Stochastic Processes And Integration

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Introduction to Stochastic Integration

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Stochastic Integration and Differential Equations Springer
It has been 15 years since the first edition of Stochastic Integration and Differential Equations, A New Approach appeared, and in those years many other texts on the same subject have been published, often with connections to applications, especially mathematical finance. Yet in spite of the apparent simplicity of approach, none of these books has used the functional analytic method of presenting semimartingales and stochastic integration. Thus a 2nd edition seems worthwhile and timely, though it is no longer appropriate to call it "a new approach". The new edition has several significant changes, most prominently the addition of exercises for solution. These are intended to supplement the text, but lemmas needed in a proof are never relegated to the exercises. Many of the exercises have been tested by graduate students at Purdue and Cornell Universities. Chapter 3 has been completely redone, with a new, more intuitive and simultaneously elementary proof of the fundamental Doob-Meyer decomposition theorem, the more general version of the Girsanov theorem due to Lenglart, the Kazamaki-Novikov criteria for exponential local martingales to be martingales, and a modern treatment of compensators. Chapter 4 treats sigma martingales (important in finance theory) and gives a more comprehensive treatment of martingale representation, including both the Jacod-Yor theory and Emery's examples of martingales that actually have martingale representation (thus going beyond the standard cases of Brownian motion and the compensated Poisson process). New topics added include an introduction to the theory of the expansion of filtrations, a treatment of the Fefferman martingale inequality, and that the dual space of the martingale space H^1 can be identified with BMO martingales. Solutions to selected exercises are available at the web site of the author, with current URL http://www.orie.cornell.edu/~protter/books.html.
Vector Integration and Stochastic Integration in Banach Spaces John Wiley & Sons
Considering Poisson random measures as the driving sources for stochastic (partial) differential equations allows us to incorporate jumps and to model sudden, unexpected phenomena. By using such equations the present book introduces a new method for modeling the states of complex systems perturbed by random sources over time, such as interest rates in financial markets or temperature distributions in a specific region. It studies properties of the solutions of the stochastic equations, observing the long-term behavior and the sensitivity of the solutions to changes in the initial data. The authors consider an integration theory of measurable and adapted processes in appropriate Banach spaces as well as the non-Gaussian case, whereas most of the literature only focuses on predictable settings in Hilbert spaces. The book is intended for graduate students and researchers in stochastic (partial) differential equations, mathematical finance and non-linear filtering and assumes a knowledge of the required

integration theory, existence and uniqueness results and stability theory. The results will be of particular interest to natural scientists and the finance community. Readers should ideally be familiar with stochastic processes and probability theory in general, as well as functional analysis and in particular the theory of operator semigroups.

Stochastic integration and differential equations John Wiley & Sons

A highly readable introduction to stochastic integration and stochastic differential equations, this book combines developments of the basic theory with applications. It is written in a style suitable for the text of a graduate course in stochastic calculus, following a course in probability. Using the modern approach, the stochastic integral is defined for predictable integrands and local martingales; then It's change of variable formula is developed for continuous martingales. Applications include a characterization of Brownian motion, Hermite polynomials of martingales, the Feynman–Kac functional and the Schrödinger equation. For Brownian motion, the topics of local time, reflected Brownian motion, and time change are discussed. New to the second edition are a discussion of the Cameron–Martin–Girsanov transformation and a final chapter which provides an introduction to stochastic differential equations, as well as many exercises for classroom use. This book will be a valuable resource to all mathematicians, statisticians, economists, and engineers employing the modern tools of stochastic analysis. The text also proves that stochastic integration has made an important impact on mathematical progress over the last decades and that stochastic calculus has become one of the most powerful tools in modern probability theory. —Journal of the American Statistical Association An attractive text...written in [a] lean and precise style...eminently readable. Especially pleasant are the care and attention devoted to details... A very fine book. —Mathematical Reviews

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the most powerful tools in modern probability theory. —Journal of the American Statistical Association [horizontal dagger separator] An attractive text...written in [a] lean and precise style...eminently readable. Especially pleasant are the care and attention devoted to details... A very fine book. —Mathematical Reviews

