

**The Hong Kong Polytechnic University
Department of Applied Mathematics**

Colloquium

Reflected stochastic differential equations: solving PDEs with Robin boundary conditions and sampling from distributions with compact support

By

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Abstract

The Feynman-Kac formula gives the probabilistic representation of solutions of parabolic and elliptic PDEs with Neumann/Robin boundary condition as the expectation of a functional of the reflected diffusion process. A simple-to-implement weak-sense numerical method to approximate reflected stochastic differential equations (RSDEs) is proposed and analysed. It is proved that the method converges with the first order. Together with the Monte Carlo technique, it can be used to numerically solve linear parabolic and elliptic PDEs with Robin boundary condition. It is shown how the proposed method can be exploited for approximately computing expectations with respect to the invariant law of RSDEs, both inside a domain and on its boundary. This allows to efficiently sample from distributions with compact support. Both time-averaging and ensemble-averaging estimators are introduced and analysed. A number of extensions are considered, including a second-order weak approximation, the case of arbitrary oblique direction of reflection, and a new adaptive weak scheme to solve a Poisson PDE with Neumann boundary condition. The presented theoretical results are supported by several numerical experiments. The talk is based on a joint work with Ben Leimkuhler (Edinburgh) and Akash Sharma (Nottingham).



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Date: 14 December 2022 (Wednesday)

Time: 16:00-17:00 (Hong Kong Standard Time GMT +8)

Venue: Online Talk via Zoom (Meeting ID: 940 4903 8099)

Speaker: Prof. Mikhail Tretyakov, University of Nottingham

Host: Prof. Zhonghua Qiao, The Hong Kong Polytechnic University

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<https://polyu.zoom.us/j/94049038099?pwd=OGdtdc1JIY1ZNS2hmYVIHZFJINmhXZz09>

***** ALL ARE WELCOME *****

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