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The Effect of Formation Parameters on Ambient Fluid Entrainment during Vortex Ring Formation[1] ALI B. OLCAY, PAUL S. KRUEGER, Southern Methodist University — In this study, entrainment of ambient fluid during vortex ring formation from a piston-cylinder mechanism is investigated. During piston motion, the shear layer which separates at the nozzle lip rolls up and entrains some of the ambient fluid into the forming vortex ring. Consequently, both ejected and ambient fluid must be accelerated with the forming vortex ring. Understanding the entrainment mechanism is of interest because enhanced entrainment can improve the pumping and propulsive effectiveness of pulsed jets. Therefore, ambient fluid entrainment is examined using planar laser induced fluorescence (PLIF) for jet Reynolds number, and piston stroke-to-diameter ratios (L/D) in the ranges of 500 to 2000 and 0.5 to 2.0, respectively. Both trapezoidal and triangular piston velocity programs were used. It is observed that changing the initial acceleration of the velocity program affected the entrainment by as much as 20% for a given L/D and Reynolds number. Also, decreasing L/D enhanced entrainment by as much as 20%, but changing Reynolds number had a much weaker effect on entrainment.

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