Martingales and Stochastic Integrals Birkhäuser

Emphasizing fundamental mathematical ideas rather than proofs, Introduction to Stochastic Processes, Second Edition provides quick access to important foundations of probability theory applicable to problems in many fields. Assuming that you have a reasonable level of computer literacy, the ability to write simple programs, and the access to software for linear algebra computations, the author approaches the problems and theorems with a focus on stochastic processes evolving with time, rather than a particular emphasis on measure theory. For those lacking in exposure to linear differential and difference equations, the author begins with a brief introduction to these concepts. He proceeds to discuss Markov chains, optimal stopping, martingales, and Brownian motion. The book concludes with a chapter on stochastic integration. The author supplies many basic, general examples and provides exercises at the end of each chapter. New to the Second Edition: Expanded chapter on stochastic integration that introduces modern mathematical finance Introduction of Girsanov transformation and the Feynman-Kac formula Expanded discussion of Itô's formula and the Black-Scholes formula for pricing options New topics such as Doob's maximal inequality and a discussion on self similarity in the chapter on Brownian motion Applicable to the fields of mathematics, statistics, and engineering as well as computer science, economics, business, biological science, psychology, and engineering, this concise introduction is an excellent resource both for students and professionals.

Student's t-Distribution and Related Stochastic Processes Cambridge University Press

This book provides an introduction to the rapidly expanding theory of stochastic integration and martingales. The treatment is close to that developed by the French school of probabilists, but is more elementary than other texts. The presentation is abstract, but largely self-contained and Dr Kopp makes fewer demands on the reader's background in probability theory than is usual. He gives a fairly full discussion of the measure theory and functional analysis needed for martingale theory, and describes the role of Brownian motion and the Poisson process as paradigm examples in the construction of abstract stochastic integrals. An appendix provides the reader with a glimpse of very recent developments in non-commutative integration theory which are of considerable importance in quantum mechanics. Thus equipped, the reader will have the necessary background to understand research in stochastic analysis. As a textbook, this account will be ideally suited to beginning graduate students in probability theory, and indeed it has evolved from such courses given at Hull University. It should also be of interest to pure mathematicians looking for a careful, yet concise introduction to martingale theory, and to physicists, engineers and economists who are finding that applications to their disciplines are becoming increasingly important.

Set-Valued Stochastic Integrals and Applications Birkhäuser
This book is devoted to mean-square and weak approximations of solutions of stochastic differential equations (SDE). These approximations represent two fundamental aspects in the contemporary theory of SDE. Firstly, the construction of numerical methods for such systems is important as the solutions provided serve as characteristics for a number of mathematical physics problems. Secondly, the employment of probability representations together with a Monte Carlo method allows us to reduce the solution of complex multidimensional problems of mathematical physics to the integration of stochastic equations. Along with a general theory of numerical integrations of such systems, both in the mean-square and the weak sense, a number of concrete and sufficiently constructive numerical schemes are considered. Various applications and particularly the approximate calculation of Wiener integrals are also dealt with. This book is of interest to graduate students in the mathematical, physical and engineering sciences, and to specialists whose work involves differential equations, mathematical physics, numerical mathematics, the theory of random processes, estimation and control theory.

Stochastic Calculus for Fractional Brownian Motion and Applications Cambridge University Press
This volume contains lecture notes from the courses given by Vlad Bally and Rama Cont at the Barcelona Summer School on Stochastic Analysis (July 2012). The notes of the course by Vlad Bally, co-authored with Lucia Caramellino, develop integration by parts formulas in an abstract setting, extending Malliavin's work on abstract Wiener spaces. The results are applied to prove absolute continuity and regularity results of the density for a broad class of random processes. Rama Cont's notes provide an introduction to the Functional Itô Calculus, a non-anticipative functional calculus that extends the classical Itô calculus to path-dependent functionals of stochastic processes. This calculus leads to a new class of path-dependent partial differential equations, termed Functional Kolmogorov Equations, which arise in the study of martingales and forward-backward stochastic differential equations. This book will appeal to both young and senior researchers in probability and stochastic processes, as well as to practitioners in mathematical finance.

Pathwise Stochastic Integration and Almost-sure Approximation of Stochastic Processes World Scientific
Drawing on advanced probability theory, Ambit Stochastics is used to model stochastic processes which depend on both time and space. This monograph, the first on the subject, provides a reference for this burgeoning field, complete with the applications that have driven its development. Unique to Ambit Stochastics are ambit sets, which allow the delimitation of space-time to a zone of interest, and ambit fields, which are particularly well-adapted to modelling stochastic volatility or intermittency. These attributes lend themselves notably to applications in the statistical theory of turbulence and financial econometrics. In addition to the theory and applications of Ambit Stochastics, the book also contains new theory on the simulation of ambit fields and a comprehensive stochastic integration theory for Volterra processes in a non-

semimartingale context. Written by pioneers in the subject, this book will appeal to researchers and graduate students interested in empirical stochastic modelling.

