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The effect of traveling wave shapes in the maneuver control and efficiency of an underwater robot propelled by an undulating fin[1] HANLIN LIU, OSCAR CURET, Florida Atlantic Univ — Effective control of propulsive undulating fins has the potential to enhance the maneuverability and efficiency of underwater vehicles allowing them to navigate in more complex environments. Aquatic animals using this type of propulsion are able to perform complex maneuvers by sending different traveling waves along one or multiple elongated fins. Recent work has investigated the propulsive forces, the hydrodynamics and the efficiency of an undulating ribbon fin. However, it is still not understood how different traveling wave shapes along the fin can be used to control the hydrodynamic forces and torques to perform different maneuvers. In this work, we study the effect of traveling wave shapes on the hydrodynamic forces and torques, swimming speed, maneuver control and propulsive performance of an underwater vehicle propelled by an undulating fin. The underwater robot propels by actuating a fin that is composed of sixteen independent rays interconnected with a flexible membrane. The hull contains all the electronics, batteries, motors and sensors. The underwater vehicle was tested in a water tank-flume facility. In a series of experiments, we measured the motion of the vessel and the power consumption for different traveling wave patterns. In addition, we measured the flow around the fin using Particle Image Velocimetry. We present the results concerning the power distribution along the fin, propulsive efficiency, free-swimming speed and pitch control based on different fin kinematics.

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