

Abstract Submitted
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Instantaneous thrust production mechanisms and vortex shedding dynamics of oscillatory propulsors in inviscid flows¹ FIRAS SIALA, MELISSA GREEN, Syracuse University — The inviscid propulsive performance and vortex shedding dynamics of purely heaving and pitching panels operating at Strouhal numbers of $St_A = 0.05 - 0.35$ are numerically investigated using discrete vortex modeling. We explore the mechanisms that these two generic types of kinematics use to produce thrust. Of particular interest is the relationship between time-dependent thrust production and wake structure. In agreement with the literature, our results show that thrust produced by purely pitching panels is primarily from added-mass, whereas thrust produced by heaving panels is entirely circulatory-based. Furthermore, it is observed that for a given Strouhal number, the heaving and pitching panels have almost identical wake structures, while the time-resolved and time-averaged thrust coefficients considerably differ. To further examine the correlation of wake vortex shedding and instantaneous thrust production, Lagrangian analysis using the finite-time Lyapunov exponent (FTLE) field was carried out using the dynamics of discrete point vortices generated by the inviscid flow simulations. The release of bounding Lagrangian saddles, identified as intersections of positive- and negative-time FTLE ridges, from the panel trailing-edge is shown to be highly correlated with the

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