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DNS and LES of Shock / Isotropic Turbulence Interaction[1]
NATHAN GRUBE, ELLEN TAYLOR, Princeton University, PINO MARTIN, University of Maryland — We use direct numerical simulation (DNS) and large-eddy simulation (LES) to investigate the interaction of highly-compressible isotropic turbulence with nominally planar shock waves. The upstream isotropic turbulence is characterized by turbulence Mach numbers ranging from 0.14 to 0.94 and Taylor microscale Reynolds numbers ranging from 16 to 78. The convection speed of the turbulence through the shock ranges from Mach 1.5 to Mach 5. Streamwise profiles of mean and fluctuating thermodynamic and turbulence quantities are computed along with budgets for Reynolds stresses and fluctuating vorticity. Approximate three-dimensional turbulence energy spectra are computed using Taylor's Hypothesis. Visualization is aided by numerical schlieren animations. The DNS and LES are run using a WENO shock-capturing method in a finite difference code. Subgrid-scale terms are modeled using a dynamic mixed model and an approximate deconvolution model. The LES results are compared with DNS data.

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