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Large-Eddy Simulation of a Transverse Jet in a Supersonic Crossflow using High-Order Compact Scheme with Artificial Fluid Properties[1]
SOSHI KAWAI, Center for Turbulence Research, Stanford University, Stanford, CA 94305-3035, SANJIVA K. LELE, Department of Aeronautics and Astronautics, Stanford University, Stanford, CA 94305-3035 — Transverse jet injected into a supersonic crossflow is studied numerically by non-reactive compressible large-eddy simulation. High-order compact differencing scheme is used to resolve the scales of turbulence through the entire computational region and coupled with artificial nonlinear fluid properties to capture the complex flow discontinuities which include unsteady shock waves, entropy discontinuities between the jet and crossflow and its interactions. The method of artificial fluid properties which is based on the approach proposed by Cook and Cabot [JCP 195 (2004) 594-601], Fiorina and Lele [JCP 222 (2007) 246-264] and Cook [POF 19 055103 (2007)] is extended to a generalized coordinate framework. Simulated flow properties are compared with the available experimental data. Preliminary results show qualitative agreement with the experiment. Important flow features such as the bow shock, the barrel shock and Mach disk within the jet, the jet penetration and its mixing are well captured.

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