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The effect of initial conditions on late time asymptotics and mixing for multimode Richtmyer-Meshov Instability

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In this paper, we investigate the development of a material interface perturbed by a spectrum of modes when subjected to an acceleration by a shock wave. We use the Eulerian Adaptive Mesh Refinement (AMR) code, *Raptor*, for the multi-fluid simulations. In two-dimensions we consider a number of broad-banded initial spectrum over a range of Atwood numbers accelerated by a weak M=1.3 shock wave. For a given realization, we consider decomposing into three cases: 1) the full broad-banded spectrum, 2) the long wavelength modes, and 3) the short wavelength modes. Here long or short is determined by comparison with the transverse dimension, L, of the computational domain. It is found that the subsequent evolution of the overall mixed width reaches an asymptotic t^{θ} scaling for both bubbles and spikes. In the broad-banded and short wave length cases, the spikes and bubbles evolve in an Atwood number independent manner with $\theta = 0.4$, approximately. The long wavelength case exhibits the strong spike Atwood number dependence given previously in the literature (Alon et al. (1995)). In three-dimensions, we reconsider the weak shock case as well as the strong shock (M=5) case. The weak shock case gives, for broad-banded perturbations, an asymptotic scaling for both bubbles and spikes of $\theta = 0.5$ at At=0.6. The evolution of the amount of mixed material also grows with a square root dependence. Including additional accelerations from the incident shock wave reflecting off of a solid end-wall, increases the rate of mixing as well as spike and bubble velocities while maintaining the same power law dependence. Turbulence, as defined by Zhou et al. (2003), appears only after the second acceleration. Simulation results for the high Mach number case will be given. Additional diagnostics such as Fourier spectra within the mixing region and advanced visualizations of the flow fields during the evolution will also be given.

References

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This work was performed under the auspices of the U.S. Department of Energy by the University of California Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.