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Computational Study of the Effect of Compositionally Inhomogeneous Fuel Streams on Turbulent Jet Flames MICHAEL E. MUELLER, BRUCE A. PERRY, Princeton University, ASSAAD R. MASRI, The University of Sydney — A new piloted turbulent jet burner has been developed at The University of Sydney to investigate how inhomogeneous partially premixed inlet conditions affect flame structure and stability characteristics [S. Meares, A.R. Masri, Combust. Flame 161 (2014) 484-495]. Compositional inhomogeneity at the inlet is achieved by recessing a central tube that separates the fuel stream and a surrounding annular air flow to allow for a controlled amount of mixing before the gases reach the nozzle exit. In this work, Large Eddy Simulation of the burner is performed using a conventional nonpremixed flamelet/progress variable model. The geometry is divided into three separately computed domains: fully developed pipe/annulus flow, pipe flow in the region of fuel/air mixing upstream of the nozzle, and the turbulent flame. The results for two recess distances of the central tube (inhomogeneous fuel inlet and effectively homogeneous fuel inlet) are compared to recent experimental measurements. Discrepancies between the simulation and experiment show that premixed combustion is dominant only for the inhomogeneous case at the base of the flame. Sensitivitiese to grid resolution in both the upstream mixing domain and the turbulent flame domain as well as pilot conditions are assessed.

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