Shape Change Propagation Through Soft Curved Materials for Dynamically-Tuned Paddling Robots

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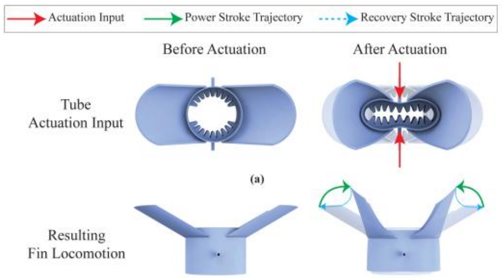
Introduction

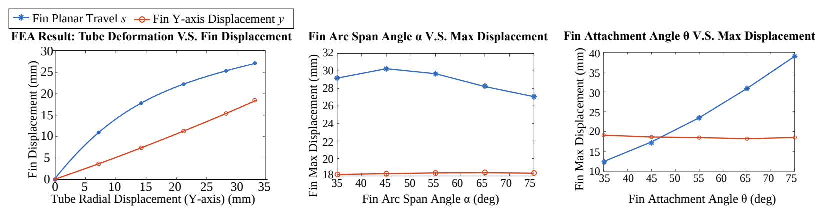
This paper introduces a method of transmitting actuation forces through soft, curved materials for use in swimming applications.

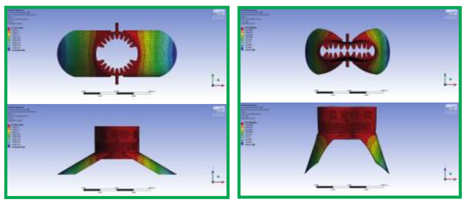


This approach can be used to simplify actuation signals in soft robotic systems. A soft tubular swimming device has thus been developed which utilizes the proposed shape propagation concept; it is actuated by a soft pneumatic actuator which has been adapted to be co-printed within the tubular geometry and change the tube's curvature when inflated.

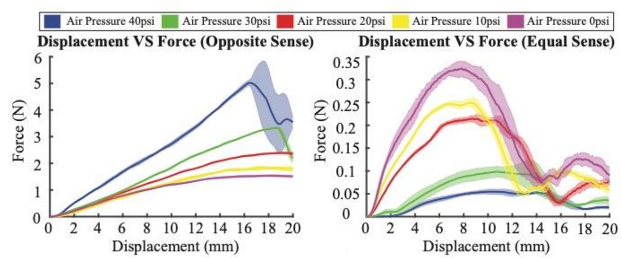
The final, 40 mm long prototype reaches **53 mm/s**, **1.33 body lengths per second**, when swimming underwater.

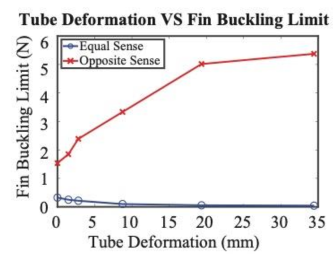
FEA Validation: Curvature Propagation

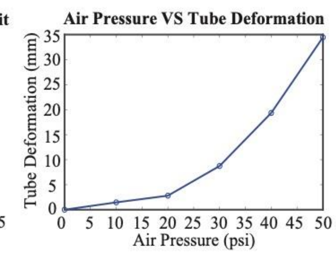




Experiment Validation: Fin Buckling Analysis







Dynamic Modeling: Swimming Thrust Analysis