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Numerical investigations of Rayleigh-Taylor instability development from an initially isotropic turbulent velocity field POOYA MOVAHED, BRUCE FRYXELL, ERIC JOHNSEN, University of Michigan, Ann Arbor — The Rayleigh-Taylor instability (RTI) is a process by which the misalignment of the pressure and the density gradient at unstably stratified interfaces generates baroclinic vorticity. This process can transition from laminar flow to a fully turbulent mixing region. Numerical simulations of RTI are traditionally initialized by either perturbing the density field at the interface or by transforming the density perturbations to velocity perturbations using linear theory. In this study, the initial interface separates the light and heavy fluids in an existing isotropic turbulent velocity field extending in the whole domain in each fluid. These initial conditions enable us to reach high Reynolds numbers rapidly during the simulation. First, we neglect gravity and quantify isotropy and intermittency of the decaying turbulent field in the mixing region. Second, the problem is revisited in the presence of a gravitational field. The initial fluctuating velocity field perturbs the interface and the baroclinic vorticity generated in the mixing region due to the instability provides energy for the initial decaying turbulent field. A comparison of relevant physical quantities regarding isotropy and mixing is made to the first case. The simulations are performed using a high-order accurate minimally dissipative kinetic-energy preserving and interface capturing scheme. This research was supported in part by the DOE NNSA under the Predictive Science Academic Alliance Program by grant DEFC52-08NA28616.

Pooya Movahed
University of Michigan, Ann Arbor

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