

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

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.

Stochastic biomathematical models are becoming increasingly important as new light is shed on the role of noise in living systems. In certain biological systems, stochastic effects may even enhance a signal, thus providing a biological motivation for the noise observed in living systems. Recent advances in stochastic analysis and increasing computing power facilitate the analysis of more biophysically realistic models, and this book provides researchers in computational neuroscience and stochastic systems with an overview of recent developments. Key concepts are developed in chapters written by experts in their respective fields. Topics include: one-dimensional homogeneous diffusions and their boundary behavior, large deviation theory and its application in stochastic neurobiological models, a review of mathematical methods for stochastic neuronal integrate-and-fire models, stochastic partial differential equation models in neurobiology, and stochastic modeling of spreading cortical depression.

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

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 paid to applications in reliability, survival analysis and related fields.

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.

This is a volume consisting of selected papers that were presented at the 3rd St. Petersburg Workshop on Simulation held at St. Petersburg, Russia, during June 28-July 3, 1998. The Workshop is a regular international event devoted to mathematical problems of simulation and applied statistics organized by the Department of Stochastic Simulation at St. Petersburg State University in cooperation with INFORMS College on Simulation (USA). Its main purpose is to exchange ideas between researchers from Russia and from the West as well as from other countries throughout the World. The 1st Workshop was held during May 24-28, 1994, and the 2nd workshop was held during June 18-21, 1996. The selected proceedings of the 2nd Workshop was published as a special issue of the Journal of Statistical Planning and Inference. Russian mathematical tradition has been formed by such genius as Tchebysh eff, Markov and Kolmogorov whose ideas have formed the basis for contemporary probabilistic models. However, for many decades now, Russian scholars have been isolated from their colleagues in the West and as a result their mathematical contributions have not been widely known. One of the primary reasons for these workshops is to bring the contributions of Russian scholars into lime light and we sincerely hope that this volume helps in this specific purpose.

WILEY-INTERSCIENCE PAPERBACK SERIES 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 is a very competently written and useful addition to the statistical literature; a book every statistician should look at and that many should study!" —Short Book Reviews, International Statistical Institute ". . .reading this book was an enjoyable learning experience. The suggestions and recommendations on the methods [make] this book an excellent reference for anyone interested in simulation. With its compact structure and good coverage of material, it [is] an excellent textbook for a simulation course." —Technometrics ". . .this work is an excellent comprehensive guide to simulation methods, written by a very competent author. It is especially recommended for those users of simulation methods who want more than a 'cook book'." —Mathematics Abstracts This book is a comprehensive guide to simulation methods with explicit recommendations of methods and algorithms. It covers both the technical aspects of the subject, such as the generation of random numbers, non-uniform random variates and stochastic processes, and the use of simulation. Supported by the relevant mathematical theory, the text contains a great deal of unpublished research material, including coverage of the analysis of shift-register generators, sensitivity analysis of normal variate generators, analysis of simulation output, and more.

In Part I, the fundamentals of financial thinking and elementary mathematical methods of finance are presented. The method of presentation is simple enough to bridge the elements of financial arithmetic and complex models of financial math developed in the later parts. It covers characteristics of cash flows, yield curves, and valuation of securities. Part II is devoted to the allocation of funds and risk management: classics (Markowitz theory of portfolio), capital asset pricing model, arbitrage pricing theory, asset & liability management, value at risk. The method explanation takes into account the computational aspects. Part III explains modeling aspects of multistage stochastic programming on a relatively accessible level. It includes a survey of existing software, links to parametric, multiobjective and dynamic programming, and to probability and statistics. It focuses on scenario-based problems with the problems of scenario generation and output analysis discussed in detail and illustrated within a case study.

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.

The Book Presents A Systematic Exposition Of The Basic Theory And Applications Of Stochastic Models.Emphasising The Modelling Rather Than Mathematical Aspects Of Stochastic Processes, The Book Bridges The Gap Between The Theory And Applications Of These Processes.The Basic Building Blocks Of Model Construction Are Explained In A Step By Step Manner, Starting From The Simplest Model Of Random Walk And Proceeding Gradually To More Complicated Models. Several Examples Are Given Throughout The Text To Illustrate Important Analytical Properties As Well As To Provide Applications.The Book Also Includes A Detailed Chapter On Inference For Stochastic Processes. This Chapter Highlights Some Of The Recent Developments In The Subject And Explains Them Through Illustrative Examples.An Important Feature Of The Book Is The Complements And Problems Section At The End Of Each Chapter Which Presents (I) Additional Properties Of The Model, (Ii) Extensions Of The Model, And (Iii) Applications Of The Model To Different Areas.With All These Features, This Is An Invaluable Text For Post-Graduate Students Of Statistics, Mathematics And Operation Research. Provides a Solid Foundation for Statistical Modeling and Inference and Demonstrates Its Breadth of Applicability Stochastic Modeling and Mathematical Statistics: A Text for Statisticians and Quantitative Scientists addresses core issues in post-calculus probability and statistics in a way that is useful for statistics and mathematics majors as well Stochastic Modeling and Mathematical StatisticsA Text for Statisticians and Quantitative ScientistsCRC Press

Readership: Undergraduates and researchers in probability and statistics; applied, pure and financial mathematics; economics; chaos.

