

# Stochastic Analysis, Control, Optimization and Applications

## A Volume in Honor of W. H. Fleming

edited by William M. McEneaney, G. George Yin and Qing Zhang

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Any time a gesture of appreciation of a life time creation is done and an encouragement is given for associating most valuable contributions in such an action to those who first planned the gesture, there always results a valuable quintessential book for the domain of reference, this time contemporary and applied mathematics, which the honoured person utterly dedicated to and put a landmark on. This is exactly what the volume dedicated to Professor Wendell H. Fleming on the occasion of his 70<sup>th</sup> birthday, which we here refer, stands for. Readers gratefully owe this volume to the inspiration, selection and diligence as much of the editors as of the Publishers. The Editors spared no time and efforts for attracting contributions from authors all over the world and they were successful. The thirty-seven articles included in the volume belong to those whom, undoubtedly, Professor W. H. Fleming's mathematical thinking had an influence on. The volume keeps trace of the areas in mathematics and applied mathematics in which the ideas and mind frames developed by Professor Fleming are to be retrieved, and the present fruition of which is a matter of fact.

The Volume bears the delicacy marks of its editors, who reserved little space for introducing their work but offered due space to the Foreword, intelligently written and remarkably pondered by Harold J. Kushner, and to the summary of Professor W. H. Fleming's life and work.

Each of the four Parts of the book contains almost the same number of contributions, alphabetically author-arranged, with no contribution availing of prominence, although they all serve to reveal a prominent domain-applied mathematics-, and to honour the domain's prominent man, Professor Wendell H. Fleming.

The volume includes calculus of variations, deterministic and stochastic differential games, stochastic control, mathematical population

genetics and mathematical finance.

The book contains surveys and research papers on important issues from stochastic analysis, control theory and optimization. The volume is structured in four Parts:

1. Large deviations, risk sensitive and  $H_\infty$  control
2. Partial differential equations and viscosity solutions
3. Stochastic control, filtering and parameter estimation
4. Mathematical finance and other applications.

In the **first Part** (Large deviations, risk sensitive and  $H_\infty$  control) the following type of results is presented: variational representation for one functionals of infinite dimensional Brownian motion and applications to the large deviations for Hilbert space valued diffusions, connections between risk-sensitive and minimax criteria for discrete-time, finite-state Markov Decision Processes, risk-sensitive control and minimax games, risk-sensitive control problem of discrete-time partially observed systems on an infinite horizon, Nisio semigroups and generators for partially observed risk-sensitive control and minimax games, infinite dimensional dissipative systems and applications to nonlinear  $H_\infty$  control, particular classes of Bellman-Isaacs or Hamilton-Jacobi-Isaacs equations.

The **second Part** (Partial differential equations and viscosity solutions) includes several results about viscosity solutions, Burgers equation, methods for proving large deviations in the small noise exit problem, approximation schemes for evolutive Hamilton equations associated with the finite horizon deterministic problem and asymptotic behavior of the Cauchy problem, critical exponent for a stochastic PDE

to hit zero.

**Part 3** is dedicated to Stochastic control, filtering and parameter estimation. We quote results related to robustness of Zakai's equation via Feynman-Kac representation, estimation of probability distributions for individual parameters using aggregate population data, stochastic control problems with infinite horizon in noncompact symmetric space, derivation of finite dimensional filters for exponential functionals of the state of a Gaussian process, Lyapunov theory of nonlinear observers, existence of optimal controls for variance control, diffusion processes with jumps and optimal ergodic problems, construction of diffusion processes with given constraints on the path space, entropy inequalities and dynamics in nonlinear filtering of diffusion processes, identification for linear stochastic distributed parameter systems, Monte Carlo estimation of diffusion distributions at inter-sampling times.

The **last Part** (Mathematical finance and other applications) reveals research works and research results such as: extension of Black-Scholes approach taking into account friction in financial markets, comparison results for some

controlled SDE and applications to finance, mathematical models with transaction costs, critical power for asymptotic connectivity in wireless networks, optimal portfolio management with partial observations and power utility function, hierarchical control of some stochastic manufacturing systems, existence of classical solutions for Bellman equations which arise in equilibrium models of asset prices.

I was enthusiastic about reading the book and I felt both a mental satisfaction and a physical pleasure in having it under my eyes. The authors brought to me the former and the Publishers the latter, because they succeeded in producing a luminous and tenderly felt volume, a volume which highly invites reading and reflection.

The volume is a valuable and welcome contribution as it provides an updated and concise account of some important topics in applied mathematics. It is helpful for specialists in the areas covered by the book.

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