

## Stochastic Processes With Applications To Finance Second Edition Chapman And Hallcrc Financial Mathematics Series

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

Based on lectures given by one of the authors with many years of experience in teaching stochastic processes, this textbook is unique in combining basic mathematical and physical theory with numerous simple and sophisticated examples as well as detailed calculations. In addition, applications from different fields are included so as to strengthen the background learned in the first part of the book. With its exercises at the end of each chapter (and solutions only available to lecturers) this book will benefit students and researchers at different educational levels. Solutions manual available for lecturers on [www.wiley-vch.de](http://www.wiley-vch.de)

The definitive textbook on stochastic processes, written by one of the world's leading information theorists, covering both theory and applications.

Financial engineering has been proven to be a useful tool for risk management, but using the theory in practice requires a thorough understanding of the risks and ethical standards involved. Stochastic Processes with Applications to Finance, Second Edition presents the mathematical theory of financial engineering using only basic mathematical tools

This book develops the theory of continuous and discrete stochastic processes within the context of cell biology. A wide range of biological topics are covered including normal and anomalous diffusion in complex cellular environments, stochastic ion channels and excitable systems, stochastic calcium signaling, molecular motors, intracellular transport, signal transduction, bacterial chemotaxis, robustness in gene networks, genetic switches and oscillators, cell polarization, polymerization, cellular length control, and branching processes. The book also provides a pedagogical introduction to the theory of stochastic process – Fokker Planck equations, stochastic differential equations, master equations and jump Markov processes, diffusion approximations and the system size expansion, first passage time problems, stochastic hybrid systems, reaction-diffusion equations, exclusion processes, WKB methods, martingales and branching processes, stochastic calculus, and numerical methods. This text is primarily aimed at graduate students and researchers working in mathematical biology and applied mathematicians interested in stochastic modeling. Applied probabilists and theoretical physicists should also find it of interest. It assumes no prior background in statistical physics and introduces concepts in stochastic processes via motivating biological applications. The book is highly illustrated and contains a large number of examples and exercises that further develop the models and ideas in the body of the text. It is based on a course that the author has taught at the University of Utah for many years.

An Introduction to Stochastic Processes with Applications to Biology, Second Edition presents the basic theory of stochastic processes necessary in understanding and applying stochastic methods to biological problems in areas such as population growth and extinction, drug kinetics, two-species competition and predation, the spread of epidemics, and the genetics of inbreeding. Because of their rich structure, the text focuses on discrete and continuous time Markov chains and continuous time and state Markov processes. New to the Second Edition A new chapter on stochastic differential equations that extends the basic theory to multivariate processes, including multivariate forward and backward Kolmogorov differential equations and the multivariate Itô's formula The inclusion of examples and exercises from cellular and molecular biology Double the number of exercises and MATLAB® programs at the end of each chapter Answers and hints to selected

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exercises in the appendix Additional references from the literature This edition continues to provide an excellent introduction to the fundamental theory of stochastic processes, along with a wide range of applications from the biological sciences. To better visualize the dynamics of stochastic processes, MATLAB programs are provided in the chapter appendices.

Stochastic Processes with ApplicationsSIAM

'Et moi, ... , si j'avait su comment en revenIT, One service mathematics has rendered the je n'y serais point allt\.' human race. It has put common sense back where it belongs, on the topmost shelf next Jules Verne to the dusty canister labelled 'discarded non- The series is divergent; therefore we may be sense'. able to do something with it. Eric T. Bell O. Heaviside Mathematics is a tool for thought. A highly necessary tool in a world where both feedback and non linearities abound. Similarly, all kinds of parts of mathematics serve as tools for other parts and for other sciences. Applying a simple rewriting rule to the quote on the right above one finds such statements as: 'One service topology has rendered mathematical physics .. .'; 'One service logic has rendered com puter science .. .'; 'One service category theory has rendered mathematics .. .'. All arguably true. And all statements obtainable this way form part of the raison d'etre of this series.

