Abstract Submitted
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Investigation of the Near-Field Acoustic Properties of Imperfectly Expanded Supersonic Jets using Large-Eddy Simulations[1] JUNHUI LIU, KAILAS KAILASANATH, RAVI RAMAMURTI, Naval Research Lab, DAVID MUNDAY, EPHRAIM GUTMARK, University of Cincinnati — Numerical simulations of Imperfectly Expanded Supersonic Jets from a CD nozzle representative of those used in military engines have been carried out. A MILES (Monotonically Integrated Large Eddy Simulations) approach with a finite element version of Flux-Corrected Transport algorithm (FEM-FCT) is used. FEM-FCT is able to accurately implement nozzle geometries and is ideal for simulating shock-containing flows. We have simulated a wide range of under-and over-expanded flow conditions as well as the design condition. The distributions of the centerline static pressure and noise spectra are in good agreement with the corresponding experimental data. It is found that this type of nozzle is not shock free even at the design condition due to the sharp change of the geometry in the throat area. The near-field acoustics is investigated, and screech tones are observed in all cases except in an over-expanded case with a low total pressure ratio. The frequencies of the screech tones are in good agreement with both the theoretical prediction and the measurement. The noise source locations are investigated by studying the noise distributions at peak frequencies and the correlations between pressure and other flow quantities.

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