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Grid-independent large-eddy simulation of compressible turbulent flows using explicit filtering[1] DONGHYUN YOU, Carnegie Mellon University, SANJEEB BOSE, PARVIZ MOIN, Center for Turbulence Research — One of the most notable drawbacks associated with the conventional implicit-filter LES is that the simulation result is dependent on the numerical grid employed due to the inherent dependence of the filtering operation on the numerical discretization. As the consequence of the grid-dependency, the implicit-filter LES is sensitive to numerical errors. In the present study, the use of explicit filtering in LES of compressible turbulent flows, is investigated in order to obtain numerical solutions that are grid independent and are not influenced by numerical errors. The efficacy of explicit-filtering to obtain a grid-independent solution of incompressible turbulent channel flow has been successfully demonstrated in the previous research (Bose, Moin & You, Phys. Fluids, 2010). In the present study, an effective methodology for explicit-filter LES is developed and validated for compressible turbulent flows. The convergence of simulations using a fixed filter width with varying mesh resolutions to a true LES solution will be analyzed, with particular attention to the performance of the chosen subgrid-scale model. Results from explicit-filtering LES of compressible turbulent flow through a channel with periodic contractions will be presented.

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