This graduate-level text offers a comprehensive account of the general theory of stationary processes and develops the foundations of the general theory of stochastic processes, examines processes with a continuous-time parameter, more. 1967 edition.

This text on stochastic processes and their applications is based on a set of lectures given during the past several years at the University of California, Santa Barbara (UCSB). It is an introductory graduate course designed for classroom purposes. Its objective is to provide graduate students of statistics with an overview of some basic methods and techniques in the theory of stochastic processes. The only prerequisites are some rudiments of measure and integration theory and an intermediate course in probability theory. There are more than 50 examples and applications and 243 problems and complements which appear at the end of each chapter. The book consists of 10 chapters. Basic concepts and definitions are provided in Chapter 1. This chapter also contains a number of motivating examples and applications illustrating the practical use of the concepts. The last five sections are devoted to topics such as separability, continuity, and measurability of random processes, which are discussed in some detail. The concept of a simple point process on  $R^+$  is introduced in Chapter 2. Using the coupling inequality and Le Cam's lemma, it is shown that if its counting function is stochastically continuous and has independent increments, the point process is Poisson. When the counting function is Markovian, the sequence of arrival times is also a Markov process. Some related topics such as independent thinning and marked point processes are also discussed. In the final section, an application of these results to flood modeling is presented.

This book provides engineers with focused treatment of the mathematics needed to understand probability, random variables, and stochastic processes, which are essential mathematical disciplines used in communications engineering. The author explains the basic concepts of these topics as plainly as possible so that people with no in-depth knowledge of these mathematical topics can better appreciate their applications in real problems. Applications examples are drawn from various areas of communications. If a reader is interested in understanding probability and stochastic processes that are specifically important for communications

networks and systems, this book serves his/her need.

A 'stochastic' process is a 'random' or 'conjectural' process, and this book is concerned with applied probability and statistics. Whilst maintaining the mathematical rigour this subject requires, it addresses topics of interest to engineers, such as problems in modelling, control, reliability maintenance, data analysis and engineering involvement with insurance. This book deals with the tools and techniques used in the stochastic process – estimation, optimisation and recursive logarithms – in a form accessible to engineers and which can also be applied to Matlab. Amongst the themes covered in the chapters are mathematical expectation arising from increasing information patterns, the estimation of probability distribution, the treatment of distribution of real random phenomena (in engineering, economics, biology and medicine etc), and expectation maximisation. The latter part of the book considers optimization algorithms, which can be used, for example, to help in the better utilization of resources, and stochastic approximation algorithms, which can provide prototype models in many practical applications. \* An engineering approach to applied probabilities and statistics \* Presents examples related to practical engineering applications, such as reliability, randomness and use of resources \* Readers with varying interests and mathematical backgrounds will find this book accessible

These notes provide a concise introduction to stochastic differential equations and their application to the study of financial markets and as a basis for modeling diverse physical phenomena. They are accessible to non-specialists and make a valuable addition to the collection of texts on the topic. --Srinivasa Varadhan, New York University This is a handy and very useful text for studying stochastic differential equations. There is enough mathematical detail so that the reader can benefit from this introduction with only a basic background in mathematical analysis and probability. --George Papanicolaou, Stanford University This book covers the most important elementary facts regarding stochastic differential equations; it also describes some of the applications to partial differential equations, optimal stopping, and options pricing. The book's style is intuitive rather than formal, and emphasis is made on clarity. This book will be very helpful to starting graduate students and strong undergraduates as well as to others who want to gain knowledge of stochastic differential equations. I recommend this book enthusiastically. --Alexander Lipton, Mathematical Finance Executive, Bank of America Merrill Lynch This short book provides a quick, but very readable introduction to stochastic differential equations, that is, to differential equations subject to additive "white noise" and related random disturbances. The exposition is concise and strongly focused upon the interplay between probabilistic intuition and mathematical rigor. Topics include a quick survey of measure theoretic probability theory, followed by an introduction to Brownian motion and the Ito stochastic calculus, and finally the theory of stochastic differential equations. The text also includes applications to partial differential equations, optimal stopping problems and options pricing. This book can be used as a text for senior undergraduates or beginning graduate students in mathematics, applied mathematics, physics, financial mathematics, etc., who want to learn the basics of stochastic differential equations. The reader is assumed to be fairly familiar with measure theoretic mathematical analysis, but is not assumed to have any particular knowledge of probability theory (which is rapidly developed in Chapter 2 of the book).

