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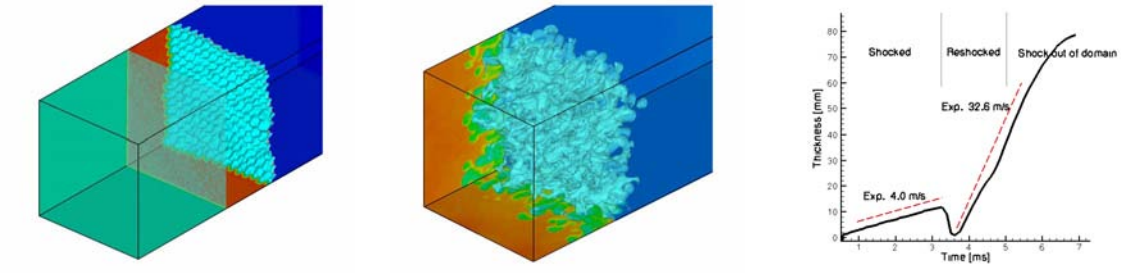
Large-eddy simulation of Richtmyer-Meshkov instability with re-shock

D.J. Hill[1], D.I. Pullin[1] & R.Deiterding[2]

1. Graduate Aeronautical Laboratories
California Institute of Technology, Pasadena, CA 91125
djh@cacr.caltech.edu

2. Center for Advanced Computing Research
California Institute of Technology, Pasadena, CA 91125

We present results from large-eddy simulations (LES) of three-dimensional Richtmyer-Meshkov (RM) instability in a rectangular tube with reshock off the tube end wall. The subgrid-scale model is the stretched-vortex model of Misra & Pullin (1997). The shock strength, tube geometry and initial interface disturbance were tailored to match the experimental conditions of Vetter and Sturtevant (1995) with shock Mach number $M_s = 1.5$, and density ratio $r = 5$. The numerical method is based on a hybrid WENO (weighted essentially non Oscillatory) scheme, used in thin regions containing shock waves, matched to a tuned centered difference (TCD) scheme in regions of smooth flow, where the SGS model is activated (Hill & Pullin, 2004). The TCD scheme is optimized for good LES performance. Results are presented for both unigrid simulations at 512×256×256 resolution and also for LES using the AMROC (adaptive mesh refinement object-oriented C++) environment. The computed growth rates of the mixing layer, both before and after reshock, are compared with the measurements of Vetter and Sturtevant (1995). To illustrate results, Figure 1 shows images of the center of the mixing layer based on the zero level set of a passive scalar, before and after reshock, and also a comparison of mixing-layer growth rates with experiment.



(a) (b) (c)

Figure 1: Density interface (a) After first shock passage. (b) Post reshock. (c) time-wise growth of mixing layer thickness compared with Vetter and Sturtevant (1995)

References

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