

Book review:

STOCHASTIC ANALYSIS, CONTROL,
OPTIMIZATION AND APPLICATIONS.
A VOLUME IN HONOR OF W.H. FLEMING

by

William M. McEneaney, G. George Yin and Qing Zhang, eds.

The volume consists of 37 papers and is dedicated to Professor Wendell Fleming on the occasion of his 70th birthday. These papers focus on various aspects of stochastic analysis, control theory and optimization, as well as applications, especially in finance. They include authoritative expositions and surveys, along with research papers concerning recent issues. Wendell Fleming has made fundamental contributions to many areas in contemporary mathematics. These include calculus of variations, deterministic and stochastic differential games, stochastic control, mathematical population genetics and mathematical finance. Most of papers presented fit into these areas. Fleming's curriculum vitae is provided in the volume.

The book consists of four parts, each of them dealing with one field of Professor Fleming's scientific activity.

Part I, entitled "Large deviations, risk sensitive and H_∞ control" includes nine papers, devoted to risk sensitive stochastic control problems, H_∞ control, game theory, infinite dimensional systems and limit theorems for control problems.

Part II, entitled "Partial differential equations and viscosity solutions", consists of ten papers. These papers deal with optimization in Banach spaces, nonlinear partial differential equations, both stochastic and deterministic, Hamilton-Jacobi equations, and their viscosity solutions.

Part III, entitled "Stochastic control, filtering and parameter estimation", comprises eleven papers. Three papers deal with filtering problems, five - with stochastic control, and yet three - with parameter estimation of stochastic processes.

The last part, Part IV, entitled "Mathematical finance and other applications", is composed of seven papers. Two of them deal with option pricing, three other - with theory of finance, one - with networks, and one - with production control.

We will describe in a more detailed manner the most representative articles

The paper “Representations for functionals of Hilbert space valued diffusions”, by Amarjit Budhiraja, contains a variational representation for the expectation of a measurable function of a Hilbert space valued Brownian motion, when the function is uniformly positive and bounded from above, and the Brownian motion has a trace class covariance. This representation is then applied to a large deviation principle for Hilbert space valued diffusion with small noise.

The paper “Nonlinear dissipative infinite dimensional systems”, by Maciej Kocan and Pierpaolo Soravia, provides a representation formula for such systems. Applications to nonlinear H_∞ are also given.

The paper by Mark Davis and Mohammad Farid, entitled “Piecewise-deterministic processes and viscosity solutions”, concerns the optimal control of piecewise-deterministic processes in the viscosity solutions context. It is proven in the paper that the value function of optimal control for the piecewise-deterministic process is the unique viscosity solution to its associated Hamilton-Jacobi-Bellman equation.

The article entitled “Homogenization of the Cauchy problem for Hamilton-Jacobi equation”, written by Hitoshi Ishii, deals with the asymptotic behaviour of solutions to the Cauchy problem for the Hamilton-Jacobi equations with periodic coefficients as the frequency of periodicity tends to infinity. The limit functions are characterized as unique solutions of Hamilton-Jacobi equations with the Hamiltonian determined by the corresponding cell problem.

Carl Mueller and Etienne Pardoux study in their paper, entitled “The critical exponent for a stochastic PDE to hit zero”, the probability of reaching zero in finite time by a solution of a stochastic partial differential equation of parabolic type.

The paper “Exact finite dimensional filters for exponential functionals of the state” by Robert Elliott and Vikram Krishnamurthy contains the derivation of the finite dimensional filters for certain exponential functionals of the state of a continuous-time linear Gaussian process. They also derive similar filters for exponential functionals of the state of nonlinear Beneš systems.

Authors of the paper “On optimal ergodic control of diffusions with jumps”, Jose-Luis Menaldi and Maurice Robin, prove the existence and uniqueness of an invariant density function for a jump diffusion. Based on this invariant probability, existence and uniqueness of solutions to the ergodic Hamilton-Jacobi-Bellman equation is established.

In paper on “Option pricing in a market with frictions” Alain Bensoussan and Hugues Julien price European and American options in an incomplete market.

All in all the volume is an interesting collection of both the survey or lecture type papers, and the presentations of new results from on-going research in a variety of domains in which relatively rapid progress is being made nowadays.

McEneaney, W., Yin, G., Zhang, Q., eds.: *Stochastic Analysis, Control, Optimization and Applications*. Birkhäuser Verlag, Basel-Berlin-Boston, 670 p., 1998. ISBN 3-7643-4078-9. Price: DEM 138.- (Hardcover)

