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Reynolds Number Dependence of Vortex Ring Formation by Transient Jet Ejection[1] PAUL S. KRUEGER, SMU — Vortex ring formation by the sudden ejection of a jet from tube and orifice openings is investigated numerically for jet Reynolds number (Re) in the range 10 – 2000 and jet slug length-to-diameter ratios (L/D) in the range 0.5 – 6.0. This Re range brackets nearly inviscid behavior (vortex sheet roll-up) at the high end and highly diffusive behavior at the low end. The present investigation is motivated by how the enhanced role of viscosity at low Re affects the development and properties of the resulting vortex rings. The results for $Re = 2000$ show classical behavior, namely, compact vortex rings at low L/D and a leading vortex ring followed by a trailing jet for L/D sufficiently high. As Re decreases below 100, viscous diffusion leads to rapid radial growth of the vortex ring trajectories, and rapid decay of total circulation and kinetic energy. For all Re, the ratio of the impulse obtained during jet ejection to that from a steady, uniform jet of the same duration increases with L/D until a trailing jet appears. The maximum impulse ratio achieved increases as Re decreases for the tube configuration, but the opposite trend is observed for the orifice configuration.

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Paul S. Krueger
SMU

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