Numerical Methods for Stochastic Differential Equations

Overview

Stochastic differential equations (SDEs) have a wide range of applications, especially in statistics, financial engineering and molecular dynamics, and also in physics, chemistry, engineering, biology. Using SDE as an effective modelling tool requires efficient numerical methods. Since solutions of SDE are not smooth functions, the theory of numerical integration of (deterministic) ordinary differential equations is not applicable to the stochastic case. Also, convergence of numerical approximation of SDE requires an interpretation, and typically one considers mean-square (strong) and weak types of convergence. This course is devoted to numerics for SDE covering a wide range of topics: essential concepts in stochastic calculus and SDE, construction of numerical methods, analysis of their convergence, Monte Carlo technique, variance reduction and complexity reduction techniques, computing ergodic limits, as well as practical implementations of numerical schemes on computers through examples from financial engineering and molecular dynamics. The course concludes with a brief introduction to recent advancements in numerical analysis of SDE.

The pre-requisite for the course is kept at minimum, which is familiarity with mathematical analysis including ordinary differential equations and with foundations of probability. Knowledge of numerical analysis of ordinary differential equations is desirable, but not essential.

Modules	**Numerical methods for stochastic differential equations: 9-17 January 2023** **Number of participants for the course will be limited to fifty.**
You Should Attend If…	▪ you are executives, engineers and researchers from private and government organizations including R&D laboratories and are looking for numerical implementation of stochastic differential equations. ▪ you are a student pursuing either B. Tech. or M. Sc. Or M. Tech. or Ph. D. from academic institutions and technical institutions and are interested in higher studies in the field of numeric of stochastic differential equations and their applications. ▪ you are a faculty member from academic institutions and technical institutions and working or interested in working in the areas related to numeric of stochastic differential equations and their applications.
Fees	The participation fees for taking the course is as follows: **Participants from abroad: US $100** **Industry/ Research Organizations: Rupees 3000** **Academic Institutions: Rupees 1000 for students and Rupees 3000 from faculty.** The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges. The participants will be provided with accommodation on payment basis.

The Faculty

Professor Michael V. Tretyakov is Professor of Mathematics at the University of Nottingham (Nottingham, UK). His research interests include numerical integration of stochastic differential equations, probabilistic approach to numerical solution of nonlinear partial differential equations, financial mathematics, uncertainty quantification, stochastic dynamics and modelling. See further information at https://www.maths.nottingham.ac.uk/plp/pmzmt/

Chaman Kumar is an Assistant Professor of Probability and Stochastic Analysis at the Indian Institute of Technology Roorkee. He completed his PhD at the School of Mathematics, University of Edinburgh, United Kingdom. He held the positions of Visiting Scientist at the Stat-Math Unit, Indian Statistical Institute, Delhi and Whittaker Research Fellow at the School of Mathematics, University of Edinburgh. His research interest includes numerical analysis of SDE, Lévy processes, McKean--Vlasov SDE, interacting particle systems and applications. See further information at https://iitr.ac.in/Departments/Mathematics%20Department/People/Faculty/100781.html

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