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Advances in Reynolds-Averaged Modeling of Transport and Mixing in High Reynolds Number Rayleigh-Taylor Turbulent Flows[1] GREGORY C. BURTON, OLEG SCHILLING, Lawrence Livermore National Laboratory — Data from the Cabot and Cook [Nature Physics 2, 562 (2006)] 3072^3 direct numerical simulation (DNS) of Rayleigh–Taylor flow is used to construct the profiles of the terms in the exact turbulent kinetic energy and its dissipation rate and the exact density variance and its dissipation rate transport equations across the mixing layer during the flow evolution. An L_2-norm minimization procedure is then applied to each dynamically important unclosed term and its gradient-diffusion or scale-similarity closure to determine the "optimal" model parameters as a function of Reynolds number. Using these dynamic model parameters, it is shown in a priori comparisons between the unclosed terms and their corresponding models that these closures provide good approximations to the turbulence production, dissipation, and diffusion mechanisms in large Reynolds number Rayleigh–Taylor mixing. In addition, models of the Reynolds stress tensor taking into account the anisotropic turbulence production mechanisms are discussed.

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