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Stochastic differential equations and their applications. (English) Zbl 0892.60057

Ellis Horwood Series in Mathematics and its Applications. Chichester: Horwood Publishing. 366 p. (1997).

The monograph is a comprehensive treatment of stochastic differential equations driven by Brownian motion with emphasis on stability properties of the zero solution. Two particular classes of equations are studied in detail: stochastic functional differential equations (SFDEs) and backward SDEs (BSDEs).

The first chapter contains preliminary material like an introduction to Brownian motion and some martingale theory (mostly without proofs) and the definition and basic properties of the Itô integral w.r.t. Brownian motion (with proofs). Chapter 2 consists of an introduction to ordinary SDEs including the existence and uniqueness of strong solutions under Lipschitz conditions. Further sections deal with discrete approximations of SDEs, the Feynman-Kac formula and the Markov property of solutions. Chapter 3 contains rather classical material on linear (and affine) SDEs. In Chapter 4 various stability concepts for the trivial solution of an SDE are introduced (moment, almost sure, in probability) and sufficient criteria via Lyapunov functions are provided. In Chapter 5 SFDEs are introduced (existence, uniqueness, stability). SFDEs of neutral type are studied in Chapter 6 and BSDEs in Chapter 7 (including a section on the martingale representation theorem). The final three chapters are oriented towards applications: stochastic oscillators, applications to economics and finance (including optimal stopping) and SDEs describing stochastic neural networks.

The book is likely to be of interest to graduate students and researchers who either have some knowledge in probability theory (including martingales) and want to learn about SDEs (they should mainly study chapters 1-4) or more advanced readers who already have some knowledge on SDEs but want to learn e.g. about SFDEs or BSDEs (subjects which have hardly been covered by monographs so far).

Reviewer: [M.Scheutzow \(Berlin\)](#)

MSC:

[60Hxx](#) Stochastic analysis

[60-02](#) Research exposition (monographs, survey articles) pertaining to probability theory

Cited in **5** Reviews
Cited in **469** Documents

Keywords:

[stochastic differential equation](#); [stochastic functional differential equation](#); [backward stochastic differential equation](#); [stability of stochastic differential equation](#)