Abstract Submitted
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A flow visualization study of single-arm sculling movement emulating cephalopod thrust generation[1] ASIMINA KAZAKIDI, Foundation for Research & Technology - Hellas, Greece, EBENEZER P. GNANAMANICKAM, Embry-Riddle Aeronautical University, USA, DIMITRIS P. TSAKIRIS, Foundation for Research & Technology - Hellas, Greece, JOHN A. EKATERINARIS, Embry-Riddle Aeronautical University, USA — In addition to jet propulsion, octopuses use arm-swimming motion as an effective means of generating bursts of thrust, for hunting, defense, or escape. The individual role of their arms, acting as thrust generators during this motion, is still under investigation, in view of an increasing robotic interest for alternative modes of propulsion, inspired by the octopus. Computational studies have revealed that thrust generation is associated with complex vortical flow patterns in the wake of the moving arm, however further experimental validation is required. Using the hydrogen bubble technique, we studied the flow disturbance around a single octopus-like robotic arm, undergoing two-stroke sculling movements in quiescent fluid. Although simplified, sculling profiles have been found to adequately capture the fundamental kinematics of the octopus arm-swimming behavior. In fact, variation of the sculling parameters alters considerably the generation of forward thrust. Flow visualization revealed the generation of complex vortical structures around both rigid and compliant arms. Increased disturbance was evident near the tip, particularly at the transitional phase between recovery and power strokes. These results are in good qualitative agreement with computational and robotic studies.

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