



The Hong Kong University of Science and Technology

Department of Mathematics

Seminar on Scientific Computation

**An Implicit Discrete Unified Gas-Kinetic Scheme
for All Flow Regimes**

By

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Abstract

This paper presents an implicit method for the discrete unified gas-kinetic scheme (DUGKS) to speed up the simulations of the steady flows in all flow regimes. The DUGKS is a multi-scale scheme finite volume method (FVM) for all flow regimes because of its ability in recovering Navier-Stokes solution in continuum regime and free transport mechanism in rarefied flow, due to the coupling of particle transport and collision in the flux evaluation at cell interfaces. In this talk the predicted iterations are constructed to update the macroscopic variables and the gas distribution functions in discrete microscopic velocity space. The lower-upper symmetric Gauss-Seidel (LU-SGS) factorization is applied to discrete implicit equations. The fast convergence of implicit discrete unified gas-kinetic scheme (IDUGKS) can be achieved through the adoption of a numerical time step with large CFL number. Some numerical test cases, including lid-driven cavity flows under different Knudsen numbers and hypersonic flow in transition flow regime around a circular cylinder, have been performed to validate this proposed IDUGKS. The computational efficiency of the IDUGKS to simulate the steady flows in all flow regimes can be improved by one or two orders of magnitude in comparison with the explicit DUGKS.

Date: Monday, 28 August 2017

Time: 11:00a.m.-12:00noon

***Venue: Room 4472, Academic Building
(near Lifts 25 & 26), HKUST***

All are welcome!