Simulation of fabrication variations in supernova hydrodynamics experiments

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Recent experiments at the Omega laser facility have used ~4.5 kJ of energy to create a blast wave similar to the one that occurs in a core-collapse supernova. In the experiment, the blast wave crosses an interface with a drop in density similar to the He-H interface in a supernova, which induces the growth of a machined perturbation on the interface surface due to the Rayleigh-Taylor instability. These experiments have exhibited different morphology than our simulations predict. It has been hypothesized that such differences may be the result of unintended structures created in the target fabrication process. We have used 2D cartesian simulations to model such fabrication variations using a branch of the hydrodynamic code FLASH. We have studied the convergence of these numerical models and developed analysis techniques to gauge and compare the impact each variation has on numerical results. In addition to this, we have implemented and verified a new viscosity package for our code. These accomplishments have allowed us to perform a thorough analysis of the effects that such fabrication variations have on our results through the use of numerical simulations.

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