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Dynamic Bridging Paradigm for Coarse Grained Simulations of Turbulent Material Mixing. FERNANDO GRINSTEIN, JUAN SAENZ, RICK RAUENZAHN, Los Alamos Natl Lab, MASSIMO GERMANO, Duke University

— We focus on simulating the consequences of material interpenetration, hydrodynamical instabilities, and mixing arising from perturbations at shocked material interfaces, as vorticity is introduced by the impulsive loading of shock waves – e.g., as in inertial confinement fusion capsule implosions. Such complex flow physics is capturable with Coarse Grained Simulation – classical and implicit Large-Eddy Simulation, where the small-scale flow dynamics is presumed enslaved to the dynamics of the largest scales. Beyond shocks and variable-density turbulence multiscale-resolution issues, we must address the difficult problem of predicting flow transitions promoted by energy deposited at the material interfacial layers during the shock interface interactions. Transition involves unsteady large-scale coherent-structure dynamics resolvable by CGS but not by Reynolds-Averaged Navier-Stokes modeling based on equilibrium turbulence assumptions and single-point-closures. We propose a dynamic blended RANS/LES bridging strategy for applications involving variable-density turbulent mixing applications, and report progress testing its implementation for relevant cases prototyping the shock-driven turbulent mixing applications (Computers and Fluids 2020).

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