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Momentum Evolution of Ejected and Entrained Fluid During Laminar Vortex Ring Formation[1] PAUL S. KRUEGER, Southern Methodist University, ALI B. OLCAY, University of Wisconsin-Platteville — Part of the complex flow evolution during vortex ring formation involves exchange of fluid momentum between ejected fluid, entrained fluid, and added mass. To investigate this process, vortex rings are generated numerically by transient jet ejection for fluid slug length – to – diameter (L/D) ratios of 0.5 – 3.0 using three different velocity programs at a jet Reynolds number of 1000. Lagrangian coherent structure (LCS) techniques are utilized to identify ejected and entrained fluid boundaries, and a Runge-Kutta 4^{th} order scheme is used for advecting these boundaries with numerical velocity data. By monitoring the center of mass of the fluid boundaries, momentum of the ejected and entrained fluid is calculated and related to the total impulse provided by the vortex ring generator. It is observed that most of the ejected fluid's momentum is transferred to the added mass while the jet is on for trapezoidal and triangular positive slope velocity programs. Also, as L/D is reduced from 3.0 to 1.0, momentum of entrained fluid in the formed ring is more than doubled.

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