Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Hovering performance of a two dimensional skeleton-reinforced flexible wing KOUROSH SHOELE, Postdoctoral Research Associate, QIANG ZHU, University of California, San Diego — Skeleton-reinforced membrane is a typical biological design. An important application of these systems is in biolocomotion apparatus, most notably the wings of insects. The structural characteristics of the wing, a composite structure including a soft membrane reinforced by embedded skeleton(venation) is an important factor in performance of a insect flexible wing during hovering flight. To study how the structural anisotropy affects the aerodynamic performance of the deformable wing, a two-dimensional numerical study is applied to simulate the flow-structure interaction of a wing during hovering flight. In this two-dimensional rendition, the underlying veins are modeled as springs, and the membrane is modeled as a flexible plate. The effect of the wing anisotropy on lift production and power expenditure is studied for a range of veins rigidity, Reynolds number and wing inertia. It is shown that with flexible veins and the leading edge strengthening, the lift production can be significantly increased. In addition, the detailed distribution of veins stiffness in the wing has a significant effect on the unsteady flow pattern around the wing.

Kourosh Shoele
University of California, San Diego

Date submitted: 05 Aug 2011 Electronic form version 1.4