications in various fields of study Offers many practical applications of probability in queueing models, all of which are related to the appropriate stochastic processes (continuous time such as waiting time, and fuzzy and discrete time like the classic Gambler’s Ruin Problem) Presents different current topics like probability distributions used in real-world applications of statistics such as climate control and pollution Different types of computer software such as MATLAB®, Minitab, MS Excel, and R as options for illustration, programing and calculation purposes and data analysis Covers reliability and its application in network queues

With R Examples Springer Nature

Stochastic differential equations are differential equations whose solutions are stochastic processes. They exhibit appealing mathematical properties that are useful in modeling uncertainties and noisy phenomena in many disciplines. This book is motivated by applications of stochastic differential equations in target tracking and medical technology and, in particular, their use in methodologies such as filtering, smoothing, parameter estimation, and machine learning. It builds an intuitive hands-on understanding of what stochastic differential equations are all about, but also covers the essentials of It calculus, the central theorems in the field, and such approximation schemes as stochastic Runge-Kutta. Greater emphasis is given to solution methods than to analysis of theoretical properties of the equations. The book's practical approach assumes only prior understanding of ordinary differential equations. The numerous worked examples and end-of-chapter exercises include application-driven derivations and computational assignments. MATLAB/Octave source code is available for download, promoting hands-on work with the methods.

Stationary Stochastic Models Springer Nature

Since the first edition of Stochastic Modelling for Systems Biology, there have been many interesting developments in the use of "likelihood-free" methods of Bayesian inference for complex stochastic models. Having been thoroughly updated to reflect this, this third edition covers everything necessary for a good appreciation of stochastic kinetic modelling of biological networks in the systems biology context. New methods and applications are included in the book, and the use of R for practical illustration of the algorithms has been greatly extended. There is a brand new chapter on spatially extended systems, and the statistical inference chapter has also been extended with new methods, including approximate Bayesian computation (ABC). Stochastic Modelling for Systems Biology, Third Edition is now supplemented by an additional software library, written in Scala, described in a new appendix to the book. New in the Third Edition New chapter on spatially extended systems, covering the spatial Gillespie algorithm for reaction diffusion master equation models in 1- and 2-d, along with fast approximations based on the spatial chemical Langevin equation Significantly expanded chapter on inference for stochastic kinetic models from data, covering ABC, including ABC-SMC Updated R package, including code relating to all of the new material New R package for parsing SBML models into simulatable stochastic Petri net models New open-source software library, written in Scala, replicating most of the functionality of the R packages in a fast, compiled, strongly typed, functional language Keeping with the spirit of earlier editions, all of the new theory is presented in a very informal and intuitive manner, keeping the text as accessible as possible to the widest possible readership. An effective introduction to the area of stochastic modelling in computational systems biology, this new edition adds additional detail and computational methods that will provide a stronger foundation for the development of more advanced courses in stochastic biological modelling.

Level Crossing Methods in Stochastic Models CRC Press

Mathematical models based on stochastic processes have proven surprisingly accurate in many situations where their underlying assumptions are unlikely to be correct. Rethinking Randomness introduces an alternative characterization of randomness and a new modeling framework that together explain the improbable success of these probabilistic models. The new approach, known as observational stochastics, is derived from "back of the envelope" methods employed routinely by engineers, experimental scientists and systems oriented practitioners working in many fields. By formalizing and extending these intuitive techniques, observational stochastics provides an entirely rigorous alternative to traditional mathematical theory that leads to vastly simpler derivations of certain major results and a deeper understanding of their true significance. Students who encounter probabilistic models in their courses in the physical, social and system sciences should find this book particularly helpful in understanding how the material they are studying in class is actually applied in practice. And because all mathematical arguments are self-contained and relatively straightforward, technically oriented non-specialists who wish to explore the connection between probability theory and the physical world should find most of the material in this book readily accessible. Most chapters are structured around a series of examples, beginning with the simplest possible cases and then extending the analysis in multiple directions. Powerful generalized results are presented only after simpler cases have been introduced and explained thoroughly. Readers who choose to bypass the mathematically complex sections of this book can still use these simpler examples to obtain a clear understanding of the basic principles involved. The most extensive series of examples appear in Chapter 7, which incorporates a "mini course" on queuing theory and its applications to Computer Science. The author's first hand accounts of early developments in this area lend Rethinking Randomness a unique flavor. Chapter 8 examines the implications of observational stochastics for the debate between Bayesians and frequentists regarding the true meaning of "probability." Once again, the discussion is centered on a series of simple and highly approachable examples, leading ultimately to an interpretation of probability that is aligned most closely with the view of the great French mathematician Poincare (1854-1912). This proportionalist interpretation of chance then provides the foundation for the intuitive discussions of the Law of Large Numbers and the Ergodic Theorem that appear in Chapter 9. Advanced students and researchers will recognize that observational stochastics has the potential to be extended in many directions that are largely unexplored. These include the use of shaped simulation to improve the speed and accuracy of Monte Carlo simulations, the development of new error bounds for cases where assumptions of empirical independence are not satisfied exactly, and the investigation of mathematical properties of special formal structures known as t-loops. Extensions required to deal with transient and trans-distributional aspects of observable behavior may also be feasible, but represent a substantially more difficult undertaking for researchers who wish to take up the challenge."

