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Application of Self-Similarity Constrained Reynolds-Averaged Turbulence Models to Rayleigh-Taylor and Richtmyer-Meshkov Unstable Turbulent Mixing[1] TUCKER A. HARTLAND, Emory University, OLEG SCHILLING, Lawrence Livermore National Laboratory — Analytical self-similar solutions corresponding to Rayleigh–Taylor, Richtmyer–Meshkov and Kelvin–Helmholtz instability are combined with observed values of the growth parameters in these instabilities to derive coefficient sets for K–ϵ and K–L–a Reynolds-averaged turbulence models. It is shown that full numerical solutions of the model equations give mixing layer widths, fields, and budgets in good agreement with the corresponding self-similar quantities for small Atwood number. Both models are then applied to Rayleigh–Taylor instability with increasing density contrasts to estimate the Atwood number above which the self-similar solutions become invalid. The models are also applied to a reshocked Richtmyer–Meshkov instability, and the predictions are compared with data. The expressions for the growth parameters obtained from the similarity analysis are used to develop estimates for the sensitivity of their values to changes in important model coefficients. Numerical simulations using these modified coefficient values are then performed to provide bounds on the model predictions associated with uncertainties in these coefficient values.

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