

Optimal Control in Random Environments

Pontryagin Maximum Principle with Environment-dependent Jumps and Mean-Field Games with Common Poissonian Noise

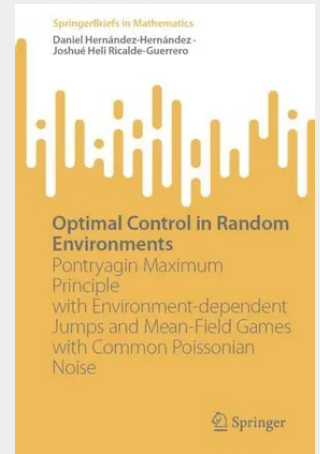
This book is an essential reference for researchers and advanced students working in stochastic control, applied probability, mathematical finance, engineering systems, and the growing field of mean-field modeling.

offers a modern and comprehensive treatment of stochastic optimal control in systems driven simultaneously by Brownian noise and marked Poisson jumps with random intensity. A central contribution of this work is its rigorous integration of random environments—probability-measure-valued processes that shape both the coefficients of the governing SDEs and the jump intensities themselves.

These environments may arise exogenously, representing external or contextual uncertainty, or endogenously, emerging from the collective behavior of large interacting systems. Originally motivated by mean-field control, where particle dynamics generate their own evolving environment, this framework proves equally powerful in settings where the environment acts independently of the system's internal state.

By unifying these viewpoints, this book develops a broad and flexible class of models capable of capturing realistic sources of randomness across applications. Through the use of forward–backward stochastic differential equations, generalized intensity kernels, and an extended Pontryagin Maximum Principle, the text provides both the theoretical foundation and the analytical tools needed to study optimal decisions in complex, jump-driven stochastic systems.

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