Introduction to Stochastic Integration Springer Science & Business Media

The purpose of this book is to present a comprehensive account of the different definitions of stochastic integration for fBm, and to give applications of the resulting theory. Particular emphasis is placed on studying the relations between the different approaches. Readers are assumed to be familiar with probability theory and stochastic analysis, although the mathematical techniques used in the book are thoroughly exposed and some of the necessary prerequisites, such as classical white noise theory and fractional calculus, are recalled in the appendices. This book will be a valuable reference for graduate students and researchers in mathematics, biology, meteorology, physics, engineering and finance.

Stochastic Integration with Jumps Springer Science & Business Media

This graduate level text covers the theory of stochastic integration, an important area of Mathematics that has a wide range of applications, including financial mathematics and signal processing. Aimed at graduate students in Mathematics, Statistics, Probability, Mathematical Finance, and Economics, the book not only covers the theory of the stochastic integral in great depth but also presents the associated theory (martingales, Levy processes) and important examples (Brownianmotion, Poisson process).

Summability of Stochastic Processes Springer

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 pro vided in Chapter 1. This chapter also contains a number of motivating ex amples 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.

Regularity and Integration Theory for a Class of Stochastic Processes Springer Science & Business Media

This textbook gives a comprehensive

introduction to stochastic processes and calculus in the fields of finance and economics, more specifically mathematical finance and time series econometrics. Over the past decades stochastic calculus and processes have gained great importance, because they play a decisive role in the modeling of financial markets and as a basis for modern time series econometrics. Mathematical theory is applied to solve stochastic differential equations and to derive limiting results for statistical inference on nonstationary processes. This introduction is elementary and rigorous at the same time. On the one hand it gives a basic and illustrative presentation of the relevant topics without using many technical derivations. On the other hand many of the procedures are presented at a technically advanced level: for a thorough understanding, they are to be proven. In order to meet both requirements jointly, the present book is equipped with a lot of challenging problems at the end of each chapter as well as with the corresponding detailed solutions. Thus the virtual text - augmented with more than 60 basic examples and 40 illustrative figures - is rather easy to read while a part of the technical arguments is transferred to the exercise problems and their solutions.

Measure, Integral, Probability & Processes John Wiley & Sons

In 1994 and 1998 F. Delbaen and W. Schachermayer published two breakthrough papers where they proved continuous-time versions of the Fundamental Theorem of Asset Pricing. This is one of the most remarkable achievements in modern Mathematical Finance which led to intensive investigations in many applications of the arbitrage theory on a mathematically rigorous basis of stochastic calculus. Mathematical Basis for Finance: Stochastic Calculus for Finance provides detailed knowledge of all necessary attributes in stochastic calculus that are required for applications of the theory of stochastic integration in Mathematical Finance, in particular, the arbitrage theory. The exposition follows the traditions of the Strasbourg school. This book covers the general theory of stochastic processes, local martingales and processes of bounded variation, the theory of stochastic integration, definition and properties of the stochastic exponential; a part of the theory of Lévy processes. Finally, the reader gets acquainted with some facts concerning stochastic differential equations. Contains the most popular applications of the theory of stochastic integration Details necessary facts from probability and analysis which are not included in many standard university courses such as theorems on monotone classes and uniform integrability Written by experts in the field of modern mathematical finance

Ambit Stochastics Pitman Publishing

This book provides an introductory albeit solid presentation of path integration techniques as applied to the field of stochastic processes. The subject began with the work of Wiener during the 1920''s, corresponding to a sum over random trajectories, anticipating by two decades Feynman''s famous work on the path integral representation of quantum mechanics. However, the true trigger for the application of these techniques within nonequilibrium statistical mechanics and stochastic processes was the work of Onsager and Machlup in the early 1950''s. The last quarter of the 20th century has witnessed a growing interest in this technique and its

