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Validating Improved Efficiency of Bioinspired Unsteady Jetting Propulsion[1] MICHAEL KRIEG, University of Hawaii, KAMRAN MOHSENI, University of Florida — Jetting propulsion has historically been considered inefficient, as the rate of momentum transfer for a continuous jet scales with the velocity squared; whereas, the rate of kinetic energy scales with the velocity cubed. For steady jets, efficiency decreases with the ratio of jet velocity to vehicle velocity. Several animals propel themselves with high velocity jets, but none jet continuously. They pause between jetting to refill, and expel the next jet starting from rest resulting in a leading vortex ring. Vortex ring formation induces a converging radial velocity increasing hydrodynamic impulse and increasing cavity pressure. Also, fluid acceleration generates propulsion without significant wake energy. This study validates improved propulsive efficiency on a freely swimming autonomous underwater vehicle (AUV). We have developed AUVs that use such thrusters for maneuvering, and previously validated propulsive efficiency measurement using motion capture position data and motor frequency data. But in a maneuvering configuration the thrusters have lower propulsive efficiency due to losses from vehicle drag. With a streamlined AUV, we demonstrate that propulsive efficiency of unsteady jetting rivals that of unducted propellers, and is nearly double the efficiency in a maneuvering configuration.

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