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Large-Eddy Simulation of a Shock Train in a Duct with Side Walls BRANDON MORGAN, KARTHIK DURAISAMY, SANJIVA LELE, Stanford University — Large-eddy simulation (LES) is utilized to investigate the three-dimensionality of a shock train in a constant-area isolator model with fully resolved side walls ($M_\infty = 1.61$, $\mathrm{Re}_\theta \approx 1660$). Flow conditions and geometry are selected to match experimental conditions investigated by Carroll (1988); although Reynolds number is reduced to ensure adequate mesh resolution. Simulations with spanwise periodic boundary conditions are first performed, the results of which are compared to experiment and validated with a three-level grid refinement study. The same shock train interaction is then simulated in a three-dimensional, low-aspect ratio rectangular duct geometry with particular emphasis placed on characterizing secondary corner flows and the effects of these corner flows on the location and structure of the shock train. It is found, for instance, that location of the initial shock is particularly sensitive to the effects of spanwise confinement. Most significantly, it is observed that the same pressure ratio which results in a stable shock train with periodic boundary conditions may result in isolator unstart when side-wall effects are fully resolved.

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