Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

The Formation Number of Accelerating and Variable Diameter Jet Flows, and a Review of Pinch-Off Criteria[1] MIKE KRIEG, KAMRAN MOHSENI, University of Florida — This study analyzes vortex ring formation from starting jets with variable jet velocity and diameter and the underlying mechanisms of separation from the feeding shear flow. We assume that the conditions necessary for a vortex ring to separate from the driving shear flow can be identified by a relationship between characteristic velocities of the jet and the vortex ring along the axis of symmetry, and examine multiple pinch-off criteria. A wide variety of jet driving conditions are examined to validate the relationship between pinch-off and characteristic velocities under different constraints, including nozzle type (inclusion of converging radial velocity), acceleration of the jet velocity, and dynamic contraction/expansion of the shear layer diameter. All of these parameters are examined and adjusted independently of each other so that the effect of each jetting parameter can be observed without being affected by the other parameters. Accelerating the jet velocity to compensate for the growing vortex ring substantially increased the formation number of both parallel and converging jet flows. Different definitions of formation time (different time scaling) are also investigated as they pertain to the final vortex ring configuration and the physics of vortex ring formation. It is observed that new definitions of formation time result in jet formation numbers more closely aligned with previous results, suggesting that the new definition corresponds to the physics of vortex ring formation.

[1]This work was supported by the Office of Naval Research.

Mike Krieg
University of Florida

Date submitted: 08 Aug 2012 Electronic form version 1.4