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A Low-Dissipation Numerical Method for Compressible Multi-component and Reacting Flows RYAN HOUIM, KENNETH KUO, The Pennsylvania State University — A low-dissipation for calculating multi-component gas dynamic flows with variable specific heat ratio that is capable of accurately simulating complex flows that contain both high- and low-Mach number features is presented. The numerical method combines features from the quasi-conservative double-flux multi-component model, high-resolution weighted essentially non-oscillatory schemes, and adaptive total variation diminishing slope limiters. Turbulence is implicitly modeled by using a low Mach-number adjustment procedure in conjunction with either AUSM or the HLLC approximate Riemann solver to evaluate numerical fluxes. To avoid spurious oscillations, characteristic variables are interpolated near shock waves and primitive variables are interpolated elsewhere for increased computational efficiency. Success of the method has been demonstrated with a series of numerical experiments including premixed deflagrations, Chapman-Jouget detonations, re-shocked Richtmyer-Meshkov instability, shock-wave and diffusion flame interactions, and multi-dimensional cellular detonations.

Ryan Houim
The Pennsylvania State University

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