HIGH-ORDER SHOCK-CAPTURING METHODS FOR COMPRESSIBLE FLOWS

A high-order Discontinuous Galerkin method based on a new set of basis functions
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THE GOAL
Many physical problems of interest may develop shocks and discontinuities
Need for high-fidelity models
Actual methods present low tolerance to under-resolved features (no robustness)
The numerical dissipation required to stabilize the solution near discontinuities typically overwhelms turbulence or shocks

THE NEW APPROACH
• Allow discontinuous interpolation inside the element
• Adaptive basis depending on the smoothness of the solution

\[ \tilde{N}_i(x; \alpha) := \alpha N_i(x) + (1 - \alpha) \phi_i(x) \]

\[ \tilde{N}_i = N_i \]
\[ \tilde{N}_i = \phi_i \]

• \( \alpha \) controls the interior jumps
• \( \alpha \) linear function of a high-order local smoothness detector
• \( S_{\Omega e} \) local discontinuity sensor

KEY ISSUES
• Equivalent to DG standard for smooth flow
• Exploit inherent advantages of DG methods
• Improve for high-degree and allow the use of coarse meshes
• Control of interior viscosity automatically
• Problem-independent and free of user-set parameters

REFERENCE