THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Computational Science Seminar

Stabilized Compact Exponential Time Differencing Methods for Gradient Flow Problems and Scalable Implementation

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Abstract

In this talk, we will present stabilized compact exponential time differencing methods (ETD) for numerical solutions of a family of gradient flow problems, which have wide applications in materials science, fluid dynamics and biological researches. These problems often form a special class of parabolic equations of different orders with high nonlinearity and stiffness, thus are often very hard to solve efficiently and robustly over large space and time scales. The proposed methods achieve efficiency, accuracy and provable energy stability under large time stepping by combining linear operator splittings, compact discretizations of spatial operators, exponential time integrators, multistep or Runge-Kutta approximations and fast Fourier transform. We will also discuss the corresponding localized ETD methods based on domain decomposition, which are highly scalable and therefore very suitable for parallel computing. Various numerical experiments are carried out to demonstrate superior performance of the proposed methods, including extreme scale phase field simulations of coarsening dynamics on the Sunway TaihuLight supercomputer.

Date:	December 7, 2017 (Thursday)
Time:	10:00 – 11:00am
Venue:	Room 210, Run Run Shaw Bldg., HKU

All are welcome