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Asymmetric Excitation of Convectively Unstable Jets in Crossflow[1] ANDREA BESNARD[2], ELIJAH HARRIS, STEPHEN SCHEIN, ALEXANDRA DEMBRY, DAVID D. W. REN, ANN KARAGOZIAN, University of California, Los Angeles, LEONARDO ALVES, Universidade Federal Fluminense
— This experimental study explores the influence of external asymmetric excitation on the dynamics, structure, and mixing characteristics of the gaseous jet in crossflow (JICF) with a jet-to-crossflow momentum flux ratio of J=61. In the absence of excitation, the jets upstream shear layer (USL) is convectively unstable with an asymmetric mean cross-section. Asymmetric forcing is applied via flush-mounted speakers about the jet exit periphery, allowing for controlled directional azimuthal forcing in counterclockwise or clockwise directions as well as localized sinusoidal excitation outside of the jet exit. For specific perturbation amplitudes, especially near the fundamental frequency, the jets USL locks-in to the forcing frequency, while other forcing conditions provide evidence of quasi-periodicity. Lock-in is typically required to affect both jet structure and mixing. Snapshot proper orthogonal decomposition (POD) analysis is applied to the JICFs scalar field, quantified via acetone planar laser induced fluorescence (PLIF). For forcing cases known to produce a strongly locked-in USL, phase space mapping of the dominant POD mode coefficients show the emergence of coherent shapes resembling strange attractors, potentially suggesting a transition in the flow.

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[2]Currently with Exponent

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