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Compressible turbulence and shock-capturing using a variational multiscale method ANIRBAN GARAI, NICHOLAS BURGESS, SCOTT MURMAN, LASLO DIOSADY, NASA Ames Research Center — We have previously developed a dynamic extension of Hughes' variational multiscale method which is implemented in an entropy-stable Discontinuous-Galerkin spectral-element solver[1]. This solver and sub-grid model have been examined on standard low-speed benchmark flows, *e.g.* homogeneous turbulence, channel flow, *etc.* Here we extend the approach to higher speeds where compressibility effects are no longer insignificant, and the flowfields develop unsteady shocklets and shock waves. Homogeneous isotropic turbulence at high turbulent Mach number is tested for two cases - decaying and passing through a normal shock. Numerical simulations using the multiscale sub-grid model, no sub-grid model, and a variation of Barter and Darmofal's shock-capturing scheme[2] are examined in isolation and combination. The computed results are compared against theoretical observations and previous computational results.

[1]Murman *et al.*, AIAA 2016-1059
[2]Barter and Darmofal, J. Comp. Physics, 229(5)

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