Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Vortex Loop Topology During the Stroke Reversal of a Flapping Wing[1] MATTHEW BURGE, CLARA WYSOCHANSKI, MATTHEW RINGUETTE, State University of New York at Buffalo — The effect of kinematic variations on the instantaneous 3-D flow structures formed during stroke-reversal of a 2-degree-of-freedom flapping wing in hover is investigated. Previous work correlates large force and circulation peaks to unsteady motion kinematics, but information from experiments detailing the instantaneous, 3-D flow-structure evolution is lacking. The objective of this work is to generate the vortex topology of a flapping wing in hover and qualitatively study the flow-structure trajectories with multi-color dye-flow visualization. Pure pitching and fixed angle of attack rotation are first examined to identify the vortices produced by each degree-of-freedom separately. For flapping motions, the stroke-reversal phase during various rotational accelerations for a constant pitching reduced frequency is studied, emphasizing vortex interactions and re-connectivity of time-elapsed vortex loops. The flow features are visualized using a scaled wing model in water with an internal dye-manifold, and captured using 2 orthogonal cameras. Motivation exists for both symmetric and advanced timing of the pitching with respect to stroke-reversal, and both are compared against pitching reduced frequency to characterize the 3-D loop structures responsible for lift generation.

[1]This work is supported by the National Science Foundation, Award Number 1336548, supervised by Dr. Dimitrios Papavassiliou.

Matthew Ringuette
State University of New York at Buffalo

Date submitted: 31 Jul 2015 Electronic form version 1.4