Originally published: San Francisco: Holden-Day, Inc., 1962; an unabridged republication of the third (1967) printing.

The Office of the Under Secretary of Defense (Personnel & Readiness), referred to throughout this report as P&R, is responsible for the total force management of all Department of Defense (DoD) components including the recruitment, readiness, and retention of personnel. Its work and policies are supported by a number of organizations both within DoD, including the Defense Manpower Data Center (DMDC), and externally, including the federally funded research and development centers (FFRDCs) that work for DoD. P&R must be able to answer questions for the Secretary of Defense such as how to recruit people with an aptitude for and interest in various specialties and along particular career tracks and how to assess on an ongoing basis service members' career satisfaction and their ability to meet new challenges. P&R must also address larger-scale questions, such as how the current realignment of forces to the Asia-Pacific area and other regions will affect recruitment, readiness, and retention. While DoD makes use of large-scale data and mathematical analysis in intelligence, surveillance, reconnaissance, and elsewhere—exploiting techniques such as complex network analysis, machine learning, streaming social media analysis, and anomaly detection—these skills and capabilities have not been applied as well to the personnel and readiness enterprise. Strengthening Data Science Methods for Department of Defense Personnel and Readiness Missions offers and roadmap and implementation plan for the integration of data analysis in support of decisions within the purview of P&R.

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.

Insurance Mathematics: Stochastic Models and Mathematical Methods gives a modern overview on the topic, emphasizing stochastic modeling and related mathematical methods. Topics covered include models for individual and aggregate losses in a portfolio of risks, models for compound losses, methods for determining premium rates, and credibility theory, which is based on Bayesian statistics.

Experience rated premiums are also discussed using the Bühlmann Straub model and other general models. The last part of this important monograph introduces important computational techniques and how to distinguish the methods arising from asymptotic analysis, i.e., the Laplace and saddlepoint approximation. Presents methods for determining premium rates Includes asymptotic approximations Introduces particular models of life insurance and important computational techniques

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

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.

Praise for the First Edition ". . . an excellent textbook . . . well organized and neatly written." —Mathematical Reviews ". . . amazingly interesting . . ." —Technometrics Thoroughly updated to showcase the interrelationships between probability, statistics, and stochastic processes, Probability, Statistics, and Stochastic Processes, Second Edition prepares readers to collect, analyze, and characterize data in their chosen fields. Beginning with three chapters that develop probability theory and introduce the axioms of probability, random variables, and joint distributions, the book goes on to present limit theorems and simulation. The authors combine a rigorous, calculus-based development of theory with an intuitive approach that appeals to readers' sense of reason and logic. Including more than 400 examples that help illustrate concepts and theory, the Second Edition features new material on statistical inference and a wealth of newly added topics, including: Consistency of point estimators Large sample theory Bootstrap simulation Multiple hypothesis testing Fisher's exact test and Kolmogorov-Smirnov test Martingales, renewal processes, and Brownian motion One-way analysis of variance and the general linear model Extensively class-tested to ensure an accessible presentation, Probability, Statistics, and Stochastic Processes, Second Edition is an excellent book for courses on probability and statistics at the upper-undergraduate level. The book is also an ideal resource for scientists and engineers in the fields of statistics, mathematics, industrial management, and engineering.

An introductory text providing the reader with a thorough background to the rich world of applications of stochastic processes.

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.

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 Matlab™.

In the present time, two of the most important approaches to tackle complex systems are probability and stochastic processes theory. Still from an analytic perspective, modeling and solving a problem using a stochastic approach is not a trivial issue, hence, a combination of the logic of probabilistic reasoning with computational science is needed to obtain qualitatively good solutions in a reasonable time. This eBook presents an interesting view of applications associated to fields of probability, statistics, and mathematic modeling, all of them supported by a computational context though the approach of stochasticity and simulation used in most of them. This collection contains three chapters, which bring applications in fields of biology, finance and physics, each chapter contains work(s) with specific applications. An editorial is also contained with a summarized version of each work, and each of them are widely explained in a specific section, which include a state of art to support the nature of the individual research, a methodology to solve the defined problem and the results and conclusions. We hope the present eBook can represent a potential source of knowledge for the academic community of implicated disciplines, and an inspirational starting point of starting for scientists in the amazing world of applied mathematics and the search to solve complex problems

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.

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.

