THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Seminar

Novel Particle-Based and Deep Learning Methods for Low-Regularity and High-Dimensional PDEs and Stochastic PDEs

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Abstract

In this talk, I will present my recent advances in developing novel numerical methods (including particle-based, model-reduction, and deep-learning methods) for deterministic and stochastic PDEs. I will focus on challenging low-regularity and high-dimensional problems, which remain prohibitively costly to solve using conventional mesh-based discretization methods.

Specifically, I will introduce the interacting particle method (IPM) for computing KPP front propagation speeds in chaotic and random flow fields, as well as the stochastic interacting particle-field (SIPF) method for solving three-dimensional (3D) parabolic-parabolic Keller–Segel chemotaxis systems with singular solution behaviors. I will also present structure-exploiting numerical algorithms tailored for high-dimensional stochastic PDEs. Furthermore, I will discuss the proposed DeepParticle framework, which unifies particle-based PDE solving, mini-batch optimal transport, deep-learning, and generative AI to tackle low-regularity PDE challenges.

For each method, I will elaborate on algorithm design, theoretical convergence analysis, and representative numerical experiments. Finally, I will summarize my findings and outline my ongoing research plans and promising future research directions.

Date:	August 28, 2026 (Friday)
Time:	4:00 pm – 5:00 pm
Venue:	Room 210, Run Run Shaw Building HKU

All are welcome