Abstract Submitted
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Wall-modeled large-eddy simulations of shock/turbulent-boundary layer interaction in a duct[1] IVAN BERMEJO-MORENO, JOHAN LARSSON, LAURA CAMPO, JULIEN BODART, DAVID HELMER, FRANK HAM, JOHN K. EATON, Stanford University — We present wall-modeled LES of the interaction of an oblique shock wave and a turbulent boundary layer in a low-aspect-ratio duct, following the experiment by Campo, Helmer & Eaton, 2012. A $M = 2.05$ air stream is deflected by a small compression wedge that spans the top wall of the duct at 20°, generating an oblique shock that reflects off the turbulent boundary layer at the bottom wall. The Reynolds number of the incoming flow based on the boundary layer momentum thickness is $Re_\theta = 6,500$. Simulations are performed with a control-volume-based, finite-volume solver of the filtered, compressible Navier-Stokes equations, utilizing a grid-based blend of non-dissipative central and dissipative upwind fluxes, Vreman (2004) subgrid scale model and ENO shock-capturing scheme, active only near shocks. An equilibrium wall model (Kawai and Larsson, 2012) is used. Turbulence is generated at the inflow from experimental data. Simulation results are compared to PIV data on four planes normal to the spanwise coordinate. A grid-convergence study is performed. Two heights of the compression wedge are considered, resulting in an increased strength of the interaction. Simulation results are also used to study the evolution of corner flows, complementing experimental findings.

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