Compressible Explicitly Filtered Large-Eddy Simulation Subgrid-Scale Models Based on the Poor Man’s Navier–Stokes Equations J.M. MCDONOUGH, J.P. STRODTBECK, University of Kentucky — A single-parameter large-eddy simulation (LES) method for compressible flows that combines explicit filtering with a chaotic backscatter term based on the compressible “poor man’s” Navier–Stokes (PMNS) equation (Strodtbeck et al., Int. J. Bifur. and Chaos, 2012) is presented and compared to direct numerical simulation (DNS) of homogeneous, isotropic, decaying turbulence in a periodic cube with a turbulent Mach number of 0.3 and Taylor micro-scale Reynolds number of 72. The DNS employed a $129^3$ mesh, and LES was run on a $65^3$ mesh. The backscatter is created by utilizing output from the PMNS equations as a multiplier on the high-pass filtered momentum to induce mixing, then using the results in a single-parameter linear forcing term that is simply added to the solution procedure. It is demonstrated that with a judicious choice of model parameter, the backscatter model is capable of enhancing small-scale turbulent flow structures and improving the flow statistics and spectral characteristics of the LES solution to more closely match the DNS results.

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