application in several branches of research, even outside physics (for instance, in economy).The aim of this book is to offer a brief but complete presentation of the path integral approach to stochastic processes. It could be used as an advanced textbook for graduate students and even ambitious undergraduates in physics. It describes how to apply these techniques for both Markov and non-Markov processes. The path expansion (or semiclassical approximation) is discussed and adapted to the stochastic context. Also, some examples of nonlinear transformations and some applications are discussed, as well as examples of rather unusual applications. An extensive bibliography is included. The book is detailed enough to capture the interest of the curious reader, and complete enough to provide a solid background to explore the research literature and start exploiting the learned material in real situations.
Introduction to Stochastic Processes
Springer Science & Business Media
Lévy processes form a wide and rich class of random process, and have many applications ranging from physics to finance. Stochastic calculus is the mathematics of systems interacting with random noise. Here, the author ties these two subjects together, beginning with an introduction to the general theory of Lévy processes, then leading on to develop the stochastic calculus for Lévy processes in a direct and accessible way. This fully revised edition now features a number of new topics. These include: regular variation and subexponential distributions; necessary and sufficient conditions for Lévy processes to have finite moments; characterisation of Lévy processes with finite variation; Kunita's estimates for moments of Lévy type stochastic integrals; new proofs of Ito representation and martingale representation theorems for general Lévy processes; multiple Wiener-Lévy integrals and chaos decomposition; an introduction to Malliavin calculus; an introduction to stability theory for Lévy-driven SDEs.
Stochastic Processes: General Theory
Cambridge University Press
This is an introduction to stochastic integration and stochastic differential equations written in an understandable way for a wide audience, from students of mathematics to practitioners in biology, chemistry, physics, and finances. The presentation is based on the naïve stochastic integration, rather than on abstract theories of measure and stochastic processes. The proofs are rather simple for practitioners and, at the same time, rather rigorous for mathematicians. Detailed application examples in natural sciences and finance are presented. Much attention is paid to simulation diffusion processes. The topics covered include Brownian motion; motivation of stochastic models with Brownian motion; Itô and Stratonovich stochastic integrals, Itô’s formula; stochastic differential equations (SDEs); solutions of SDEs as Markov processes; application examples in physical sciences and finance; simulation of solutions of SDEs (strong and weak approximations). Exercises with hints and/or solutions are also provided.
Numerical Integration of Stochastic Differential Equations Springer
The idea of this book began with an invitation to give a course at the Third Chilean Winter School in Probability and Statistics, at Santiago de Chile, in July, 1984. Faced with the problem of teaching stochastic integration in only a

few weeks, I realized that the work of C. Dellacherie [2] provided an outline for just such a pedagogic approach. I developed this into aseries of lectures (Protter [6]), using the work of K. Bichteler [2], E. Lenglart [3] and P. Protter [7], as well as that of Dellacherie. I then taught from these lecture notes, expanding and improving them, in courses at Purdue University, the University of Wisconsin at Madison, and the University of Rouen in France. I take this opportunity to thank these institut ions and Professor Rolando Rebolledo for my initial invitation to Chile. This book assumes the reader has some knowledge of the theory of stochastic processes, including elementary martingale theory. While we have recalled the few necessary martingale theorems in Chap. I, we have not provided proofs, as there are already many excellent treatments of martingale theory readily available (e. g. , Breiman [1], Dellacherie-Meyer [1,2], or Ethier Kurtz [1]). There are several other texts on stochastic integration, all of which adopt to some extent the usual approach and thus require the general theory. The books of Elliott [1], Kopp [1], Metivier [1], Rogers-Williams [1] and to a much lesser extent Letta [1] are examples.

Stochastic Integration in Banach Spaces Springer

This brief monograph is an in-depth study of the infinite divisibility and self-decomposability properties of central and noncentral Student’s distributions, represented as variance and mean-variance mixtures of multivariate Gaussian distributions with the reciprocal gamma mixing distribution. These results allow us to define and analyse Student-Lévy processes as Thorin subordinated Gaussian Lévy processes. A broad class of one-dimensional, strictly stationary diffusions with the Student’s t-marginal distribution are defined as the unique weak solution for the stochastic differential equation. Using the independently scattered random measures generated by the bi-variate centred Student-Lévy process, and stochastic integration theory, a univariate, strictly stationary process with the centred Student’s t- marginals and the arbitrary correlation structure are defined. As a promising direction for future work in constructing and analysing new multivariate Student-Lévy type processes, the notion of Lévy copulas and the related analogue of Sklar’s theorem are explained.

Stochastic Integration and Differential Equations Sudwestdeutscher Verlag Fur Hochschulschriften AG

Also called Ito calculus, the theory of stochastic integration has applications in virtually every scientific area involving random functions. This introductory textbook provides a concise introduction to the Ito calculus. From the reviews: "Introduction to Stochastic Integration is exactly what the title says. I would maybe just add a ‘friendly’ introduction because of the clear presentation and flow of the contents." --THE MATHEMATICAL SCIENCES DIGITAL LIBRARY