Abstract Submitted
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Effects of heating and Mach number on global modes of high-speed jets[1] JOSEPH NICHOLS, SANJIVA LELE, Center for Turbulence Research, Stanford University — The noise produced by high-speed jets is analyzed by global mode decomposition over a range of Mach numbers and jet-to-ambient density ratios. A massively parallel shift-and-invert Arnoldi method is used to extract global modes from simulations of the fully compressible linearized Navier–Stokes equations. Both laminar and turbulent mean (satisfying the Reynolds averaged Navier-Stokes equations with the k-epsilon model of Tam and Thies) base flows are considered. The least-stable portions of the global spectra were observed to split into two types of branches, which are shown to be linked to Kelvin-Helmholtz and Tam-Hu instability waves, respectively. Because they are upstream propagating, Tam-Hu waves are neglected by traditional analyses based on the parabolized stability equations. Significant transient growth is recovered through an optimal superposition of the global modes, and it is found that non-normality increases with decreasing density ratio as well as with decreasing Mach number.

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