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Vortical structures of an axisymmetrically oscillating self-excited jet subjected to transverse acoustic forcing[1] ABHIJIT KUMAR KUSHWAHA, The Hong Kong University of Science and Technology, NICHOLAS WORTH, JAMES R. DAWSON, Norwegian University of Science and Technology, LARRY K.B. LI, The Hong Kong University of Science and Technology, MAE-HKUST/EPT-NTNU COLLABORATION COLLABORATION — We experimentally examine the vortical structures in the near-field region of an axisymmetrically oscillating self-excited low-density jet subjected to axial and transverse acoustic forcing. We apply the forcing at frequencies around the global frequency of the jet and measure its response via time-resolved stereoscopic particle image velocimetry. We find that, when forced at amplitudes sufficient for synchronization, the jet exhibits two distinct types of coherent structures: (i) in-phase roll-up of shear layers when the forcing is axial and (ii) anti-phase roll-up of shear layers when the forcing is transverse. We find that the latter type coincides with a suppression of the self-excited global mode via asynchronous quenching. Using proper orthogonal decomposition, we extract the dominant modes of the jet, resolving the flow structures associated with acoustic and vortical disturbances. As well as providing new insight into the way external acoustic oscillations interact with self-excited hydrodynamic oscillations, this study clarifies the role of symmetry breaking in suppressing global instability in axisymmetrically oscillating self-excited jets.

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