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Global Mode-Based Control of Supersonic Jet Noise[1] MAHESH NATARAJAN[2], JONATHAN FREUND[3], DANIEL BODONY[4], University of Illinois at Urbana-Champaign — The loudest source of high-speed jet noise appears to be describable by unsteady wavepackets that resemble instabilities. We seek to reduce their acoustic impact by developing a novel control strategy that uses global modes to model their dynamics and structural sensitivity of the linearized compressible Navier-Stokes operator to determine effective linear feedback control. Using co-located actuators and sensors we demonstrate the method on an axisymmetric Mach 1.5 fitted with a nozzle. Direct numerical simulations using this control show significant noise reduction, with additional reduction with increase in control gain. Eigenanalysis of the uncontrolled and controlled mean flows reveal fundamental changes in the spectrum at frequencies lower than that used by the control. The non-normality of the global modes is shown to enable this control to affect a wide range of frequencies. The low-frequency wavepacket components are made less acoustically efficient, which is reflected in the far-field noise spectrum. Mean flow alterations are minor near the nozzle and only become apparent further downstream.

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