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Ambient fluid entrainment by pinched off laminar vortex rings
ALI OLCAY, University of Wisconsin - Platteville, PAUL KRUEGER, Southern Methodist University — A starting jet produced with a jet slug length-to-diameter (L/D) ratio greater than a limiting value called the formation number leads to a leading vortex ring pinched off from its generating jet. It is our interest to understand the significance of formed trailing jet on ambient fluid entrainment by the leading vortex ring. In this study, starting jets are produced from a piston – cylinder mechanism for jet Reynolds number of 1400 at L/D of 3.0, 6.0, and 9.0 for a trapezoidal velocity program. Using Lagrangian Coherent Structures (LCS) along with experimental velocity field data, a gap between the vortex spiral and trailing jet is identified where entrainment into the ring takes place. It is noticed that entrainment occurs through much smaller area for a pinched off vortex ring than an isolated vortex ring due to the existence of a trailing jet. This indicates that entrainment into the leading vortex ring is limited by the trailing jet and changes in L/D will not significantly affect entrainment into the ring once pinch off has occurred.

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