Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Low-order Modeling of Bio-inspired Pitching and Perching at Low Reynolds Number CHENGJIE WANG, JEFF D. ELDREDGE, Mechanical & Aerospace Engineering, University of California, Los Angeles, CA, USA — A low-order inviscid point vortex model is used to simulate the pitching and perching motion of a thin flat plate at low Reynolds number. These motions induce coherent vortex shedding at the leading edge, which has a profound influence on the generated force. The low-order method is based on the inviscid Brown-Michael point vortex model, which accounts for the unsteady aerodynamics by tracking a small number of vortices with time-varying strengths. For the pitching motion, the results from the low-order model are compared with high fidelity simulations under different pitching rate and axis position, and this comparison shows a good qualitative agreement. The perching motion is characterized by larger rotations and an unsteady translation. The low-order model results are compared with previous experiments conducted in a water tunnel, and good qualitative agreement is achieved. To investigate the mechanism of force generation, the force obtained from the model is decomposed into inertial reaction and circulatory components, and their relative contributions are inspected.

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Date submitted: 03 Aug 2010 Electronic form version 1.4