Departmental Colloquia

Department of Mathematics
香港城市大學
City University of Hong Kong

DEPARTMENT OF MATHEMATICS

City University of Hong Kong

Lagrangian Approximations and Computations of Front Speeds in Chaotic Flows

by

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Date: 14 Dec. 2022 (Wednesday)
Time: 4:00 – 5:00 pm
Venue: G5-314, Yeung Kin Man Academic Building

ABSTRACT

We study the propagation speeds of reaction-diffusion-advection (RDA) fronts in time-periodic cellular and chaotic flows with Kolmogorov-Petrovsky-Piskunov (KPP) nonlinearity. We first apply the variational principle to reduce the computation of KPP front speeds to a principal eigenvalue problem of a linear advection-diffusion operator with space-time periodic coefficient on a periodic domain. To this end, we develop efficient Lagrangian particle methods to compute the principal eigenvalue through the Feynman-Kac formula. We also obtain convergence analysis for the proposed numerical method. Finally, we present numerical results to demonstrate the accuracy and efficiency of the proposed method in computing KPP front speeds in time-periodic cellular and chaotic flows, especially the time-dependent Arnold-Beltrami-Childress (ABC) flow and time-dependent Kolmogorov flow in three-dimensional space. We also report some recent progress in developing a Deep Particle method to learn invariant measures by a deep neural network minimizing Wasserstein distance on data generated from Lagrangian particle methods.

~ALL ARE WELCOME~