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**Fluid structure interactions of an oscillating compliant membrane hydrofoil** VARGHESE MATHAI[1], GALI ALON TZEZANA, KENNETH BREUER, Center for Fluid Mechanics, Brown University, Providence, RI 02912, USA — We study the fluid-structure interactions of a compliant membrane hydrofoil undergoing heaving and pitching oscillations in a uniform flow. Experiments were conducted in a low speed, circulating water channel with a mean flow velocity $U_\infty = 0.3$ m/s, and chord-based Reynolds number, $Re = 3 \times 10^4$. Simultaneous measurements of the forces, membrane deformation and the flow field we conducted using a 6-axis load cell, high-speed imaging, and particle image velocimetry (PIV), respectively. The membrane foil passively adapts its shape and camber during each oscillation cycle, which enables the leading-edge-vortex to remain attached, thus contributing to lift enhancements and better power production when compared to a rigid symmetric hydrofoil. We model the instantaneous membrane deformation using the Young-Laplace equation, by considering the instantaneous angle of attack, in good agreement with the membrane tracking measurements for a range of pitch angles. The total lift force generated by the oscillating membrane is decomposed into a lumped model that includes a steady lift contribution and a vortex lift. The force measurements and PIV results will be used to explain the origin of these contributions.

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