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Preface

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From March to July 2016 Brazil's National Institute of Pure and Applied Mathematics, IMPA, hosted in Rio de Janeiro the thematic program SVAN 2016, on topics of Stochastic Variational Analysis.

Stochastic Variational Analysis deals with mathematical models, methods, and theory for decisions under uncertainty. The subject covers a broad spectrum of mathematical theory that has grown in connection with the study of problems of optimization, equilibrium, control, and stability of linear and nonlinear systems. The area emerged in response to the need of solving generalized equations, optimization and variational problems whose parameters are, in part, uncertain. Problems of this type arise in stochastic optimization, stochastic equilibrium problems, uncertainty quantification, statistical estimation problems that turn up in a broad variety of engineering, economics, finance, energy networks, signal processing, ecology and biological problems.

This special volume published by Set-Valued and Variational Analysis gathers contributions related to the workshop Analysis and Applications of Stochastic Systems, that inaugurated the thematic program. A brief description of the works follows.

In "A Review on Ambiguity in Stochastic Portfolio Optimization", Georg Ch Pflug and Mathias Pohl review tractable formulations of the portfolio selection problem under model ambiguity and show that distributionally robust portfolio optimization can lead to diversification but also to concentration.

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"Solving Stochastic Programming Problems with Risk Measures by Progressive Hedging" by Tyrrel Rockafellar, explains how to cast minimization of risk measures, such as conditional value-at-risk, in a manner that induces scenario separability, via the ingenious introduction of additional variables. The approach makes it possible to extend the well-known progressive hedging algorithm for stochastic programming problems from risk neutral to risk-averse formulations.

In "Geometry of the Expected Value Set and the Set-Valued Sample Mean Process", Alois Pichler describes the limiting behavior of the sample mean process for set-valued random variables by analyzing the process taking into account the local geometry of the boundary of the expectation set.

The work "On Stochastic Mirror-prox Algorithms for Stochastic Cartesian Variational Inequalities: Randomized Block Coordinate and Optimal Averaging Schemes, by Farzad Yousefian, Angelia Nedich, and Uday V. Shanbhag, considers numerical methods to solve stochastic Cartesian variational inequality problems arising in connection with non-cooperative Nash games in uncertain regimes.

"Properties of Chance Constraints in Infinite Dimensions with an Application to PDE Constrained Optimization", by Mohammad Hassan Farshbaf Shaker, Rene Henrion and Dietmar Hömberg, generalizes the semi-continuity, convexity and stability properties of chance constraints to an infinite dimensional setting. The abstract results are applied to a simple PDE constrained control problem subject to (uniform) state chance constraints.

In "An Approximation Scheme for Uncertain Minimax Optimal Control Problems" Laura S. Aragone, Justina Gianatti, Pablo A. Lotito, and Lisandro Parente study an uncertain minimax optimal control problem with linear dynamics where the objective functional is the expected value of the supremum of the running cost over a time interval. The proposed sample average approximation problems are shown to epiconverge to the initial one. A convergent descent method is proposed to solve certain discrete time problems whose accumulation points are optimal solutions of the original problem.

"The Metric Integral of Set-Valued Functions", by Georg Nira Dyn, Elza Farkhi and Alona Mokhov, introduces a new integral of univariate set-valued functions of bounded variation with compact images. Unlike the Aumman integral, the new concept, termed the metric integral, is not necessarily convex.

The main focus of "(Sub-)Differentiability of Probability Functions with Elliptical Distributions" by Georg Wim van Ackooij, Ivana Aleksovska, and Miguel Muñoz Zuñiga, is to investigate probability functions acting on nonlinear systems wherein the random vector can follow an elliptically symmetric distribution. The proposed formulae for first and second order differentiability can be readily employed using standard non-linear programming software.

"Full Stability of General Parametric Variational Systems" by Boris S. Mordukhovich,T. T. A. Nghia, and Dat Tien Pham, introduces and studies the notions of Lipschitzian and Hölderian full stability of solutions to three-parametric variational systems described in the generalized equation formalism involving nonsmooth base mappings and partial subgradients of prox-regular functions acting in Hilbert spaces. The obtained results are specified for important classes of variational inequalities and variational conditions in both finite and infinite dimensions.

In "Measures and Integrals in Conditional Set Theory" Asgar Jamneshan, Michael Kupper, and Martin Streckfuß develop basic elements of a conditional measure theory. Representation results for conditional distributions of random variables and disintegrations in arbitrary measurable spaces are given as application.

"Variance-Optimal Martingale Measures for Diffusion Processes with Stochastic Coefficients", by Daniel Hernández–Hernández, presents the solution of the optimal variance martingale measure for stochastic volatility models, when the noises are correlated. The dual problem of the quadratic hedging problem is studied analyzing the expression obtained after a change of measure, which corresponds to some class of risk-sensitive control problems.

The work "Viability Theorem for Deterministic Mean Field Type Control Systems", by Yurii Averboukh, develops theory for dynamical systems in the Wasserstein space describing an evolution of a large population of agents with mean-field interaction under a control of a unique decision maker.

The last paper presented in this volume "Subgradient Projectors: Extensions, Theory, and Characterizations" by Shawn Xianfu Wang, Heinz Bauschke, Caifang Wang, and Jia Xu, presents a novel theory on subgradient projectors, which play an important role in optimization and for solving feasibility problems involving locally Lipschitz functions. Global and local convergence analyses, illustrative examples, and the relationship between the subgradient projector of a prox-regular function and the subgradient projector of its Moreau envelope are some of the points addressed by the work.

Our acknowledgment goes to the authors for their interesting contributions. The variety of the subjects addressed by the manuscripts composing this issue shows the interest of the mathematical community on the topics of the workshop.

As final note, we, the four Co-Editors, wish to warmly thank the reviewers who participated in the editorial process of this SI. Their wonderful and timely work was fundamental to bring this special volume to a successful completion.

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