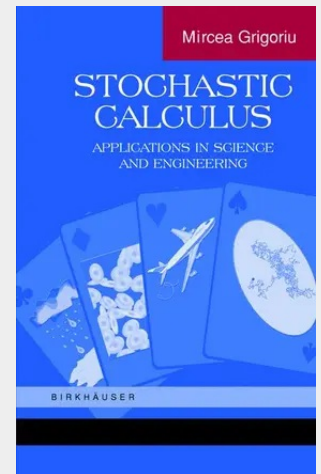


Stochastic Calculus

Applications in Science and Engineering

Algebraic, differential, and integral equations are used in the applied sciences, engineering, economics, and the social sciences to characterize the current state of a physical, economic, or social system and forecast its evolution in time. Generally, the coefficients of and/or the input to these equations are not precisely known because of insufficient information, limited understanding of some underlying phenomena, and inherent randomness. For example, the orientation of the atomic lattice in the grains of a polycrystal varies randomly from grain to grain, the spatial distribution of a phase of a composite material is not known precisely for a particular specimen, bone properties needed to develop reliable artificial joints vary significantly with individual and age, forces acting on a plane from takeoff to landing depend in a complex manner on the environmental conditions and flight pattern, and stock prices and their evolution in time depend on a large number of factors that cannot be described by deterministic models. Problems that can be defined by algebraic, differential, and integral equations with random coefficients and/or input are referred to as stochastic problems. The main objective of this book is the solution of stochastic problems, that is, the determination of the probability law, moments, and/or other probabilistic properties of the state of a physical, economic, or social system. It is assumed that the operators and inputs defining a stochastic problem are specified.

"Stochastic Calculus" focuses on analyzing and presenting solutions for a wide range of stochastic problems in applied mathematics, probability theory, physics, science, engineering, and finance. The author outlines essentials of probability theory, random processes, stochastic integration, and Monte Carlo simulation, then presents methods for solving problems defined by equations with deterministic and/or random coefficients and deterministic and/or stochastic inputs. This self-contained text may be used for graduate courses and as a reference for applied scientists interested in methods for solving stochastic problems.



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