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Large-Eddy and Unsteady RANS Simulations of a Shock-Accelerated Heavy Gas Cylinder[1] BRANDON MORGAN, JEFFREY GREENOUGH, Lawrence Livermore National Laboratory — Two-dimensional numerical simulations of the so-called "shock-jet" test problem for Richtmyer-Meshkov instability (RMI) are conducted using both large-eddy simulation (LES) and unsteady Reynolds-averaged Navier-Stokes (URANS) approaches in an arbitrary Lagrangian/Eulerian (ALE) hydrodynamics code. Turbulence statistics are extracted from LES by running an ensemble of simulations with multi-mode perturbations to the initial conditions. Detailed grid convergence studies are conducted, and LES results are found to agree well with both experiment and high-order simulations conducted by Shankar, Kawai, and Lele (Phys. Fluids, 2011). URANS results using a k-L approach are found to be highly sensitive to the initialization of L and to the time at which L becomes resolved on the computational mesh. It is observed that a gradient diffusion closure for turbulent species flux is a poor approximation at early time, and a new closure based on the mass-flux velocity is proposed for low-Reynolds-number mixing.

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