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Structure and Dynamics of a Reacting Jet in a Swirling Vitiated Crossflow[1] PRATIKASH PANDA[2], MARIO ROA[3], ROBERT LUCHT[4], Purdue University, West Lafayette — A reacting jet issuing into a vitiated, swirled cross flow operating at a pressure of 5.5 bars is investigated using high repetition rate (5 kHz) Particle Image Velocimetry (PIV). A premixed jet composed of natural gas and air is injected into the vitiated stream through an extended nozzle downstream of a low swirl burner (LSB) that produces the vitiated, swirled flow. The jet-to-crossflow momentum flux ratio is varied to study the corresponding impact on the flow structures. The raw PIV images indicate a strong influence of the swirling crossflow on the jet at planes closest and farthest away from the nozzle exit. The mean flow field is found to preserve the counter-rotating vortex pair (CRVP) which is the most dominant flow structure in a jet in crossflow flow-field. The instantaneous vector field indicates presence of a very interesting oscillatory motion of the CRVP indicating a in plane jet flapping behavior. This oscillatory motion is affected by the accelerating flow above and below the CRVP which could be correlated to the instantaneous heat release at that location. Proper Orthogonal Decomposition (POD) is used to extract the frequency characteristics and dynamics of this flapping jet.

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