Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Vortex Formation, Shedding and Energy Harvesting from a Cyber-Physical Pitching Flat Plate[1] KYOHEI ONOUE, KENNETH BREUER, Brown University — We examine the dynamics and energy harvesting capabilities of an elastically mounted flat plate undergoing large amplitude limit cycle oscillations in a uniform flow. All experiments are performed using a cyber-physical system, wherein the structural inertia, stiffness and damping are numerically simulated using a position-following feedback algorithm. The cyber-physical system also allows for implementation of nonlinear spring and damping coefficients, which control the plate dynamics and subsequent energy harvesting characteristics. Analysis of the plate kinematics and the fluid flow over the plate and in the wake (measured using PIV) are used to understand the interplay between structural motion and vortex formation at the sharp leading and trailing edges of the plate. By varying the structural properties of the system we systematically analyze the formation, strength, stability and separation of the leading edge vortex, as well as the dependence on kinematic parameters and Reynolds number. Connections to previous results on vortex formation time and bluff body aerodynamics are discussed.

[1]This research is funded by the Air Force Office of Scientific Research (AFOSR)

Kyohei Onoue
Brown University

Date submitted: 24 Jul 2014 Electronic form version 1.4