Título:

Autor:

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Sinopsis

ISBN: 9781461476863

?Written in an accessible, easy to read manner without detailed rigorous proofs
Lots of examples and exercises throughout the book
Written from the scientists point of view with deep insight into several modelling situations in biology ?
Brownian dynamics serve as mathematical models for the diffusive motion of microscopic particles of various shapes in gaseous, liquid, or solid environments. The renewed interest in Brownian dynamics is due primarily to their key role in molecular and cellular biophysics: diffusion of ions and molecules is the driver of all life. Brownian dynamics simulations are the numerical realizations of stochastic differential equations that model the functions of biological micro devices such as protein ionic channels of biological membranes, cardiac myocytes, neuronal synapses, and many more. Stochastic differential equations are ubiquitous models in computational physics, chemistry, biophysics, computer science, communications theory, mathematical finance theory, and many other disciplines. Brownian dynamics simulations of the random motion of particles, be it molecules or stock prices, give rise to mathematical problems that neither the kinetic theory of Maxwell and Boltzmann, nor Einstein's and Langevin's theories of Brownian motion could predict.

This book takes the readers on a journey that starts with the rigorous definition of mathematical Brownian motion, and ends with the explicit solution of a series of complex problems that have immediate applications. It is aimed at applied mathematicians, physicists, theoretical chemists, and physiologists who are interested in modeling, analysis, and simulation of micro devices of microbiology. The book contains exercises and worked out examples throughout.

Content Level » Graduate

Keywords » Application to channel simulation - Brownian dynamics simulation at boundaries - Stochastic model of a non-Arrhenius reaction - The Langevin equation - Trajectories, fluxes, and boundary concentrations

Related subjects » Dynamical Systems & Differential Equations - Probability Theory and Stochastic Processes - Theoretical, Mathematical & Computational Physics

TABLE OF CONTENTS

?The Mathematical Brownian Motion.- Euler Simulation of Ito SDEs.- Simulation of the Overdamped Langevin Equation.- The First Passage Time of a Diffusion Process.- Chemical Reaction in Microdomains.- The Stochastic Separatrix.- Narrow Escape in R2.- Narrow Escape in R3.