

Abstract Submitted
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Effects of leading edge tubercles on the flow over a humpback whale flipper¹ HEESU KIM, JOOHA KIM, HAECHEON CHOI, Seoul National University — In the present study, we conduct a laboratory experiment for the effect of tubercles on the hydrodynamic performance of a humpback whale flipper. The shape of the flipper used is the same as that of Miklosovic et al. (2004, 2007), and the Reynolds number considered is 100,000 based on the free-stream velocity and mean chord length. The lift and drag forces on the flipper with and without tubercles are measured by varying the angle of attack, and PIV measurements are conducted in several cross-flow planes at a few different angles of attack. As observed in previous studies, the stall angle is delayed and the maximum lift coefficient is increased. Without tubercles, the cross flow above the flipper does not show large-scale vortical motions except tip vortex. With tubercles, however, strong streamwise vortices having negative streamwise vorticity are observed along the tubercles, but the vortices with positive streamwise vorticity are either relatively weak or unobserved. This result is very different from those found in a two-dimensional wing with tubercles with which strong counter-rotating streamwise vortex pair were observed. Those vortical motions reattach the flow on the flipper and delay the separation.

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