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Squid-inspired vehicle design using coupled fluid-solid analytical modeling FRANCESCO GIORGIO-SERCHI, GABRIEL WEYMOUTH, University of Southampton — The need for enhanced automation in the marine and maritime fields is fostering research into robust and highly maneuverable autonomous underwater vehicles. To address these needs we develop design principles for a new generation of soft-bodied aquatic vehicles similar to octopi and squids. In particular, we consider the capability of pulsed-jetting bodies to boost thrust by actively modifying their external body-shape and in this way benefit of the contribution from added-mass variation. We present an analytical formulation of the coupled fluid-structure interaction between the elastic body and the ambient fluid. The model incorporates a number of new salient contributions to the soft-body dynamics. We highlight the role of added-mass variation effects of the external fluid in enhancing thrust and assess how the shape-changing actuation is impeded by a confinement-related unsteady inertial term and by an external shape-dependent fluid stiffness contribution. We show how the analysis of these combined terms has guided us to the design of a new prototype of a squid-inspired vehicle tuning of the natural frequency of the coupled fluid-solid system with the purpose of optimizing its actuation routine.

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