Shock-confining filters for LES of compressible turbulence[1]
NATHAN GRUBE, M. PINO MARTIN, Princeton University — Uniformly high-order-accurate filtering of fluid flow properties in the presence of shocks and shocklets is susceptible to the introduction of Gibbs-like overshoots and stability problems. An example is given in Taylor, Grube and Martin (2007)[2], who show that linear filtering of highly compressible turbulent flow fields creates antiphysical flow characteristics. To alleviate this problem, we develop shock-confining filters (SCF). These non-linear filters adapt in order to avoid filtering across discontinuities. When used in combination with WENO methods, the data smoothness is gaged by the shock-capturing method and used to control the SCF adaptation. In smooth turbulent regions, the SCF reduces to a desired linear filter, and a traditional LES is recovered. We assess the benefits of SCF in the simulation of shock/isotropic turbulence interactions using the dynamic mixed model and the approximate deconvolution model.

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