Oberseminar Mathematische Strömungsmechanik

Institut für Mathematik der Julius-Maximilians-Universität Würzburg

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Dissipation-based WENO stabilization and monolithic convex limiting for continuous finite element discretizations of hyperbolic problems

Abstract: High-order finite element schemes for hyperbolic conservation laws tend to produce spurious oscillations and/or nonphysical states near shocks or steep gradients. The proposed approach prevents such unacceptable behavior using simple algebraic manipulations of standard continuous Galerkin (CG) methods. Local Weighted Essentially Non-Oscillatory (WENO) reconstructions are used to evaluate smoothness indicators and compute artificial viscosity coefficients that control the amounts of numerical dissipation. In contrast to popular Hermite-WENO limiters for discontinuous Galerkin (DG) methods, the reconstructed polynomials do not replace the original high-order finite element solution. Instead, they only guide the adaptive dissipation mechanism. The employed cell-vertex reconstruction procedure minimizes mesh-imprinting effects by using candidate polynomials associated with the vertices of a cell. Positivity preservation and local discrete maximum principles for scalar quantities of interest are enforced using a new element-based monolithic convex limiting (MCL) procedure. Representing the semi-discrete scheme in terms of admissible intermediate cell averages, deviations from these averages are constrained in a manner that guarantees the validity of the imposed constraints for the degrees of freedom of a high-order Bernstein finite element approximation. Conceptually, this approach adapts the slope limiting strategy developed by Zhang and Shu in the DG context to the semi-discrete CG setting.

room 40.03.003 (Emil Fischer Str. 40)

Thursday, July 23, 2026 at 12:30 pm,

Zu diesem Vortrag sind Sie herzlich eingeladen.

gez. Christian Klingenberg