Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Flapping Dynamics of an Inverted Flexible Foil in a Uniform Axial Flow PARDHA SARADHI GURUGUBELLI VENKATA, RAJEEV K. JAIMAN, National University of Singapore — This work presents a numerical study on self-induced flapping dynamics of an inverted flexible foil in uniform flow. The inverted foil considered in this study is clamped at the trailing edge and the leading edge is allowed to oscillate. A high-order coupled FSI solver based on CFEI formulation has been used to present the flapping response results for a wide range of nondimensional bending rigidity using a fixed Reynolds number of 1000 and a mass-ratio of 0.1. As a function of bending rigidity four flapping regimes have been discovered: fixed point, inverted limit-cycle oscillation, deflected flapping, and flipped flapping. The inverted foil configuration undergoes flapping motion more readily and experiences very large amplitude oscillations than the conventional foil. A wide variety of vortex wakes with a maximum of 14 vortices per oscillation cycle have been observed. The inverted limit-cycle flapping generate novel 4P+6S (14 vortices) and 2P+6S (10 vortices) wakes. On the other hand, the flipped flapping regime is characterized by a von Kármán wake. We also observe that inverted foil can extract 1000 times more energy from the surrounding fluid compared to the conventional foil

Pardha Saradhi
National University of Singapore

Date submitted: 01 Aug 2014 Electronic form version 1.4