THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF APPLIED MATHEMATICS
應 用 數 學 系

PolyU Numerical PDEs Seminar

Prof. Jizu HUANG
Chinese Academy of Sciences

Topic
APTT: An accuracy-preserved tensor-train method for the Boltzmann-BGK equation

Date| Time
16 April 2024 (Tuesday) | 14:00 – 15:00 (HK Time)

Zoom
https://polyu.zoom.us/j/84997846107?pwd=kJ7eCxaANrxp9zftxk961kRjua5bAl.1
Meeting ID: 849 9784 6107
Passcode: 0416

Abstract
In this talk, we propose a novel accuracy-preserved tensor-train (APTT) method to solve the Boltzmann-BGK equation. We use the Crank-Nicolson Leap Frog (CNLF) scheme for temporal discretization, based on which the collision term can be evaluated only once at each time step. A second-order scheme based on the upwind rule is employed for spatial discretization to match the accuracy of the CNLF scheme. At each time step, the linear system is constructed with the tensor-train (TT) format, where the matrix, the right-hand side, and the collision term involved in the linear system are all represented using the low-rank TT format. Based on such a representation, an efficient and effective iterative solver can be implemented for solving the linear system, which can reduce two orders of magnitude in terms of both time and memory costs compared with classical methods. We present a theoretical analysis to show that the proposed APTT method can maintain accuracy and an extensive set of 3D3V Boltzmann-BGK test examples to demonstrate its effectiveness.

ALL ARE WELCOME