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This book explores the latest advances in algebraic structures and applications, and focuses on mathematical concepts, methods, structures, problems, algorithms and computational methods important in the natural sciences, engineering and modern technologies. In particular, it features mathematical methods and models of non-commutative and non-associative algebras, hom-algebra structures, generalizations of differential calculus, quantum deformations of algebras, Lie algebras and their generalizations, semi-groups and groups, constructive algebra, matrix analysis and its interplay with topology, knot theory, dynamical systems, functional analysis, stochastic processes, perturbation analysis of Markov chains, and applications in network analysis, financial mathematics and engineering mathematics. The book addresses both theory and applications, which are illustrated with a wealth of ideas, proofs and examples to help readers understand the material and develop new mathematical methods and concepts of their own. The high-quality chapters share a wealth of new methods and results, review cutting-edge research and discuss open problems and directions for future research. Taken together, they offer a source of inspiration for a broad range of researchers and research students whose work involves algebraic structures and their applications, probability theory and mathematical statistics, applied mathematics, engineering mathematics and related areas.

Plenty of examples, diagrams, and figures take readers step-by-step through well-known classical biological models to ensure complete understanding of stochastic formulation. Probability, Markov Chains, discrete time branching processes, population genetics, and birth and death chains. For biologists and other professionals who want a comprehensive, easy-to-follow introduction to stochastic formulation as it pertains to biology.

An introduction to stochastic processes through the use of R Introduction to Stochastic Processes with R is an accessible and well-balanced presentation of the theory of stochastic processes, with an emphasis on real-world applications of probability theory in the natural and social sciences. The use of simulation, by means of the popular statistical freeware R, makes theoretical results come alive with practical, hands-on demonstrations. Written by a highly-qualified expert in the field, the author presents numerous examples from a wide array of disciplines, which are used to illustrate concepts and highlight computational and theoretical results. Developing readers' problem-solving skills and mathematical maturity, Introduction to Stochastic Processes with R features: Over 200 examples and 600 end-of-chapter exercises A tutorial for getting started with R, and appendices that contain review material in probability and matrix algebra Discussions of many timely and interesting supplemental topics including Markov chain Monte Carlo, random walk on graphs, card shuffling, Black-Scholes options pricing, applications in biology and genetics, cryptography, martingales, and stochastic calculus Introductions to mathematics as needed in order to suit readers at many mathematical levels A companion website that includes relevant data files as well as all R code and scripts used throughout the book Introduction to Stochastic Processes with R is an ideal textbook for an introductory course in stochastic processes. The book is aimed at undergraduate and beginning graduate-level students in the science, technology, engineering, and mathematics disciplines. The book is also an excellent reference for applied mathematicians and statisticians who are interested in a review of the topic. Providing the necessary materials within a theoretical framework, this volume presents stochastic principles and

processes, and related areas. Over 1000 exercises illustrate the concepts discussed, including modern approaches to sample paths and optimal stopping.

