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Effects of a flexible margin on Robojelly vortex structures ALEX VILLANUEVA, KELLEY STEWART, PAVLOS VLACHOS, SHASHANK PRIYA, Department of Mechanical Engineering, Virginia Tech — An Unmanned Underwater Vehicle (UUV) inspired by jellyfish morphology and propulsion mechanism, termed "Robojelly," was used to analyze the effects of the flexible margin on jellyfish propulsion. The natural animal has a bell section which deforms at a different phase then the rest of the bell. This lagging section, referred to as flexible margin or flap, is delimited by the bell margin and an inflexion point. The flap was replicated on the robotic vehicle by a flexible passive material to conduct a systematic parametric study. In a preliminary experiment, Robojelly was tested without a flap and with a flap. This revealed a thrust increase over an order of magnitude. We hypothesize that the length of this passive flap affects the vortex ring circulation strength of the jellyfish which can lead to higher efficiency and thrust. Velocity field measurements were performed using planar Time Resolved Digital Particle Image Velocimetry (TRDPIV) to analyze the change in vortex structures as a function of flap length. The robot input parameters stayed constant over the different configurations tested thus maintaining a near constant power consumption. Results clearly demonstrate that the flap plays an important role in the propulsion mechanism of Robojelly and provides an anatomical understanding of natural jellyfish.

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