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Understanding sideline jet noise using input-output analysis[1] JINAH JEUN, JOSEPH W. NICHOLS, Department of Aerospace Engineering and Mechanics, Univ of Minnesota - Twin Cities, MIHAILO R. JOVANOVIC, Department of Electrical and Computer Engineering, Univ of Minnesota - Twin Cities —
We apply input-output analysis to high-speed turbulent jets to obtain the far-field acoustic response at different radiation angles. We consider both axisymmetric and higher azimuthal modes over a range of different frequencies to investigate the resulting noise spectra. At each frequency, singular value decomposition of the resolvent operator distinguishes between the optimal mode and several sub-optimal input-output modes by the magnitude of corresponding singular value. While both types of modes resemble wavepackets, the optimal mode associated with the largest singular value is superdirective in the peak noise radiation angle. Sub-optimal modes, in contrast, appear increasingly omnidirectional, rotating progressively to the sideline direction. Our analysis also recovers a broadening of the far-field acoustic spectra as the radiation angle increases. We show that a significant amount of the entire acoustic field can be captured by a superposition of a small number of coherent input-output modes.

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