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Locomotion Performance of Biomimetic Fish-like Swimming Devices BRENDEN P. EPPS, PABLO VALDIVIA Y ALVARADO, ALEXANDRA H. TECHET, MIT — The swimming performance of a biomimetic, fish-like swimming device, designed to exploit the natural dynamics of its compliant body to achieve locomotion, is studied experimentally. A theoretical model combines beam-bending stress analysis and unsteady hydrodynamic forcing with known material properties of the robot to reveal desired geometry distributions and actuation modes. Swimming kinematics and corresponding performance of the device are also predicted and tested for a carangiform prototype device in a quiescent tank of water. Experimental swimming tests show good agreement with the simplified theoretical models. The hydrodynamic characteristics of the wake behind the device are investigated using time-resolved particle imaging velocimetry (PIV) over a range of tail beat frequencies, from 1 to 4 Hz, to asses vortical wake patterns and hydrodynamic forces. PIV data are compared to theoretical model predictions. Reynolds numbers for the swimming device are between 2500 and 8500 based on body length.

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