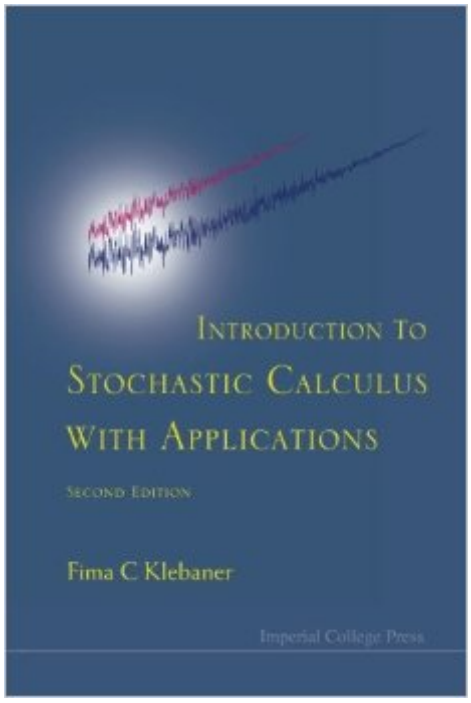
Introduction To Stochastic Calculus With Applications



Synopsis

This book presents a concise treatment of stochastic calculus and its applications. It gives a simple but rigorous treatment of the subject including a range of advanced topics, it is useful for practitioners who use advanced theoretical results. It covers advanced applications, such as models in mathematical finance, biology and engineering. Self-contained and unified in presentation, the book contains many solved examples and exercises. It may be used as a textbook by advanced undergraduates and graduate students in stochastic calculus and financial mathematics. It is also suitable for practitioners who wish to gain an understanding or working knowledge of the subject. For mathematicians, this book could be a first text on stochastic calculus; it is good companion to more advanced texts by a way of examples and exercises. For people from other fields, it provides a way to gain a working knowledge of stochastic calculus. It shows all readers the applications of stochastic calculus methods and takes readers to the technical level required in research and sophisticated modelling. This second edition contains a new chapter on bonds, interest rates and their options. New materials include more worked out examples in all chapters, best estimators, more results on change of time, change of measure, random measures, new results on exotic options, FX options, stochastic and implied volatility, models of the age-dependent branching process and the stochastic Lotka Volterra model in biology, non-linear filtering in engineering and five new figures. Contents: Preliminaries from Calculus; Concepts of Probability Theory; Basic Stochastic Processes; Brownian Motion Calculus; Stochastic Differential Equations; Diffusion Processes; Martingales; Calculus for Semimartingales; Pure Jump Processes; Change of Probability Measure; Applications in Finance: Stock and FX Options; Applications in Finance: Bonds, Rates and Options; Applications in Biology; Applications in Engineering and Physics.

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Customer Reviews

The second edition of this delightful title by Fima C. Klebaner (Monash University, Australia) is a well-written and worthwhile excursion into the realm of stochastic calculus. The text is suited for self-study for a newcomer to the area and there are numerous worked out examples interspersed throughout. Chapters 1 and 2 cover the basics of math and probability/random processes. The author next moves to discuss Brownian Motion and its calculus (the Ito calculus) in chapters 3 and 4. The coverage of the SDEs, diffusions, martingales, semi-martingales, and pure jump processes are included next. Subsequently a chapter on some results concerning the change of probability measure rounds up the theoretical part of the book. There are four final chapters (in the 2nd edition) on applications in finance (stocks, bonds, two fundamental theorems on asset pricing, discussion of various market models), biology (Feller and Wright-Fisher diffusions, branching and birth-death processes, stochastic Lotka-Volterra models) and engineering/physics (filtering and random oscillators) to help satisfy the curiosity of the application-minded readers.The second edition contains a new chapter on bonds and interest rates, and incorporates more worked-out examples throughout. The discussion of the Stratanovich formulation of Ito's calculus has been moved from the final chapter in the first edition, to the last section of chapter 5 on SDEs. Also at the back of the book there are many answers provided to the selected exercises. For fully grasping the concepts presented, having a background in real analysis and measure theory is helpful but not completely necessary.

As an aerospace engineering grad student with some real analysis background but not formal training in stochastic calculus, this textbook is ideal for self study. Fundamental concepts that are brushed over (such as the similarities/differences of Riemann, Stieltjes, and Lebesgue integrals) or altogether ignored (such as jump processes) by the classic Oksendal text (Stochastic Differential Equations: An Introduction with Applications) are covered in detail.While Oksendal devotes just three pages to the Brownian motion process, which is fundamental to the construction of the Ito integral, Klebaner takes half of chapter 3 and all of chapter 4 explore the Brownian motion process, develop intuition about its properties, and carefully explain how it is used in the construction of the Ito integral.In terms of mathematical preliminaries, Oksendal's text largely assumes the reader is

well versed in measure theoretic probability. The Oksendal text is woefully brief in its review of mathematical background needed to dive into the text (14 pages, 6 of which are exercises). The Klebaner text devotes 54 pages to review, providing an excellent opportunity to not only provide the reader with familiarity of the author's notation, but also to tie together concepts from real analysis, probability theory, and differential equations that the reader has probably not seen together in a single setting.Finally, the Klebaner text is far more navigable. The first 11 pages of the 6th edition of the Oksendal text consist of various forwards, dedications, and prefaces; this arrangement makes it rather difficult to get to the table of contents. Oksendal's table of contents are, in a word, terse.