Reliability theory is of fundamental importance for engineers and managers involved in the manufacture of high-quality products and the design of reliable systems. In order to make sense of the theory, however, and to apply it to real systems, an understanding of the basic stochastic processes is indispensable. As well as providing readers with useful reliability studies and applications, Stochastic Processes also gives a basic treatment of such stochastic processes as: the Poisson process, the renewal process, the Markov chain, the Markov process, and the Markov renewal process. Many examples are cited from reliability models to show the reader how to apply stochastic processes. Furthermore, Stochastic Processes gives a simple introduction to other stochastic processes such as the cumulative process, the Wiener process, the Brownian motion and reliability applications. Stochastic Processes is suitable for use as a reliability textbook by advanced undergraduate and graduate students. It is also of interest to researchers, engineers and managers who study or practise reliability and maintenance.

Stochastic processes and diffusion theory are the mathematical underpinnings of many scientific disciplines, including statistical physics, physical chemistry, molecular biophysics, communications theory and many more. Many books, reviews and research articles have been published on this topic, from the purely mathematical to the most practical. This book offers an analytical approach to stochastic processes that are most common in the physical and life sciences, as well as in optimal control and in the theory of filtering of signals from noisy measurements. Its aim is to make probability theory in function space readily accessible to scientists trained in the traditional methods of applied mathematics, such as integral, ordinary, and partial differential equations and asymptotic methods, rather than in probability and measure theory.

Most introductory textbooks on stochastic processes which cover standard topics such as Poisson process, Brownian motion, renewal theory and random walks deal inadequately with their applications. Written in a simple and accessible manner, this book addresses that inadequacy and provides guidelines and tools to study the applications. The coverage includes research developments in Markov property, martingales, regenerative phenomena and Tauberian theorems, and covers measure theory at an elementary level.

This book introduces stochastic processes and their applications for students in engineering, industrial statistics, science, operations research, business, and finance. It provides the theoretical foundations for modeling time-dependent random phenomena encountered in these disciplines. Through numerous science and engineering-based examples and e  
This book is concerned with the theory of stochastic processes and the theoretical aspects of statistics for stochastic

processes. It combines classic topics such as construction of stochastic processes, associated filtrations, processes with independent increments, Gaussian processes, martingales, Markov properties, continuity and related properties of trajectories with contemporary subjects: integration with respect to Gaussian processes, Itô integration, stochastic analysis, stochastic differential equations, fractional Brownian motion and parameter estimation in diffusion models. Stochastic processes have wide relevance in mathematics both for theoretical aspects and for their numerous real-world applications in various domains. They represent a very active research field which is attracting the growing interest of scientists from a range of disciplines. This Special Issue aims to present a collection of current contributions concerning various topics related to stochastic processes and their applications. In particular, the focus here is on applications of stochastic processes as models of dynamic phenomena in research areas certain to be of interest, such as economics, statistical physics, queuing theory, biology, theoretical neurobiology, and reliability theory. Various contributions dealing with theoretical issues on stochastic processes are also included.

This second edition has a unique approach that provides a broad and wide introduction into the fascinating area of probability theory. It starts on a fast track with the treatment of probability theory and stochastic processes by providing short proofs. The last chapter is unique as it features a wide range of applications in other fields like Vlasov dynamics of fluids, statistics of circular data, singular continuous random variables, Diophantine equations, percolation theory, random Schrödinger operators, spectral graph theory, integral geometry, computer vision, and processes with high risk. Many of these areas are under active investigation and this volume is highly suited for ambitious undergraduate students, graduate students and researchers.

Intended for a second course in stationary processes, *Stationary Stochastic Processes: Theory and Applications* presents the theory behind the field's widely scattered applications in engineering and science. In addition, it reviews sample function properties and spectral representations for stationary processes and fields, including a portion on stationary point processes. Features Presents and illustrates the fundamental correlation and spectral methods for stochastic processes and random fields Explains how the basic theory is used in special applications like detection theory and signal processing, spatial statistics, and reliability Motivates mathematical theory from a statistical model-building viewpoint Introduces a selection of special topics, including extreme value theory, filter theory, long-range dependence, and point processes Provides more than 100 exercises with hints to solutions and selected full solutions This book covers key topics such as ergodicity, crossing problems, and extremes, and opens the doors to a selection of special topics, like extreme value theory, filter theory, long-range dependence, and point processes, and includes many exercises and examples to illustrate the theory. Precise in mathematical details without being pedantic, *Stationary*

Stochastic Processes: Theory and Applications is for the student with some experience with stochastic processes and a desire for deeper understanding without getting bogged down in abstract mathematics.

