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Applications of Analytical Self-Similar Solutions of Reynolds-Averaged Models for Instability-Induced Turbulent Mixing[1] TUCKER HARTLAND, University of California, Merced, OLEG SCHILLING, Lawrence Livermore National Laboratory — Analytical self-similar solutions to several families of single- and two-scale, eddy viscosity and Reynolds stress turbulence models are presented for Rayleigh–Taylor, Richtmyer–Meshkov, and Kelvin–Helmholtz instability-induced turbulent mixing. The use of algebraic relationships between model coefficients and physical observables (e.g., experimental growth rates) following from the self-similar solutions to calibrate a member of a given family of turbulence models is shown. It is demonstrated numerically that the algebraic relations accurately predict the value and variation of physical outputs of a Reynolds-averaged simulation in flow regimes that are consistent with the simplifying assumptions used to derive the solutions. The use of experimental and numerical simulation data on Reynolds stress anisotropy ratios to calibrate a Reynolds stress model is briefly illustrated. The implications of the analytical solutions for future Reynolds-averaged modeling of hydrodynamic instability-induced mixing are briefly discussed.

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