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Effect of initial conditions on compressible mixing for multimode systems driven by a strong blast wave

A.R. Miles[1,2], M.J. Edwards[2], J.A. Greenough[2] & H.F. Robey[2]

1. University of Maryland at College Park, USA

2. Lawrence Livermore National Laboratory, USA

miles15@llnl.gov
edwards39@llnl.gov
greenough1@llnl.gov
robey1@llnl.gov

Perturbations on an interface driven by a strong blast wave grow in time due to a combination of Rayleigh-Taylor, Richtmyer-Meshkov, and decompression effects. In this paper, we present results from a computational study of such a system under drive conditions to be attainable on the National Ignition Facility. Using the multi-physics, AMR, higher order Godunov Eulerian hydrocode, Raptor, we consider the late nonlinear instability evolution for multiple amplitude and phase realizations of a variety of multimode spectral types. We show that compressibility effects preclude the emergence of a regime of self-similar instability growth independent of the initial conditions by allowing for memory of the initial conditions to be retained in the mix-width at all times. The loss of transverse spectral information is demonstrated, however, along with the existence of a quasi-self-similar regime over short time intervals. The initial conditions are shown to have a strong effect on the time to transition to the quasi-self-similar regime. For high Mach number systems, nonlinear interactions between spikes can drive anomalously-fast generation of large scales that dominate the late-time growth. Results from both 3D and 2D calculations are presented, and 3D verses 2D effects are discussed.

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