
PREFACE

This book is a revision of lecture notes for a course on stochastic differential equations (SDE) that I have taught several times over the past decades at the University of Maryland, the University of California, Berkeley, and the Mathematical Sciences Research Institute.

My intention has been to survey, honestly but with some omission of precise detail, the basics of the Itô stochastic calculus and the foundations of stochastic differential equations, with particular emphasis upon applications to partial differential equations (PDE).

I assume my readers to be fairly conversant with measure-theoretic mathematical analysis but do not assume any particular knowledge of probability theory (which I develop very rapidly in Chapter 2). I downplay most measure theory issues but do emphasize the probabilistic interpretations. I “prove” many formulas by confirming them in easy cases (for simple random variables or for step functions) and then just stating that by approximation these rules hold in general. This whirlwind introduction is of course no substitute for a solid graduate level course in probability; but this book should provide enough background and motivation for students who lack the preparation to tackle the standard SDE text Øksendal [O].

Thanks to my colleague Fraydoun Rezakhanlou, who has taught from these notes and added several improvements, and to Lisa Goldberg, who several years ago gave my class with several lectures on financial applications. Jonathan Weare provided several computer simulations illustrating the text. Thanks also to many readers of the online version who have found errors, especially Robert Piche, who provided me with an extensive list of typos and suggestions.

For this printing as a book, the notes have been retyped and reformatted; I have also updated the references and made many improvements in the presentation. I have, as usual, received great help from everyone at the American Mathematical Society, especially Sergei Gelfand, Stephen Moye, Arlene O'Sean, Tom Costa and Chris Thivierge.

I will post a list of errors on my homepage, accessible through the math.berkeley.edu website.

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