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Large eddy simulation of high velocity compressible flows interacting with immersed objects IMAN BORAZJANI, AMIR MAHDI AKBARZADEH, Texas AM University — Large-eddy simulations (LES) of flows involving solid surfaces, shock waves, and turbulent flows are performed using a dynamic subgrid-scale model along with a sharp-interface immersed boundary method. The inviscid fluxes of compressible flow equations in curvilinear coordinates are discretized with a hybrid discretization comprising a fourth-order central scheme and a third-order weighted essentially non-oscillatory (WENO) scheme. The LES is validated by comparing the results for the decay of isotropic homogeneous turbulent flows with the results obtained from direct numerical simulations (DNS). Then, the method is validated against experimental measurements and shown to be second-order accurate in the presence of immersed boundaries. The numerical results capture all of shock features observed in the experiments and show great agreement with the measurements. Finally, the interaction of the shock and turbulent flow is studied by modeling transonic flow over a circular-arc bump. This work was partly supported by the National Science Foundation (NSF) CAREER Grant CBET 1453982, and the High Performance and Research Center (HPRC) of Texas A&M University.

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