Department of Mathematics

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Scientific Computing Seminar

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Limiting Techniques for Continuous and Discontinuous Finite Elements

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3:00 PM- 4:00 PM
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Abstract: We review the state of the art in the design of constrained high-resolution finite element schemes for transport equations. The discrete maximum principle for continuous piecewise-linear approximations is enforced using algebraic flux correction, a black-box postprocessing technique designed to control the antidiffusive part of the standard Galerkin discretization. In this talk, we use AFC to solve the linear advection equation, an anisotropic diffusion equation, and the Euler equations of gas dynamics. In the context of discontinuous Galerkin (DG) methods, we represent the shape functions in terms of cell averages (coarse scales) and derivatives (fine scales). The unresolvable fine-scale components are eliminated using a vertex-based hierarchical slope limiter. Our limiting strategy preserves the order of accuracy at smooth extrema and may serve as a parameter-free regularity estimator for *hp*-adaptivity. We highlight the existing similarities to variational multiscale methods and explore the possibility of enriching continuous piecewise-linears with discontinuous piecewise-quadratics. This approach leads to an intrinsically stable approximation which converges at the same rate as the DG method, while offering a considerable reduction in the number of degrees of freedom.

This is joint work with Li Wang from UCLA.