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Flow and Acoustic Features of a Mach 0.9 Free Jet Using High-Frequency Excitation[1] PUJA UPADHYAY, FARRUKH ALVI, Florida State University — This study focuses on active control of a Mach 0.9 ($Re_D = 6 \times 10^5$) free jet using high-frequency excitation for noise reduction. Eight resonance-enhanced microjet actuators with nominal frequencies of 25 kHz ($St_D \approx 2.2$) are used to excite the shear layer at frequencies that are approximately an order of magnitude higher than the jet preferred frequency. The influence of control on mean and turbulent characteristics of the jet is studied using Particle Image Velocimetry. Additionally, far-field acoustic measurements are acquired to estimate the effect of pulsed injection on noise characteristics of the jet. Flow field measurements revealed that strong streamwise vortex pairs, formed as a result of control, result in a significantly thicker initial shear layer. This excited shear layer is also prominently undulated, resulting in a modified initial velocity profile. Also, the distribution of turbulent kinetic energy revealed that forcing results in increased turbulence levels for near-injection regions, followed by a global reduction for all downstream locations. Far-field acoustic measurements showed noise reductions at low to moderate frequencies. Additionally, an increase in high-frequency noise, mostly dominated by the actuators resonant noise, was observed.

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