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LES of Supersonic Turbulent Flows with the Scalar FMDF ARAZ BANAEIZADEH, ZHAORUI LI, FARHAD JABERI, Michigan State University — The scalar filtered mass density function (FMDF) subgrid-scale model is further developed and tested for large eddy simulation (LES) of supersonic turbulent mixing and reacting flows in complex geometries. The LES/FMDF is implemented via a hybrid numerical method. In this method, the filtered compressible Navier-Stokes equations in curvilinear coordinate systems are solved with a generalized, high-order, multi-block, compact differencing scheme. To reduce the numerical oscillations of the compact scheme in shock regions, a localized high order artificial viscosity is added. The compressible scalar FMDF equation is solved with a stochastic Lagrangian Monte Carlo method. The results obtained with the LES/FMDF for shock tube and other compressible flows indicate that the pressure effects on the scalar field are well captured by the extended compressible FMDF model. The consistency of the filtered temperature and density fields as obtained from the Eulerian (finite difference) and Lagrangian (Monte Carlo) components of the LES/FMDF also indicate the reliability and the accuracy of the model in high speed flows.

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