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A mixed LES model based on the residual-based variational multiscale formulation of compressible flows JIANFENG LIU, ZHEN WANG, ASSAD OBERAI, Department of Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytechnic Institute — In the residual-based variational multiscale (RBVM) formulation of large eddy simulation (LES) a projection operator is used to separate the solution of the Navier-Stokes equations into coarse and fine scales. The coarse scale equations are solved numerically while the fine scale equations are solved analytically. In particular, an algebraic approximation for the fine scale velocities is derived wherein they are expressed in terms of the residual of the Navier-Stokes operator applied to the coarse scale solution. We have recently demonstrated that while the RBVM model accurately models the cross-stress term, it under-estimates the contribution from the Reynolds-stress term. To remedy this we add to it a Smagorinsky eddy viscosity which provides a good approximation to the Reynolds-stress term. This leads us to a mixed model capable of accurately modeling all components of the subgrid stress. In this talk we extend this model to compressible flows and use it to predict the decay of compressible homogeneous isotropic turbulence. We note that the mixed model yields better agreement with direct numerical simulation than either of its components: the dynamic Smagorinsky model and the residual-based VMS model.

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