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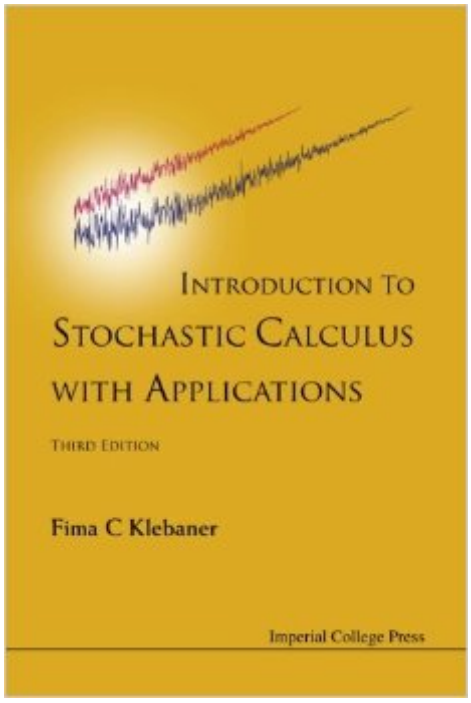
Introduction To Stochastic Calculus With Applications (3rd Edition)



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Synopsis

This book presents a concise and rigorous treatment of stochastic calculus. It also gives its main applications in finance, biology and engineering. In finance, the stochastic calculus is applied to pricing options by no arbitrage. In biology, it is applied to populations' models, and in engineering it is applied to filter signal from noise. Not everything is proved, but enough proofs are given to make it a mathematically rigorous exposition. This book aims to present the theory of stochastic calculus and its applications to an audience which possesses only a basic knowledge of calculus and probability. It may be used as a textbook by graduate and advanced undergraduate students in stochastic processes, financial mathematics and engineering. It is also suitable for researchers to gain working knowledge of the subject. It contains many solved examples and exercises making it suitable for self study. In the book many of the concepts are introduced through worked-out examples, eventually leading to a complete, rigorous statement of the general result, and either a complete proof, a partial proof or a reference. Using such structure, the text will provide a mathematically literate reader with rapid introduction to the subject and its advanced applications. The book covers models in mathematical finance, biology and engineering. For mathematicians, this book can be used as a first text on stochastic calculus or as a companion to more rigorous texts by a way of examples and exercises.

Book Information

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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.

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