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Performance of hydrofoils with humpback whale-like leading edge protuberances.¹ ALEXANDRA LEVSHIN, WPI, CHARLES HENOCH, NUWC, Newport, RI, HAMID JOHARI, WPI — The humpback whale (*Megaptera novaeangliae*) is extremely maneuverable, compared to other whale species, despite its large size and rigid body. Turning maneuvers are especially evident during pursuit of prey. The agility of humpback whale has been attributed to their use of pectoral flippers. The thick flippers have large aspect ratios, and large scale protuberances are present on the leading edge. The flippers do not flap during turning maneuvers. The cross-section of the flipper has a profile similar to a NACA 63₄-021 airfoil. The amplitude of leading edge protuberances ranges from 2.5 to 12% of the chord, with a spanwise extent of 10 to 50% the chord depending on the location along the span. It has been hypothesized that the ‘bumpy’ leading edge is used for flow control. To examine the effects of protuberances on the leading edge of hydrofoils, a series of rectangular foils with bumpy leading edges were manufactured. The leading edge is sinusoidal in the spanwise direction with amplitudes and wavelengths comparable to that of humpback whale’s flippers. The forces and moments on these bumpy foils were measured in a water tunnel and compared with a smooth leading edge foil.

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Hamid Johari
WPI

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