Stochastic Calculus and Stochastic Models Academic Press

Newly revised by the author, this undergraduate-level text introduces the mathematical theory of probability and stochastic processes. Using both computer simulations and mathematical models of random events, it comprises numerous applications to the physical and biological sciences, engineering, and computer science. Subjects include sample spaces, probabilities distributions and expectations of random variables, conditional expectations, Markov chains, and the Poisson process. Additional topics encompass continuous-time stochastic processes, birth and death processes, steady-state probabilities, general queuing systems, and renewal processes. Each section features worked examples, and exercises appear at the end of each chapter, with numerical solutions at the back of the book. Suggestions for further reading in stochastic processes, simulation, and various applications also appear at the end.

Stochastic Modelling for Systems Biology, Third Edition Academic Press

The aim of this Special Issue of Mathematics is to commemorate the outstanding Russian mathematician Vladimir Zolotarev, whose 90th birthday will be celebrated on February 27th, 2021. The present Special Issue contains a collection of new papers by participants in sessions of the International Seminar on Stability Problems for Stochastic Models founded by Zolotarev. Along with research in probability distributions theory, limit theorems of probability theory, stochastic processes, mathematical statistics, and queuing theory, this collection contains papers dealing with applications of stochastic models in modeling of pension schemes, modeling of extreme precipitation, construction of statistical indicators of scientific publication importance, and other fields.

Probability, Statistics, and Stochastic Processes CRC Press

Coherent introduction to techniques also offers a guide to the mathematical, numerical, and simulation tools of systems analysis. Includes formulation of models, analysis, and interpretation of results. 1995 edition.

Concepts in Probability and Stochastic Modeling Springer

Presents the basic mathematical ideas and algorithms of the matrix analytic theory in a readable, up-to-date, and comprehensive manner.

In Memory of Andrei Yakovlev John Wiley & Sons Incorporated

From 1972 to 1974, I was working on a PhD thesis entitled Multiple Server Queues with Service Time Depending on Waiting Time.The method of analysis was the embedded Markov chain technique, described in the papers [82] and [77]. My analysis involved lengthy, tedious deri-tions of systems of integral equations for the probability density function (pdf) of the waiting time. After pondering for many months whether there might be a faster, easier way to derive the integral equations, I ?nally discovered the basic theorems for such a method in August, 1974. The theorems establish a connection between sample-path level-crossing rates of the virtual wait process and the pdf of the waiting time. This connection was not found anywhere else in the literature at the time. I immediately developed a comprehensive new methodology for deriving the integral equations based on these theorems, and called it system point theory. (Subsequently it was called system point method,or system point level crossing method: SPLC or simply LC.) I rewrote the entire PhD thesis from November 1974 to March 1975, using LC to reach solutions. The new thesis was called System Point Theory in Exponential Queues. On June 12, 1975 I presented an invited talk on the new methodology at the Fifth Conference on Stochastic Processes and their Applications at the University of Maryland. Many queueing theorists were present.

Stochastic Modelling of Electricity and Related Markets Duxbury Press

The problem of identifiability is basic to all statistical methods and data analysis, occurring in such diverse areas as Reliability Theory, Survival Analysis, and Econometrics, where stochastic modeling is widely used. Mathematics dealing with identifiability per se is closely related to the so-called branch of "characterization problems" in Probability Theory. This book brings together relevant material on identifiability as it occurs in these diverse fields.