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Computational Study of Shock-Associated Noise Characteristics Using LES[1] J. LIU, A. CORRIGAN, K. KAILASANATH, Naval Research Laboratory, N. HEEB, D. MUNDAY, E. GUTMARK, University of Cincinnati — Shock-associated noise generation has been investigated by using large-eddy simulations to compute jet flows at an underexpanded jet condition with three jet temperatures. To better understand shock-associated noise generation, shock-free jets with the same fully expanded jet conditions have also been simulated. The predictions agree well with the available experimental data in both the near and far field. It is found that shock cells at this underexpanded jet condition have little impact on the jet core length and the turbulence kinetic energy distribution, whereas the heating effect has a much larger impact by increasing the initial shear-layer spreading and shortening the jet core length. Shock-associated noise dominates in the upstream direction, and the broadband peak frequencies move to higher values in downstream direction. This frequency increase is initially small in the upstream direction, but becomes much larger in the downstream direction. In addition, it is found that the heating effect increases the broadband peak frequency. Overall the heating effect increases the mixing noise and slightly reduces the shock-associated noise. This reduces the difference between the shock-containing jets and the shock-free jets as the temperature increases.

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