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ON THE DESIGN OF LIMITERS FOR VECTOR FIELDS AND SYSTEMS OF CONSERVED QUANTITIES

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In this talk, we present some new approaches to avoiding spurious oscillations in (piecewise-linear) finite element discretizations of conservation laws. The main focus is on the design of objective limiters for vector fields that may belong to a larger set of conserved quantities. In the context of discontinuous Galerkin methods, we explore the possibility of using the polar decomposition of the gradient tensor to define frame-invariant limiting directions. We also address the design of physics-compatible limiters for the shallow water equations and the Euler equations of gas dynamics. This task involves formulation of appropriate local maximum principles for derived quantities and adjusting the gradients of conserved variables so as to enforce the corresponding inequality constraints while preserving optimal accuracy in smooth regions. The limiting tools to be presented in this talk are applicable to continuous and discontinuous Galerkin approximations alike. Numerical results will be shown for 2D benchmark problems.

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