This textbook, now in its fourth edition, offers a rigorous and self-contained introduction to the theory of continuous-time stochastic processes, stochastic integrals, and stochastic differential equations. Expertly balancing theory and applications, it features concrete examples of modeling real-world problems from biology, medicine, finance, and insurance using stochastic methods. No previous knowledge of stochastic processes is required. Unlike other books on stochastic methods that specialize in a specific field of applications, this volume examines the ways in which similar stochastic methods can be applied across different fields. Beginning with the fundamentals of probability, the authors go on to introduce the theory of stochastic processes, the Itô Integral, and stochastic differential equations. The following chapters then explore stability, stationarity, and ergodicity. The second half of the book is dedicated to applications to a variety of fields, including finance, biology, and medicine. Some highlights of this fourth edition include a more rigorous introduction to Gaussian white noise, additional material on the stability of stochastic semigroups used in models of population dynamics and epidemic systems, and the expansion of methods of analysis of one-dimensional stochastic differential equations. An Introduction to Continuous-Time Stochastic Processes, Fourth Edition is intended for graduate students taking an introductory course on stochastic processes, applied probability, stochastic calculus, mathematical finance, or mathematical biology. Prerequisites include knowledge of calculus and some analysis; exposure to probability would be helpful but not required since the necessary fundamentals of measure and integration are provided.

Researchers and practitioners in mathematical finance, biomathematics, biotechnology, and engineering will also find this volume to be of interest, particularly the applications explored in the second half of the book.

This book presents various results and techniques from the theory of stochastic processes that are useful in the study of stochastic problems in the natural sciences. The main focus is analytical methods, although numerical methods and statistical inference methodologies for studying diffusion processes are also presented. The goal is the development of techniques that are applicable to a wide variety of stochastic models that appear in physics, chemistry and other natural sciences. Applications such as stochastic resonance, Brownian motion in periodic potentials and Brownian motors are studied and the connection between diffusion processes and time-dependent statistical mechanics is elucidated. The book contains a large number of illustrations, examples, and exercises. It will be useful for graduate-level courses on stochastic processes for students in applied mathematics, physics and engineering. Many of the topics covered in this book (reversible diffusions, convergence to equilibrium for diffusion processes, inference methods for stochastic differential equations, derivation of the generalized Langevin equation, exit time problems) cannot be easily found in

textbook form and will be useful to both researchers and students interested in the applications of stochastic processes. The objective of this book is to introduce the elements of stochastic processes in a rather concise manner where we present the two most important parts — Markov chains and stochastic analysis. The readers are led directly to the core of the main topics to be treated in the context. Further details and additional materials are left to a section containing abundant exercises for further reading and studying. In the part on Markov chains, the focus is on the ergodicity. By using the minimal nonnegative solution method, we deal with the recurrence and various types of ergodicity. This is done step by step, from finite state spaces to denumerable state spaces, and from discrete time to continuous time. The methods of proofs adopt modern techniques, such as coupling and duality methods. Some very new results are included, such as the estimate of the spectral gap. The structure and proofs in the first part are rather different from other existing textbooks on Markov chains. In the part on stochastic analysis, we cover the martingale theory and Brownian motions, the stochastic integral and stochastic differential equations with emphasis on one dimension, and the multidimensional stochastic integral and stochastic equation based on semimartingales. We introduce three important topics here: the Feynman-Kac formula, random time transform and Girsanov transform. As an essential application of the probability theory in classical mathematics, we also deal with the famous Brunn-Minkowski inequality in convex geometry. This book also features modern probability theory that is used in different fields, such as MCMC, or even deterministic areas: convex geometry and number theory. It provides a new and direct routine for students going through the classical Markov chains to the modern stochastic analysis.

