LIMITING TECHNIQUES AND HP-ADAPTIVITY FOR HIGH-ORDER FINITE ELEMENTS

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In this talk, we present three new approaches to blending a continuous high-order Bernstein finite element discretization with a monotone piecewise-linear approximation based on the same nodal points. The first approach is a predictor-corrector method which constrains the difference between the high and low-order solutions using a localized flux-corrected transport (FCT) algorithm. The second approach constrains the difference between the residuals of the underlying discretizations using nodal limiters to adjust monotonicity-preserving artificial diffusion coefficients. This correction leads to a nonlinear algebraic system which is solved iteratively. The third approach combines the high and low-order finite element bases using a continuous piecewise-linear limiter function. This low-level limiting strategy represents a new kind of hp adaptivity. The proposed method adjusts the local order of approximation in a continuous manner while keeping the number of degrees of freedom fixed. The pros and cons of each limiting technique for high-order finite elements will be discussed and results of numerical studies for two-dimensional test problems will be presented.