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Acoustic resonance in a supersonic ducted jet VICTOR TOPALIAN, JONATHAN FREUND, University of Illinois at Urbana-Champaign — We consider an overexpanded jet confined by a finite-length duct, which is a model for a particular jet-engine test cell flow in which high-amplitude resonances are observed. This resonance is studied with a two-dimensional model configuration, the flow in which is solved using high-order finite differences on a staggered mesh. A resonant regime was identified for a Mach 1.2 jet, with the amplitude of the acoustic fluctuations of the same order to those observed in test cells. The feedback mechanisms of the resonance will be discussed, and it will be shown that the resonance is suppressed when a damping term designed to remove a small amount of energy from the dominant acoustic mode is added to the equations. The observations from these simulations suggest a scaling that seems to collapse results for the most excited tones observed in several experiments over a broad range of parameters (jet Mach numbers, and duct and nozzle diameters), in both cylindrical and rectangular duct geometries.

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