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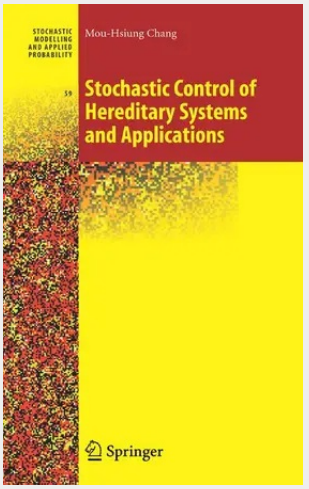
Stochastic Control of Hereditary Systems and Applications



This research monograph develops the Hamilton-Jacobi-Bellman theory via dynamic programming principle for a class of optimal control problems for stochastic hereditary differential equations (SHDEs) driven by a standard Brownian motion and with a bounded or an infinite but fading memory. These equations represent a class of stochastic infinite-dimensional systems that become increasingly important and have wide range of applications in physics, chemistry, biology, engineering and economics/finance. This monograph covers a very active research area. It can be used as a research reference for researchers and advanced graduate students who have special interest in optimal control theory and applications of stochastic hereditary systems.

ThisresearchmonographdevelopstheHamilton-Jacobi-Bellman(HJB)theory viathedynamicprogrammingprincipleforaclassofoptimalcontrolproblems for stochastic hereditary di?erential equations (SHDEs) driven by a standard Brownian motion and with a bounded or an unbounded but fading m- ory. These equations represent a class of in? nite-dimensional stochastic s- tems that become increasingly important and have wide range of applications in physics, chemistry, biology, engineering, and economics/?nance. The wide applicability of these systems is due to the fact that the reaction of re- world systems to exogenous e?ects/signals is never ¿instantaneous¿ and it needs some time, time that can be translated into a mathematical language by some delay terms. Therefore, to describe these delayed e?ects, the drift and di?usion coe?cients of these stochastic equations depend not only on the current state but also explicitly on the past history of the state variable. The theory developed herein extends the ?nite-dimensional HJB theory of controlled di?usion processes to its in?nite-dimensional counterpart for c- trolledSHDEsinwhichacertainin?nite-dimensionalBanachspaceorHilbert space is critically involved in order to account for the bounded or unbounded memory. Another type of in? nite-dimensional HJB theory that is not treated in this monograph but arises from real-world application problems can often be modeled by controlled stochastic partial di? erential equations. Although they are both in?nite dimensional in nature and are both in the infancy of their developments, the SHDE exhibits many characteristics that are not in common with stochastic partial di?erential equations. Consequently, the HJB theory for controlled SHDEs is parallel to and cannot betreated as a subset of the theory developed for controlled stochastic partial di?erential equations.

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