This book highlights the latest advances in stochastic processes, probability theory, mathematical statistics, engineering mathematics and algebraic structures, focusing on mathematical models, structures, concepts, problems and computational methods and algorithms important in modern technology, engineering and natural sciences applications. It comprises selected, high-quality, refereed contributions from various large research communities in modern stochastic processes, algebraic structures and their interplay and applications. The chapters cover both theory and applications, illustrated by numerous figures, schemes, algorithms, tables and research results to help readers understand the material and develop new mathematical methods, concepts and computing applications in the future. Presenting new methods and results, reviews of cutting-edge research, and open problems and directions for future research, the book serves as a source of inspiration for a broad spectrum of researchers and research students in probability theory and mathematical statistics, applied algebraic structures, applied mathematics and other areas of mathematics and applications of mathematics. The book is based on selected contributions presented at the International Conference on “Stochastic Processes and Algebraic Structures – From Theory Towards Applications” (SPAS2017) to mark Professor Dmitrii



Silvestrov's 70th birthday and his 50 years of fruitful service to mathematics, education and international cooperation, which was held at Mälardalen University in Västerås and Stockholm University, Sweden, in October 2017.

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.

Stochastic processes are mathematical models of random phenomena that evolve according to prescribed dynamics. Processes commonly used in applications are Markov chains in discrete and continuous time, renewal and regenerative processes, Poisson processes, and Brownian motion. This volume gives an in-depth description of the structure and basic properties of these stochastic processes. A main focus is on equilibrium distributions, strong laws of large numbers, and ordinary and functional central limit theorems for cost and performance parameters. Although these results differ for various processes, they have a common trait of being limit theorems for processes with regenerative increments.

Extensive examples and exercises show how to formulate stochastic models of systems as functions of a system's data and dynamics, and how to represent and analyze cost and performance measures. Topics include stochastic networks, spatial and space-time Poisson processes, queueing, reversible processes, simulation, Brownian approximations, and varied Markovian models. The technical level of the volume is between that of introductory texts that focus on highlights of applied stochastic processes, and advanced texts that focus on theoretical aspects of processes.

This definitive textbook provides a solid introduction to discrete and continuous stochastic processes, tackling a complex field in a way that instils a deep understanding of the relevant mathematical principles, and develops an intuitive grasp of the way these principles can be applied to modelling real-world systems. It includes a careful review of elementary probability and detailed coverage of Poisson, Gaussian and Markov processes with richly varied queueing applications. The theory and applications of inference, hypothesis testing, estimation, random walks, large deviations, martingales and investments are developed. Written by one of the world's leading information theorists, evolving over twenty years of graduate classroom teaching and enriched by over 300 exercises, this is an exceptional resource for anyone looking to develop their understanding of stochastic processes.

An easily accessible, real-world approach to probability and stochastic processes Introduction to Probability and Stochastic Processes with Applications presents a clear, easy-to-understand treatment of probability and stochastic processes, providing readers with a solid foundation they can build upon throughout their careers. With an emphasis on applications in engineering, applied sciences, business and finance, statistics, mathematics, and operations research, the book features numerous real-world examples that illustrate how random phenomena occur in nature and how to use probabilistic techniques to accurately model these phenomena. The authors discuss a broad range of topics, from the basic concepts of probability to advanced topics for further study, including Itô integrals, martingales, and sigma algebras. Additional topical coverage includes: Distributions of discrete and continuous random variables frequently used in applications Random vectors, conditional probability, expectation, and multivariate normal distributions The laws of large numbers, limit theorems, and convergence of sequences of random variables Stochastic processes and related applications, particularly in queueing systems Financial mathematics, including pricing methods such as risk-neutral valuation and the Black-Scholes formula Extensive appendices containing a review of the requisite mathematics and tables of standard distributions for use in applications are provided, and plentiful exercises, problems, and solutions are found throughout. Also, a related website features additional exercises with solutions and supplementary material for classroom use. Introduction to Probability and Stochastic Processes with Applications is an ideal book for probability courses at the upper-undergraduate level. The book is also a valuable reference for researchers and practitioners in the fields of engineering, operations research, and computer science who conduct data analysis to make decisions in their everyday work.

