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Compressible, diffusive, reactive flow simulations of the double Mach reflection phenomenon J.L. ZIEGLER, California Institute of Technology, R. DEITERDING, Oak Ridge National Laboratory, J.E. SHEPHERD, D.I. PULLIN, California Institute of Technology — We describe direct numerical simulations of the multi-component, compressible, reactive Navier-Stokes equations in two spatial dimensions. The simulations utilize a hybrid, WENO/centered-difference numerical method, with low numerical dissipation, high-order shock-capturing, and structured adaptive mesh refinement (SAMR). These features enable resolution of diffusive processes within reaction zones. A series of one- and two-dimensional test problems are used to verify the implementation, specifically the high-order accuracy of the diffusion terms, including a viscous shock wave, the decaying Lamb-Oseen vortex, laminar flame and unstable ZND detonation. High-resolution simulations are discussed of the reactive double Mach reflection phenomenon. The diffusive scales (shear/mixing/boundary layers and flame thicknesses) and weak shocks are resolved while the strong shocks emanating from the triple points are captured. Additionally, a minimally reduced chemistry and transport model for hydrocarbon detonation is used to accurately capture the induction time, chemical relaxation, and the diffusive mixing within vortical structures evolving from the triple-point shear layer.

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