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**High-fidelity simulations of simple models of biomorphic aquatic locomotion** JEFF ELDREDGE, DANIEL HECTOR, MEGAN WILSON, UCLA Mechanical & Aerospace Engineering — Aquatic creatures self-propel and maneuver with an incredible diversity of mechanics, even at the moderate Reynolds numbers appropriate for bio-inspired autonomous vehicles. In this work, we explore simple two-dimensional abstractions of two such mechanisms—undulatory and jellyfish-like locomotion—effected by prescribed hinge motion in articulated rigid body systems. These mechanisms are explored using a high-fidelity Navier-Stokes solver based on the viscous vortex particle method, strongly coupled with the rigid-body dynamics of the system. Such coupling enables an investigation of untethered swimming and maneuvering, which is essential for developing reduced-order models for motion planning and control. In the case of undulatory locomotion, it is shown that swimming effectiveness depends on both the relative phase and amplitude of the oscillatory hinge motions. The optimal shape control at these finite Reynolds numbers is contrasted with optima found for zero Reynolds number and inviscid swimmers. The jellyfish motion is enabled by periodic contractions of the bell shape, adapted from experimentally-measured kinematics of medusan swimmers (Dabiri et al., J. Exp. Biol., 2005). The vortex formation processes, energy budgets and fluid forces are explored for their relationship with forward propulsion.

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