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Thrust Characterization for Vortex Ring Thrusters[1] MIKE KRIEG, KAMRAN MOHSENI, University of Colorado Boulder — Synthetic jets are zero net mass pulsatile jets that are commonly used in flow control applications in air. In these cases the natural resonant frequency of the actuators plays an important role. In this work we will present thrust characterization of vortex ring thrusters (VRTs) in liquid (equivalent of synthetic jets in liquid medium). VRTs design are motivated by pulsatile jet propulsion in squid and jellyfish. A prototype jet thruster was designed and build for this investigation. The effect of the actuation frequency and stroke ratio on the thrust level was experimentally studied. A simplified slug model was defined which predicted the thrust according to the momentum transfer. According to the model the thrust values for various frequencies converges to a single non-dimensionalized thrust, which is only a function of the stroke ratio. The accuracy of the model was defined in terms of a coefficient α which related predicted thrust values to those measured experimentally. This coefficient was observed to be nearly unity for stroke ratios below the formation number of the jet, and for frequencies below critical cavitation frequencies. α was seen to decrease (measured thrust drops below predicted thrust) with increasing frequency for all jets with stroke ratios above the formation number. The feasibility of using such a device in typical marine vehicles was tested by implementing the thruster in an unmanned underwater vehicle. The vehicle test-bed was operated in various dynamic maneuvers, including a simulated parallel park.

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