Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Understanding the Role of Chord-wise Flexibility in Flapping Wing Flight ZACHARY GASTON, HAIBO DONG, HUI WAN, Wright State University, MICHAEL OL, Air Force Research Laboratory — Aerodynamic performance of flapping hinged plates is numerically studied to explore the effects of chord-wise flexibility in flapping wing flight. The plate with chord-wise flexibility is modeled as a two-link mechanism with a torsional spring hinge in between. The upper-link of the plate is controlled by prescribed motion and the rest of body is subjected to passive deflection due to fluid-body interaction. The effect of forced to natural frequency ratio is studied first for a flapping hinged-plate, on which prescribed hovering motion is actively applied. The effects of torsional stiffness and chord-wise flexibility are further explored for pitching and plunging plates, observing the flow phenomena and lift production as a result of this change. Comparisons between rigid plates, free-to-pivot hinged plates, and the torsional spring hinged plates are made, identifying a more optimal model for promoting lift production in flapping plates.

Zachary Gaston
Wright State University

Date submitted: 28 Jul 2011 Electronic form version 1.4