Preface

This special volume contains contributed papers of selected speakers of the International Conference "Modern Stochastics: Theory and Applications III." This conference was held on September 10–14, 2012, at Taras Shevchenko National University of Kyiv, Ukraine. It was dedicated to anniversaries of prominent Ukrainian scientists of international recognition: 100th anniversary of B.V. Gnedenko and 80th anniversary of M.I. Yadrenko.

This conference is third in the "Modern Stochastics: Theory and Applications" series, the first two having taken place in 2006 and 2010. It was a major scientific event, providing an excellent opportunity for exchanging ideas and discussing recent results and new trends in probability, statistics, and their applications. The conference covered all research areas in probability theory and its applications: stochastic analysis, stochastic processes and fields, random matrices, optimization methods in probability, stochastic models of evolution systems, financial mathematics, risk processes and actuarial mathematics, statistics, information security, etc. Over 250 scientists from 29 countries took part in the conference, including both top-level specialists as well as young researchers.

The editors pursued two goals in collecting chapters for this volume: to present the most deep and bleeding-edge results and to make this volume accessible to as wide audience as possible. This resulted in extensive overview of some modern trends in probability and stochastic analysis and its applications. Scientific researchers will find in the volume a variety of new tools, ideas, and optimization methods, while practitioners will find a rigorous mathematical background for their studies.

The volume consists of five parts.

The first part is devoted to properties of probability distributions and their applications. The chapter by F. Hirsch and M. Yor describes the relation between the inequalities for the integrands of stochastic integrals and convex order of the integrals. This result is of particular interest in financial mathematics for pricing of contingent claims in continuous financial market models. Yu.V. Kozachenko and R.E. Yamnenko show how sub-Gaussian random processes can be applied to queuing theory. New probabilistic tools for mathematical physics are given in

the chapter by E. Orsingher, where pseudoprocesses governed by higher-order heat-type equations are considered and a probabilistic representation of their densities is given. The chapter by S. Rœlly is concerned with reciprocal processes (whose concept can be traced back to E. Schrödinger), discussing an approach to characterize different types of these processes via duality formulae on path spaces.

The second part discusses stochastic ordinary and partial differential equations. The chapter by Ya.I. Belopolskaya shows how theory of backward stochastic differential equations can be extended in order to construct a viscosity solution to the Cauchy problem for a system of quasilinear parabolic equations. Stochastic partial differential equations with fractional noise are studied in the chapter by M. Dozzi, E.T. Kolkovska, and J.A. López-Mimbela, which focuses mainly on the cases where solution of equation does not exist globally, but blows up in a finite time. The authors make substantial contribution by giving both lower and upper bounds for the blowup time of solutions of stochastic partial differential equations, thus providing tools for sharp estimation of risks and reliability. S. Fang shows how variational principles for the Navier–Stokes equation can be established by analysis of ordinary and stochastic differential equations with Sobolev coefficients, thus opening new ways to investigate this famous equation from hydrodynamics. Stochastic partial differential equations driven by fractional noises with long memory are also studied in the chapter by M. Hinz, E. Issoglio, and M. Zähle, who survey recent results on solvability and regularity of such equations. Stochastic integrals with respect to general stochastic measures are studied in the chapter by V. Radchenko. The uniqueness of the approach is that no special assumptions, such as martingale property or integrability, are imposed, which allows to apply these results in a vast variety of situations. It allows to establish the solvability of parabolic stochastic partial differential equations under mildest assumptions on the random driver.

The third part of this collection is about limit theorems for stochastic processes and fields. S.V. Anulova and A.Yu. Veretennikov make a considerable progress in the investigation of Langevin–Smoluchowski-type system, proving existence of unique solution with a strong Markov property and establishing exponential stability of the system. V.P. Knopova and A.M. Kulik study fractional Lévy motion both in long-memory and in short-memory cases and provide examples showing the difference of asymptotic behavior of the distribution density of the process in these cases. V.S. Korolyuk and I.V. Samoilenko discuss the problem of large deviations for random evolutions in the scheme of asymptotically small diffusion. The chapter by E. Spodarev is devoted to limit behavior of geometric characteristics of random fields, which are widely used for data analysis purposes in medicine (FMR image processing), physics and cosmology (e.g., microwave background radiation analysis), and materials science (quantification of porous media).

Particular attention in the volume is given to financial applications of stochastic analysis, which is the subject of *the fourth part* of the book. J.M. Corcuera, G. Farkas, and A. Valdivia review ambit processes, which share their mathematical structure with the solutions of random evolution equations, allowing them great flexibility for modelling. They discuss applications of ambit processes to finance. A.A. Gushchin, R.V. Khasanov, and I.S. Morozov give a review of new tools in the

utility maximization problem. They propose new ideas on how to embed the original maximization problem in an appropriate functional space and then to deduce the dual variational problem. The techniques developed by the authors allow to get rid of singular functionals in the dual problem. O. Ragulina considers the classical risk model where an insurance company has the opportunity to adjust franchise amount continuously. She solves the problem of optimal control by franchise amount.

The last part of this book is devoted to statistics. The chapter by Yu. Mishura, K. Ral' chenko, O. Seleznev, and G. Shevchenko discusses parameter estimation for stochastic differential equations driven by fractional Brownian motion. The chapter by L. Sakhno deals with the parameter estimation of stationary fields in the spectral domain based on minimum contrast principle. The chapter by S. Shklyar presents different methods of estimation for generalized linear models with measurement errors (Poissonian regression, Gamma regression, exponential regression).

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http://www.springer.com/978-3-319-03511-6

Modern Stochastics and Applications

Korolyuk, V.; Limnios, N.; Mishura, Y.; Sakhno, L.;
Shevchenko, G. (Eds.)

2014, XVII, 349 p. 2 illus., 1 illus. in color., Hardcover
ISBN: 978-3-319-03511-6