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Dynamics of Axisymmetrically Excited Transverse Jets[1] ELIJAH HARRIS, DAVID D. W. REN, ANDREA BESNARD[2], STEPHEN SCHEIN, ROBERT M'CLOSKEY, ANN KARAGOZIAN, University of California, Los Angeles, LUCA CORTELEZZI, Politecnico di Milano — The present experimental study investigates axisymmetric excitation of a gaseous jet issuing into a uniform crossflow as pertains to jet dynamics as well as structural and mixing characteristics. A naturally absolutely unstable (AU) transverse jet, with a jet-to-crossflow momentum flux ratio of J=6, is forced with a variety of different periodic waveforms including sinusoidal, square wave, and multi-pulse square waves. For specific perturbation amplitudes and within specific forcing frequency regimes, the jet locks-in to the forcing frequency, prior to which there is evidence of quasi-periodicity. The critical conditions to achieve lock-in differ amongst the various excitation waveforms, where the sinuous forcing cases have the greatest challenges in achieving lock-in for this AU jet. As one increases the forcing amplitude beyond lock-in, the jet displays complex synchronization dynamics and mode shapes, en route to more chaotic behavior, as quantified through snapshot proper orthogonal decomposition (POD) analysis of the velocity field extracted via stereo particle image velocimetry (PIV), and time delay embedding of velocity fluctuations along the jet shear layer.

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