Develops an introductory and relatively simple account of the theory and application of the evolutionary type of stochastic process. Professor Bailey adopts the heuristic approach of applied mathematics and develops both theoretical principles and applied techniques simultaneously.

This second edition preserves the original text of 1968, with clarification and added references. From the Preface to the Second Edition: "Since the First Edition of this book, numerous important results have appeared--in particular stochastic integrals with respect to martingales, random fields, Riccati equation theory and realization of nonlinear filters, to name a few. In Appendix D, an attempt is made to provide some of the references that the authors have found useful and to comment on the relation of the cited references to the field ... [W]e hope that this new edition will have the effect of hastening the day when the nonlinear filter will enjoy the same popularity in applications as the linear filter does now." This book develops systematically and rigorously, yet in an expository and lively manner, the evolution of general random processes and their large time properties such as transience, recurrence, and convergence to steady states. The

emphasis is on the most important classes of these processes from the viewpoint of theory as well as applications, namely, Markov processes. The book features very broad coverage of the most applicable aspects of stochastic processes, including sufficient material for self-contained courses on random walks in one and multiple dimensions; Markov chains in discrete and continuous times, including birth-death processes; Brownian motion and diffusions; stochastic optimization; and stochastic differential equations. This book is for graduate students in mathematics, statistics, science and engineering, and it may also be used as a reference by professionals in diverse fields whose work involves the application of probability.

This unique text for beginning graduate students gives a self-contained introduction to the mathematical properties of stochastics and presents their applications to Markov processes, coding theory, population dynamics, and search engine design. The book is ideal for a newly designed course in an introduction to probability and information theory.

Prerequisites include working knowledge of linear algebra, calculus, and probability theory. The first part of the text focuses on the rigorous theory of Markov processes on countable spaces (Markov chains) and provides the basis to developing solid probabilistic intuition without the need for a course in measure theory. The approach taken is gradual beginning with the case of discrete time and moving on to that of continuous time. The second part of this text is more applied; its core introduces various uses of convexity in probability and presents a nice treatment of entropy.

This volume is a revised and enlarged version of Chapter 3 of a book with the same title, published in Romanian in 1968. The revision resulted in a new book which has been divided into two of the large amount of new material. The whole book parts because is intended to introduce mathematicians and biologists with a strong mathematical background to the study of stochastic processes and their applications in biological sciences. It is meant to serve both as a textbook and a survey of recent developments. Biology studies complex situations and therefore needs skilful methods of abstraction. Stochastic models, being both vigorous in their specification and flexible in their manipulation, are the most suitable tools for studying such situations. This circumstance deter mined the writing of this volume which represents a comprehensive cross section of modern biological problems on the theory of stochastic processes. Because of the way some specific problems have been treat ed, this volume may also be useful to research scientists in any other field of science, interested in the possibilities and results of stochastic modelling. To understand the material presented, the reader needs to be acquainted with probability theory, as given in a sound introductory course, and be capable of abstraction.

Unlike traditional books presenting stochastic processes in an academic way, this book includes concrete applications that students will find interesting such as gambling, finance, physics, signal processing, statistics, fractals, and biology. Written with an important illustrated guide in the beginning, it contains many illustrations, photos and pictures, along with

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several website links. Computational tools such as simulation and Monte Carlo methods are included as well as complete toolboxes for both traditional and new computational techniques.

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