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Cavitation on Hydrofoils with Leading Edge Protuberances[1]
DERRICK CUSTODIO, CHARLES HENOCH, Naval Undersea Warfare Center (NUWC), Newport, RI, HAMID JOHARI, California State University, Northridge, OFFICE OF NAVAL RESEARCH COLLABORATION — The effects of spanwise-uniform sinusoidal leading edge protuberances on the flow characteristics and forces of finite-span hydrofoils under vaporous cavitation conditions were examined experimentally over angles of attack ranging from -9 $^\circ$ $\leq \alpha \leq$ 27 $^\circ$. Two planforms were studied, rectangular and swept, at a Reynolds number of $\approx$ 720,000. Two protuberance wavelengths, $\lambda = 0.25c$ and $0.50c$, and three amplitudes, $A = 0.025c$, $0.05c$, and $0.12c$, were examined as they resemble the humpback whale flipper morphology. All hydrofoils retain a mean NACA 63_4-021 profile. The forces and moments were measured at a freestream velocity of 7.2 m/s, and high-speed digital photography was used to capture flow field images at several angles of attack. The cavitation number corresponding to incipient leading edge cavitation was also calculated. As far as forces and cavitation number are concerned, results show that the baseline hydrofoil tends to have nearly equal or improved performance over the modified hydrofoils at most angles of attack tested. Flow images reveal that it is possible that the extent of sheet and tip vortex cavitation can be reduced with the introduction of leading edge protuberances. The forces and cavitation characteristics will be presented.

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Derrick Custodio
Naval Undersea Warfare Center (NUWC), Newport, RI

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