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Flow Visualization for Pulsatile Vortex Ring Thrusters TORIN CLARK, KAMRAN MOHSENI, University of Colorado — Formation and evolution of vortex rings produced from pulsatile vortex ring thrusters were studied using flow visualization techniques. A vortex ring thruster consists of a cavity with an orifice at one end and an oscillating plunger at the opposite end which periodically creates a volume change in the cavity forcing a jet emission of fluid through the orifice into the surrounding reservoir. The ratio of the cylindrical jet length to its diameter, known as the stroke ratio, is a primary factor in the vortex ring formation characteristics. Flow visualization was employed in order to measure the translational velocity of the leading vortex ring for the range of stroke ratios of 2-7.5. It was observed that vortex rings with smaller stroke ratios have lower induction velocities, but the initial velocity is retained for a longer period of time as compared with vortex rings with larger stroke ratios. Additionally vortex ring dimensions, including semi-major axis, semi-minor axis, the ratio of these dimensions, and core to core radius, were considered. Also the volume of the vortex ring atmosphere was studied. The variations of these parameters with respect to Reynolds number, stroke ratio, time, and distance from the orifice are investigated. Finally the vortex ring formation and evolution during periodic operation of the vortex ring thrusters were visualized for various actuation frequency and stroke ratios.

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