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THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

PHD STUDENT SEMINAR

Adaptive finite volume-particle method for free surface flows

By

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Abstract

This study proposes a novel adaptive finite volume-particle method (AFVPM) for accurate and efficient free surface flow simulations. The proposed AFVPM synergistically combines the Eulerian finite volume method (FVM) on unstructured meshes with the Lagrangian smoothed particle hydrodynamics (SPH) approach. Specifically, the mesh-based FVM is employed in the bulk flow regions to leverage its computational efficiency and numerical accuracy, while a weakly compressible SPH formulation is applied in the vicinity of the interface to maintain robust free-surface tracking capabilities. A key innovation of this framework is a block-based dynamic and adaptive conversion strategy between Eulerian mesh regions and Lagrangian particle regions and a buffer region-based cell-particle algorithm is designed to ensure seamless data communication across the Eulerian mesh–Lagrangian particle interface. Furthermore, isothermal gas-kinetic scheme (GKS) incorporating gravitational effects is utilized to calculate the fluxes in the mesh regions. The performance and reliability of the proposed AFVPM are validated through a series of benchmark cases that involve complex free surface phenomena. Numerical results demonstrate that AFVPM achieves superior accuracy and efficiency compared to full SPH approaches.

Date : 6 May 2026 (Wednesday)
Time : 10:00am
Venue : Room 2611 (near Lifts 31/32)

All are Welcome!