Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Analysis of Non-symmetrical Flapping Airfoils WEE BENG TAY, KAH BIN LIM, National University of Singapore — Simulations have been done to assess the performance of different types of non-symmetrical airfoils on lift, thrust and propulsive efficiency under different flapping configurations at a Reynolds number of 10,000. The variables studied include the Stroudal number, reduced frequency, pitch angle and phase angle difference. In order to analyze the variables more efficiently, the Design of Experiments using the response surface methodology is applied. The simulation results show that besides the flapping configuration, airfoil shape also has a profound effect on the efficiency, thrust and lift production. The 4 factors have different levels of significance on the responses, indicating the shape of the airfoil plays a part as well. Thrust production depends more heavily on these parameters, rather than the shape of the airfoil. On the other hand, lift production is primarily dominated by its airfoil shape. Efficiency falls somewhere in between. Two-factor interactions among the variables also exist in efficiency and thrust production. Vorticity plots are analyzed to explain some of the results. Overall, the s1020 airfoil is able to provide relatively good efficiency and at the same time generate high thrust and lift force. These results can be used to help in the design of a better ornithopter's wing.

Wee Beng Tay
National University of Singapore

Date submitted: 07 Aug 2007 Electronic form version 1.4