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Structural and mixing characteristics in actively controlled transverse jets[1] TAKESHI SHOJI, ANDREA BESNARD, ELIJAH HARRIS, ROBERT M'CLOSKEY, ANN KARAGOZIAN, UCLA, LUCA CORTELEZZI, Politecnico di Milano — These experiments explore the effect of external excitation on gaseous transverse jet (TJ) structural and mixing characteristics, emphasizing axisymmetric jet forcing. Sinusoidal as well as single and multiple square wave pulses, the latter with variable amplitudes, are explored for a range of jet-to-crossflow momentum flux ratios J, spanning regimes[2] of absolutely unstable upstream shear layers ($J < 10$) and convectively unstable shear layers ($J > 10$). The studies utilize acetone PLIF imaging of the jet, as done for unforced jets[3]. Axisymmetric forcing, irrespective of the waveform, can enhance cross-sectional symmetry of the TJ for convectively unstable conditions, but generally disrupts the usually symmetric counter-rotating vortex pair (CVP) observed for the absolutely unstable TJ. Conditions producing deeply penetrating, periodic vortical structures, such as square wave forcing at critical stroke ratios, increase jet spread, but do not always optimize molecular mixing. Creating multiple vortex structures of different strengths via multiple square pulses leads to enhanced interactions and accelerated vortex breakdown, potentially increasing mixing.

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[2]Megerian, et al, JFM **593**, pp. 93-129, 2007
[3]Gevorkyan, et al, JFM **790**, pp. 237-274, 2016

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