Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Experimental study of the wing-rotation mechanism using a mechanical flapper operating at high Reynolds numbers ($10^5 \sim 10^6$) YU-HUNG CHANG, SHANG-CHIEH TING, JING-TANG YANG, Department of Mechanical Engineering, National Taiwan University, Taipei 10617, Taiwan, BEAM LAB TEAM[1] — This work aims to investigate whether the 'wing-rotation' mechanism remains effective for flapping wings operating at Reynolds numbers ranging between 10^5 and 10^6. We also address the feasibility of evaluating transient lift forces based on a modified vortex-ring model. The experiments were conducted with a biomimetic mechanical flapper that partially emulates the dominant motions of flapping wings of hovering *Zosterops japonicus* and *Erythrura gouldiae*. Lift forces produced by the flapping wing of the mechanical flapper were directly measured via a load cell, and indirectly evaluated using a modified vortex-ring model, according to the wing wake flow-fields quantified by DPIV. Lift forces evaluated through the vortex-ring model were found to be of values approximately 15% less than those measured by the load cell. It was also found that an increase in the pitching frequency of the flapping wing is capable of enhancing the lift production. This finding suggests that for a flapping wing, the 'wing-rotation' mechanism remains effective for high Reynolds numbers in a range $10^5 \sim 10^6$.

[1]Department of Mechanical Engineering National Taiwan University

Yu-Hung Chang
Department of Mechanical Engineering,
National Taiwan University, Taipei 10617, Taiwan

Date submitted: 05 Aug 2010 Electronic form version 1.4