THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

An exponential integration generalized multiscale finite element method for parabolic problems

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Abstract

In this talk, we present a quick introduction to the Generalized Multiscale Finite Element Method (GMsFEM) and mention some of its applications. The GMsFEM is a two-scale approximation method that allows the computation of approximations with fine-mesh details using a coarse mesh that is adequate for practical computations. In particular, we will focus on a general semilinear time-dependent diffusion model posed in a high-contrast media. To efficiently compute solutions of this model, we have to face two important challenges: 1) In the presence of high-contrast multiscale coefficients, the spatial resolution needed to correctly approximate the solution of this model (or its steady-state version) is related to the smallest scale at which we find variations of the coefficients. In addition to the multiscale variations, the discontinuities and high jumps of the coefficient bring additional difficulties to the numerical approximation of this time-dependent problem. Accuracy and efficiency can be negatively affected by solving large and ill-conditioned linear systems at each time step. 2) The presence of high contrast in the coefficients (even without complicated multiscale variations) reduces the stability region of time discretization methods such as Crank–Nicolson and similar time integrators. For challenges 1) and 2), we use the Generalized Multiscale Finite Element Method combined with exponential integration - GMsFEMEXPINT. We present the finite element discretization and the GMsFEMEXPINT formulation together with representative numerical experiments that show the advantages of the proposed approach. This talk is based on the submitted paper: *Contreras, Pardo, Abreu, Muñoz-Matute, Diaz and Galvis, "An exponential integration generalized multiscale finite element method for parabolic problems".*

Date:	January 18, 2023 (Wednesday)
Time:	10:00 – 11:00am
Venue:	ZOOM: https://hku.zoom.us/j/ Meeting ID: 913 6532 3891 Password: 310656

All are welcome