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Numerical investigation of coupling between twin supersonic rectangular jets[1] JINAH JEUN, Center for Turbulence Research, Stanford University, GAO JUN WU, SANJIVA K. LELE, Stanford University — In this work we perform large-eddy simulations (LES) using Voronoi-CharLES from Cascade Technologies to study coupling between cold over-expanded supersonic jets, issuing from two closely placed rectangular nozzles with an aspect ratio of 2. The far-field sound generated from these jets is obtained by projecting the near-field LES data using the Ffowcs Williams-Hawkings method and the effects of jet-to-jet interactions are studied. Noise characteristics predicted by LES compare favorably with the experiments conducted at the University of Cincinnati, including screech. The LES captures out-of-phase flapping motions of the two jets with respect to each other, constructing 3-d coupled oscillations. At the screech frequency and its harmonics, the LES detects strong coherence between the two jets with the phase lag suggesting anti-symmetric coupling, consistent with the out-of-phase jet flapping. By applying spectral proper orthogonal decomposition analysis to near-field pressure and velocity fluctuations, coupling modes at such frequencies are further identified, and mechanisms behind the twin-jet coupling and its impact on the screech noise generation are discussed.

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