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Shock Turbulence Interaction using Observable Euler Equations
CHANG XIAO, KAMRAN MOHSENI, University of Colorado at Boulder — Accurate numerical simulations of turbulent flows requires minimizing numerical dissipation, while the usual shock-capturing schemes need numerical dissipation for the algorithm stabilization. To overcome this dilemma, the observable Euler equations (Mohseni, AIAA paper 2009-5695) were proposed as a technique for simultaneous regularization of shocks and turbulence. The effects of the observable Euler equations in 3D shock turbulence simulation have been tested in several problems including the Shu-Osher, Taylor-Green Vortex, Noh problem, and decaying compressible isotropic turbulence with eddy shocklets. The Taylor-Green Vortex problem tests the stability for severely under-resolved motions, as well as a measure of the preservation of kinetic energy and the growth of enstrophy. In the Noh problem, strong shock waves interact with interfaces separating different fluids and with the resulting turbulence. It tests the capability to handle a strong spherical shock. In the case of decaying compressible isotropic turbulence with eddy shocklets, the ability of the observable Euler equations to handle "randomly" distributed shocklets, as well as the accuracy for broadband motions in the presence of shocks was tested.

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