Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Three-dimensional unsteady wake dynamics of hydrofoils with combined pitching and heaving motion[1] SUYASH VERMA, ARMAN HEMMATI, University of Alberta — The primary and secondary vortex evolution in the wake of an oscillating teardrop foil with combined heaving and pitching motion is investigated using Direct Numerical Simulations at Re=8000. Recent experiments of Van Buren et al. (2019) suggested that either high propulsive efficiency or large thrust generation is achieved for limited motion settings. The former case corresponded to Strouhal number (St)=0.2, phase difference(Φ) =270^o and reduced frequency(f*) =0.6, while the settings for the latter were: St=0.9, Φ =330^o and f*=0.8. In this study we examine how the vortex dynamics differ for these settings. Initial results indicate that the high efficiency system is characterized by a thrust generating 2P wake that transitions to an inverse 2S wake downstream. In contrast, the large thrust generating system depicted the Mode-A asymmetric wake comprising of vortex dipoles. Primary vortex interactions and their transitional features further suggest differences in vortex dislocations. Also, statistical analysis on the identification of secondary vortex characteristics revealed close resemblance to a long wavelength mode. Two new vortex skeleton models are introduced that incorporates the new findings on wake dynamics.

[1]Canada First Research Excellence Grant

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Date submitted: 30 Jul 2020 Electronic form version 1.4