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Thrust and Lift generation of heaving and pitching oscillating foil propulsion in ground effect AMIN MIVEHCHI, PhD Candidate, University of Rhode Island, JASON M. DAHL, STEPHEN LICHT, Assistant Professor, University of Rhode Island — Experimental results are presented for the thrust and lift generation on a NACA0012 airfoil undergoing heave and pitch oscillation near a solid boundary. For ground effect in the steady flow over a lifting surface, lift and drag forces are altered by an enhanced spanwise flow around the tip of the lifting surface, resulting in a strong low pressure region on the upper part of the wing and increased lift in the presence of a boundary. In the present study, this effect is investigated for an inherently unsteady flow, a propulsive flapping foil. It is found that ground effect has a significant effect on the instantaneous and average lift and thrust forces generated by the oscillating foil with heave and pitch motion. It is found that the forces on a flapping foil in the presence of the ground is not only dependent on the aspect ratio but shows high dependency on the kinematics of motion such as maximum angle of attack, frequency of flapping, and the distance from the ground. The relation between these parameters and their effect on the cycle averaged thrust, lift, propulsive efficiency, and instantaneous force over the airfoil is shown. It is hypothesized that ground effect may be used as a proxy sensor for identifying solid boundaries with biomimetic underwater vehicles. Keywords: Ground effect, Flapping foil propulsion, flow-structure interaction

Amin Mivehchi
PhD Candidate, University of Rhode Island

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