Abstract Submitted
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Harnessing vortices for the energy-efficient jet propulsion[1] MRUDHULA BASKARAN, KAREN MULLENERS, Ecole Polytechnique Federale de Lausanne — Jellyfish are among the most energy-efficient swimmers: their evolved physiology and propulsive motion offer them the advantage of being able to generate large amounts of thrust at low energy costs. These organisms optimally harness vortices and inspire designs for vehicles for underwater transport. Here, we present a robust vortex propulsor that generates thrust through pulsed jet propulsion. Vortex rings of varying strengths are produced by controlling a large range of input motion profiles. Using velocity fields from particle image velocimetry and force measurements, we relate vortex ring formation, pinch-off, and separation in the wake to the transient thrust output of the device. We validate and use a pressure-methodology for characterizing vortex ring pinch-off and its separation from the trailing jet. Features in the pressure field can provide a novel means of characterizing vortices. These findings contribute to our understanding of the role of vortices in jet propulsion and enable us to manipulate them for the design of energy-efficient bio-inspired vehicles.

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