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Characteristics of a Strongly-Pulsed Non-Premixed Jet Flame in Cross-flow MIRKO GAMBA, NOEL T. CLEMENS, OFODIKE A. EZEKOYE, Department of Aerospace Engineering and Engineering Mechanics, and Department of Mechanical Engineering, The University of Texas at Austin — The effects of large-amplitude, high-frequency harmonic forcing of turbulent nonpremixed hydrogen/methane jet flames in cross-flow (JFICF) are investigated experimentally. Flame lengths, penetration lengths, and mixing characteristics are studied using flame luminosity imaging, planar laser Mie scattering visualization and particle image velocimetry. Mean jet Reynolds numbers of 1,600 and 3,250 (peak Re ∼2,500–6,500) with corresponding mean momentum flux ratios, r, of 1.9 and 3.7 (peak r ∼2.6–8.3) are considered. Forcing frequencies of 100 Hz and 300 Hz with amplitudes of ∼60%–300% are investigated. Consistent with previous work, a drastic decrease in flame length and soot emission, an increase in flame penetration and an improved jet fuel/cross-flow air mixing are observed for the larger forcing amplitude cases. Partial pre-mixing induced by near-field reverse flow, near-field vortex/vortex interaction and large-scale stirring, rendered stronger by large forcing amplitudes and frequencies, are thought to play a key role on the observed effects.

Mirko Gamba
Department of Aerospace Engineering and Engineering Mechanics,
The University of Texas at Austin

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