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Experiments on the Thrust of a Synthetic Jet in Crossflow[1]
BRADLEY AYERS, California State University, Northridge, CHARLES HENOCH, Naval Undersea Warfare Center, Newport, HAMID JOHARI, California State University, Northridge — A set of water tunnel experiments were conducted to investigate the effect of crossflow on the thrust of a synthetic jet. This research was motivated by the desire to generate significant turning moments on a fully-submerged, supercavitating vehicle without using control fins or canards. The water tunnel model was a sting-mounted, 3-inch diameter cylindrical body interfaced to a 6-axis waterproof load cell. The synthetic jet actuator was contained within the model and the jet orifice located near the aft end of the model was oriented perpendicular to the mean flow. The actuator consisted of an externally controlled solenoid driving a piston into the cavity. The jet thrust was measured over a broad range of synthetic jet operating parameters, including the actuation frequency and duty cycle, as well as the jet-to-crossflow velocity ratios. Previous work which is based on the slug flow model of an individual vortex ring predicts the time-averaged thrust scales with the square of actuation frequency and the stroke length. The measurements will be compared with the theoretical predictions, and the results will be used to assess the effect of crossflow on the thrust of synthetic jet.

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