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Self-similarity of a Rayleigh-Taylor mixing layer at low Atwood number with a multimode initial perturbation[1] BRANDON MORGAN, BRITTON OLSON, Lawrence Livermore National Laboratory, JUSTIN WHITE, JACOB MCFARLAND, Department of Mechanical and Aerospace Engineering, University of Missouri — High-fidelity large eddy simulation (LES) of a low-Atwood number ($A = 0.05$) Rayleigh-Taylor mixing layer is performed using the tenth-order compact difference code Miranda. An initial multimode perturbation spectrum is specified in Fourier space as a function of mesh resolution such that a database of results is obtained in which each successive level of increased grid resolution corresponds approximately to one additional doubling of the mixing layer width, or *generation*. The database is then analyzed to determine approximate requirements for self-similarity, and a new metric is proposed to quantify how far a given simulation is from the limit of self-similarity. It is determined that the present database reaches a high degree of self-similarity after approximately 4.5 generations. Finally, self-similar turbulence profiles from the LES database are compared with one-dimensional simulations using the k-L-a and BHR-2 Reynolds-averaged Navier-Stokes (RANS) models. The k-L-a model, which is calibrated to reproduce a quadratic turbulence kinetic energy profile for a self-similar mixing layer, is found to be in better agreement with the LES than BHR-2 results.

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