Abstract Submitted
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The Performance of Finite-span Hydrofoils with Humpback Whale-like Leading Edge Protuberances[1] DERRICK CUSTODIO, Worcester Polytechnic Institute, CHARLES HENOCH, Naval Undersea Warfare Center, Newport, RI, HAMID JOHARI, California State University, Northridge — The effects of leading edge protuberances on the lift and drag performance of finite-span hydrofoils were examined in a series of water tunnel experiments. The leading edge protuberances are analogous to the tubercles on humpback whale pectoral flippers. The hydrofoils have a rectangular planform and an aspect ratio of 4. The hydrofoil section profile is based on NACA 63(4)-021, and the leading edge has a sinusoidal geometry with constant amplitude and wavelength. The hydrofoil angle of attack was varied up to 30 $^\circ$, and the freestream velocity ranged from 1.8 to 5.4 m/s. Results indicate that the hydrofoils with leading edge protuberances do not stall in the traditional manner. Below 12 $^\circ$ lift increased linearly with angle of attack. Beyond this angle, the lift either attained a nearly constant value or increased slowly up to 30 $^\circ$ depending on the Reynolds number. Drag increased continuously with the angle of attack, and was not dependent on the Reynolds number. These observations are consistent with our previous infinite span hydrofoil data, and may be explained in terms of the flow modifications created by the leading edge protuberances.

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