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Wavelet-Based Simulations of Rayleigh-Taylor Instability[1]
SCOTT RECKINGER, University of Colorado, DANIEL LIVESCU, Los Alamos National Laboratory, OLEG VASILYEV, University of Colorado — The Rayleigh-Taylor instability is investigated using numerical simulations on an adaptive mesh, performed with the Adaptive Wavelet Collocation Method (AWCM). The wide range of scales present in the development of the instability are efficiently resolved with AWCM, due to the physics-based adaptivity and direct error control of the method. The problem is initialized consistent with the solutions from linear stability theory, where the base state is the diffusive mixing of incompressible variable density fluids. Of interest are the variable density and compressibility effects on the departure time from the linear growth, the onset of strong non-linear interactions, and the late- time behavior of the fluid structures. Simulations performed for a single-mode perturbation in the incompressible limit match the early time linear growth, the terminal bubble velocity, and a reacceleration region. In order to investigate the turbulent mixing rates of the pure heavy and light fluids within the Rayleigh-Taylor mixing layer, simulations of compressible homogeneous isotropic turbulent mixing in a triply-periodic domain are also performed.

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