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Study of Noise Generation Mechanisms of a Turbulent Jet through Analysis of Simulation Data

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ABSTRACT

Computational simulation techniques produce considerably more information about turbulent jets than experimentation and have the potential to be effective research tools for reducing the noise footprint of jet engine exhaust. There is a need to exploit the large amount of data generated by such simulations to gain a better understanding of the noise generation mechanisms in a jet. Such information can be vital to the design of future noise-reducing nozzle geometries. This project uses the simulation data generated by a large eddy simulation (LES) tool to investigate the creation and propagation of upstream moving sound waves in the potential core of a subsonic jet. Two tools are implemented to analyze the aforementioned sound waves. The first performs spectral analysis that provides insight about the dominant frequencies associated with these waves. The second determines space-time correlations that can be used to find the velocity of propagation of the waves, and where they originate in the potential core. The results of this study show that there are two dominant low-frequency waves along with their harmonics present within the upstream traveling waves. Near the center of the potential core the wave velocities were found to change sign indicating the point of generation of the upstream propagating waves. These results and developed tools will enable further research on the interactions between the sound waves and the shear layer.

KEYWORDS

Jet noise, wave propagation, LES, CFD