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Bio-Inspired Pressure Sensing for Active Yaw Control of Underwater Vehicles AMY GAO, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — A towed underwater vehicle equipped with a bio-inspired artificial lateral line was constructed and tested with the goal of active detection and correction of the vehicle's angle of attack. Preliminary experiments demonstrate that a low number of sensors are sufficient to enable the discrimination between different orientations, and that a basic proportional controller is capable of keeping the vehicle aligned with the direction of flow. We propose that a model based controller could be developed to improve system response. Toward this, we derive a vehicle model based on a first-order 3D Rankine Source Panel Method, which is shown to be competent in estimating the pressure field in the region of interest during motion at constant angles of attack, and during execution of dynamic maneuvers. To solve the inverse problem of estimating the vehicle orientation given specific pressure measurements, an Unscented Kalman Filter is developed around the model. It is shown to provide a close estimation of the vehicle state using experimentally collected pressure measurements. This demonstrates that an artificial lateral line is a promising technology for dynamically mediating the angle of a body relative to the oncoming flow.

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