



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

**Recent developments on an Active Flux-type
method: The PAMPA Scheme**

By

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Abstract

Active Flux (AF) methods provide an attractive framework for solving hyperbolic conservation laws by evolving both cell averages and point values located on element boundaries, leading to compact high-order discretizations with globally continuous approximations. A major difficulty of the classical AF framework lies in the evolution of point values, which typically relies on exact or approximate evolution operators. While such operators can be conveniently constructed for one-dimensional linear problems, their design becomes considerably more involved in multiple dimensions, especially for nonlinear hyperbolic systems. The semi-discrete AF, nicknamed as PAMPA (Point-Average-Moment Polynomial-interpreted) framework provides an alternative semi-discrete formulation, in which point values are evolved through a residual-distribution-type approach, while cell averages are updated conservatively.

In this talk, I will present the recent developments of the PAMPA scheme. I will first introduce its construction on 1D interval and 2D unstructured triangular meshes and discuss the main ingredients leading to a compact third-order discretization. I will then focus on several developments aimed at enhancing the robustness and flexibility of the method, including bound-preserving strategies for both point values. I will also discuss a recent extension to shallow water models, where well-balancedness and positivity preservation are achieved through global flux quadrature together with suitable limiting strategies. Numerical experiments for scalar conservation laws, the compressible Euler equations, and shallow water models will be presented to demonstrate the accuracy and robustness of the resulting schemes.

These developments demonstrate the potential of PAMPA as a flexible and compact high-order framework for the numerical approximation of hyperbolic problems on general computational meshes, while accommodating important structural properties such as bound preservation, oscillation elimination and stationarity preservation.

Date : 27 October 2026 (Tuesday)
Time : 11:00a.m.-12:00noon
Venue : Room 5508 (near Lift 25/26)
All are Welcome!