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Mixing and Flow-field Characteristics of Strongly-forced Transitional / Turbulent Jets and Jet Flames KRISHNA LAKSHMINARASIMHAN, NOEL CLEMENS, OFODIKE EZEKOYE, Department of Mechanical Engineering and Department of Aerospace Engineering and Engineering Mechanics, The University of Texas at Austin — Strong pulsations of the fuel flow rate have previously been shown to dramatically alter the flame length and luminosity of nonpremixed jet flames. The mechanisms responsible for such changes are explored experimentally in nonreacting and reacting strongly pulsed jets by using cinematographic PIV and acetone PLIF. The large amplitude forcing was obtained by pulsing the flow using a solenoid valve at the organ-pipe resonance frequency of the fuel delivery tube. The velocity fluctuations in the flow produced by the resonant pulsing of the jet can reach to about 8 times that of the mean flow. The jet characteristics were studied for Reynolds numbers based on mean flow velocity ranging between 800 and 2400. The PIV shows that with strong pulsations the jet exhibits significant reverse flow into the fuel delivery tube and an increase in turbulence in the near-field region. The acetone PLIF imaging was performed inside and outside the fuel tube in order to study the effects of pulsations on the mixing. These measurements showed significant in-tube partial premixing due to the reverse flow near the nozzle exit as well as enhanced mixing due to coherent vortical structures and increased turbulence.

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