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Effect of Hybrid-Heave Motions on the Lift of Oscillating Airfoils¹ JAY YOUNG, SARAH MORRIS, C. H. K. WILLIAMSON, Cornell University — Inspiration for a number of unsteady airfoil dynamics studies has been drawn from animal locomotion. In the present research, we instead employ a sports-mimetic approach, studying unsteady airfoil motions inspired by sail dynamics. One such technique is "sail flicking," whereby sailors use their bodyweight motion to roll the boat about its longitudinal axis, flicking the sail periodically. Because sailors do not sail directly into the wind, the boat travels at an angle relative to the apparent wind it experiences. A "flicking" sail will therefore oscillate at non-perpendicular angles to the incoming flow, in a motion we call "hybrid-heave." We study these hybrid-heave motions with a NACA 0012 airfoil. We find both a "high-lift" and low-lift" mode. The high-lift mode delivers significant lift increase compared to that of a static airfoil. We study the case of the two distinct modes in terms of instantaneous angle of attack, speed, and vortex dynamics.

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