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Adaptive Wavelet-based Large Eddy Simulations of Compressible Turbulent Flows[1] ERIC BROWN-DYMKOSKI, OLEG V. VASILYEV, University of Colorado — Adaptive wavelet simulation exploits intermittency in turbulent flows by resolving locally on the most coherent structures, offering improved computational efficiency and a priori fidelity control. Adaptive LES utilizing a wavelet grid filter, hereto developed for incompressible flows, is extended to the compressible regime with a kinetic energy equation-based approach. Nonlinear filtered terms are scaled by the SGS kinetic energy and model coefficients are locally determined through a dynamic procedure. The influence of the modeled terms relative to the resolved physics can be used as a fidelity-based feedback control for the adaptive grid. Several benchmark cases, including turbulent mixing layers, are considered for the validation of this approach across multiple Mach numbers. Of particular interest is capturing compressibility and variable density effects within turbulent flows, notably the reduced growth rate of turbulent shear layer thickness and accurate modeling of the SGS heat flux. These simulations have been performed solving the filtered compressible Navier-Stokes equations with the adaptive wavelet collocation method.

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