

Department of Applied and Computational Mathematics and Statistics Colloquium



Jianxian Qiu

Xiamen University

A Moment-Based Hermite WENO Scheme with Unified Stencils for Hyperbolic Conservation Laws

In this presentation, we introduce a fifth-order moment-based Hermite weighted essentially non-oscillatory scheme with unified stencils (termed as HWENO-U) for hyperbolic conservation laws. The main idea of the HWENO-U scheme is to modify the first-order moment by a HWENO limiter only in the time discretization using the same information of spatial reconstructions, in which the limiter not only overcomes spurious oscillations well, but also ensures the stability of the fully-discrete scheme. For the HWENO reconstructions, a new scale-invariant nonlinear weight is designed by incorporating only the integral average values of the solution, which keeps all properties of the original one while is more robust for simulating challenging problems with sharp scale variations. Compared with previous HWENO schemes, the advantages of the HWENO-U scheme are: (1) a simpler implemented process involving only a single HWENO reconstruction applied throughout the entire procedures without any modifications for the governing equations; (2) increased efficiency by utilizing the same candidate stencils, reconstructed polynomials, and linear and nonlinear weights in both the HWENO limiter and spatial reconstructions; (3) reduced problem-specific dependencies and improved rationality, as the nonlinear weights are identical for the function u and its non-zero multiple ζu . Besides, the proposed scheme retains the advantages of previous HWENO schemes, including compact reconstructed stencils and the utilization of artificial linear weights. Extensive benchmarks are carried out to validate the accuracy, efficiency, resolution, and robustness of the proposed scheme.

Monday, October 6, 2025

3:30 – 4:30 PM

117 Hayes-Healy Center

Colloquium Tea – 3:00 PM in 117 Hayes-Healy