

Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

The effects of initial conditions on single and two-mode Rayleigh-Taylor instability TIE WEI, DANIEL LIVESCU, MALCOLM ANDREWS, Los Alamos National Laboratory — The dependence on initial conditions of single and two-mode Rayleigh-Taylor instability (RTI) is investigated using Direct Numerical Simulations (DNS). A new stage, chaotic development, was found at very late time of single-mode RTI, after the re-acceleration stage. We found that details of the shape of the initial perturbation, such as the diffusion thickness and perturbation amplitude, have a strong effect on the growth rate during the early and late time development, but minimal during the potential flow regime, such that the Goncharov “terminal velocity” result remains robust. The early time evolution is sensitive to diffusive effects and the dependence on initial conditions can be minimized by increasing the Reynolds and/or Schmidt numbers. At very late time, single-mode RTI transitions into a chaotic development stage, with strong sensitivity to initial conditions. We have also studied the effect of initial conditions on two-mode RTI, and found that the growth is strongly affected by the combination of mode numbers and amplitudes as well as the phase shift between modes. At late times, the motions become quite complicated, however some new phenomena, such as “leaning,” “ejection,” and “mode resonance,” can be identified as significantly influencing the growth rate.

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Date submitted: 09 Aug 2010

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