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Analysis of Screech Generation in a Cold Supersonic Rectangular Jet with Large-Eddy Simulations[1] GAO JUN WU, Department of Aeronautics and Astronautics, Stanford University, SANJIVA LELE, Department of Aeronautics and Astronautics and Department of Mechanical Engineering, Stanford University, JINAH JEUN, Center for Turbulence Research, Stanford University — Screech is an aeroacoustic resonance phenomenon found in non-ideally expanded supersonic jets. Using large-eddy simulations, this work studies screech generation for a cold under-expanded rectangular jet at several Nozzle Pressure Ratios (NPRs) around maximum screech. The aspect ratio of the converging-diverging rectangular nozzle is 4:1 and the design Mach number is 1.44. In the noise spectra, screech tones are detected at various observer locations. Spectral Proper Orthogonal Decomposition (SPOD) techniques are used to extract the temporal-spatial coherent structures from the LES data. At the screech frequency, a flapping motion is detected along the minor-axis plane, and a spatially modulating antisymmetric standing wave pattern is observed in the near field as a result of oppositely travelling hydrodynamic and acoustic wavepackets. In contrast to the conventional belief that screech feedback is closed by upstream-travelling acoustic waves outside the jet, recent research has indicated that the closure mechanism could arise from an internal acoustic mode supported by the jet plume. To further investigate this hypothesis, a linear instability analysis for the jet flow will be conducted, and the results will be compared with the SPOD data.

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