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Acoustic and hydrodynamic responses of turbulent cavity flows<sup>1</sup> QIONG LIU, CHITRARTH PRASAD, DATTA GAITONDE, Ohio State Univ -Columbus — Flow-acoustic interaction produces a self-sustained feedback oscillation in a compressible cavity flow. We examine this interaction at Re=10,000 and Mach 0.6 and 1.4, and the effect of harmonic forcing, by decomposing resolvent response modes into acoustic and hydrodynamic components with Doaks momentum potential theory. The forcing frequencies considered include those organic to the unforced flow, as well as higher non-organic values that trigger more substantial energy amplification. In the first scenario, the response acoustic modes emerge at the trailing edge and propagate forward, confirming the role of self-sustained feedback oscillation. For high-order forcing frequencies, the response acoustic modes concentrate in the shear layer region and weaken towards trailing edge, without impinging in it. This indicates that despite their larger response, the higher-order acoustic modes participate less in the feedback oscillation of the cavity flow. The acoustic response modes correlate highly with the hydrodynamic response modes. We also investigate the compressibility effect on the acoustic and hydrodynamic responses in the supersonic cavity flow. The resulting view of acoustic and hydrodynamic responses provides insights that can help guide control strategies.

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