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)

In various scientific and industrial fields, stochastic simulations are taking on a new importance. This is due to the increasing power of computers and practitioners' aim to simulate more and more complex systems, and thus use random parameters as well as random noises to model the parametric uncertainties and the lack of knowledge on the physics of these systems. The error analysis of these computations is a highly complex mathematical undertaking. Approaching these issues, the authors present stochastic numerical methods and prove accurate convergence rate estimates in terms of their numerical parameters (number of simulations, time discretization steps). As a result, the book is a self-contained and rigorous study of the numerical methods within a theoretical framework. After briefly reviewing the basics, the authors first introduce fundamental notions in stochastic calculus and continuous-time martingale theory, then develop the analysis of pure-jump Markov processes, Poisson processes, and stochastic differential equations. In particular, they review the essential properties of Itô integrals and prove fundamental results on the probabilistic analysis of parabolic partial differential equations. These results in turn provide the basis for developing stochastic numerical methods, both from an algorithmic and theoretical point of view. The book combines advanced mathematical tools, theoretical analysis of stochastic numerical methods, and practical issues at a high level, so as to provide optimal results on the accuracy of Monte Carlo simulations of stochastic processes. It is intended for master and Ph.D. students in the field of stochastic processes and their numerical applications, as well as for physicists, biologists, economists and other professionals working with stochastic simulations, who will benefit from the ability to reliably estimate and

control the accuracy of their simulations.

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.

This book presents essential tools for modelling non-linear time series. The first part of the book describes the main standard tools of probability and statistics that directly apply to the time series context to obtain a wide range of modelling possibilities. Functional estimation and bootstrap are discussed, and stationarity is reviewed. The second part describes a number of tools from Gaussian chaos and proposes a tour of linear time series models. It goes on to address nonlinearity from polynomial or chaotic models for which explicit expansions are available, then turns to Markov and non-Markov linear models and discusses Bernoulli shifts time series models. Finally, the volume focuses on the limit theory, starting with the ergodic theorem, which is seen as the first step for statistics of time series. It defines the distributional range to obtain generic tools for limit theory under long or short-range dependences (LRD/SRD) and explains examples of LRD behaviours. More general techniques (central limit theorems) are described under SRD; mixing and weak dependence are also reviewed. In closing, it describes moment techniques together with their relations to cumulant sums as well as an application to kernel type estimation. The appendix reviews basic probability theory facts and discusses useful laws stemming from the Gaussian laws as well as the basic principles of probability, and is completed by R-scripts used for the figures. Richly illustrated with examples and simulations, the book is recommended for advanced master courses for mathematicians just entering the field of time series, and statisticians who want more mathematical insights into the background of non-linear time series.

This is the expanded second edition of a successful textbook that provides a broad introduction to important areas of stochastic modelling. The original text was developed from lecture notes for a one-semester course for third-year science and actuarial students at the University of Melbourne. It reviewed the basics of probability theory and then covered the following topics: Markov chains, Markov decision processes, jump Markov processes, elements of queueing theory, basic renewal theory, elements of time series and simulation. The present edition adds new chapters on elements of stochastic calculus and introductory mathematical finance that logically complement the topics chosen for the first edition. This makes the book suitable for a larger variety of university courses presenting the fundamentals of modern stochastic modelling. Instead of rigorous proofs we often give only sketches of the arguments, with indications as to why a particular result holds and also how it is related to other results, and illustrate them by examples. Wherever possible, the book includes references to more specialised texts on respective topics that contain both proofs and more advanced material. Request Inspection Copy

This text stresses modern ideas, including simulation and interpretation of results. It focuses on the aspects of probability most relevant to applications, such as stochastic modeling, Markov chains, reliability, and queuing.

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.

"Stochastic Tools in Mathematics and Science" covers basic stochastic tools used in physics, chemistry, engineering and the life sciences. The topics covered include conditional expectations, stochastic processes, Brownian motion and its relation to partial differential equations, Langevin equations, the Liouville and Fokker-Planck equations, as well as Markov chain Monte Carlo algorithms, renormalization, basic statistical mechanics, and generalized Langevin equations and the Mori-Zwanzig formalism. The applications include sampling algorithms, data assimilation, prediction from partial data, spectral analysis, and turbulence. The book is based on lecture notes from a class that has attracted graduate and advanced undergraduate students from mathematics and from many other science departments at the University of California, Berkeley. Each chapter is followed by exercises. The book will be useful for scientists and engineers working in a wide range of fields and applications. For this new edition the material has been thoroughly reorganized and updated, and new sections on scaling, sampling, filtering and data assimilation, based on recent research, have been added. There are additional figures and exercises. Review of earlier edition: "This is an excellent concise textbook which can be used for self-study by graduate and advanced undergraduate students and as a recommended textbook for an introductory course on probabilistic tools in science." Mathematical Reviews, 2006

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.

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.

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.

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.

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.

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