

Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Flow and forces of flexible wings under a plunging motion DIEGO CAMPOS, LAWRENCE UKEILEY, University of Florida — The effects of flexibility on the flow fields and production of aerodynamic forces of Zimmerman planform wings with different stiffness are investigated. The wings are subjected to a symmetric sinusoidal plunging motion under forward flight conditions. Particle Image Velocimetry (PIV) is used to measure the flow at different spanwise locations and Laser Doppler Vibrometry (LDV) is utilized to obtain deformation characteristics from the wings. The results from the PIV and LDV analysis are phase averaged discrete points throughout the plunging cycle, resulting in three component flow field data coupled with wing twist obtained from the LDV, thus allowing for a better understanding of the fluid-structure interactions. The forces are then calculated through a momentum balance technique to better understand the effects of different stiffness. The Q criterion is used to identify and analyze the vortical structures that form around the wing. Results show the strongest leading edge vortex formation between 70 and 80 percent span. The effect of the deformation on the production and evolution of the vortical structures will be related to the generation of aerodynamic forces.

Lawrence Ukeiley
University of Florida

Date submitted: 05 Aug 2011

Electronic form version 1.4