

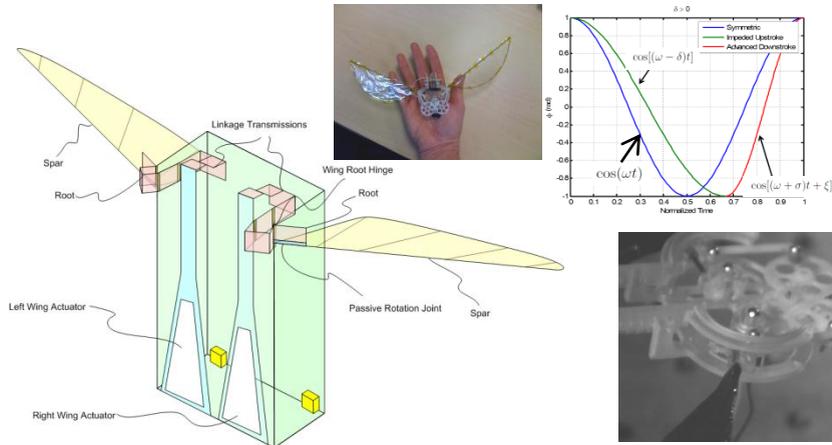


AIAA

American Institute of Aeronautics and Astronautics Dayton-Cincinnati Section

Lunch 'n' Learn Friday 26 Feb 2010 "Wingbeat Shape Modulation for Control of Flapping Wing Micro Air Vehicles"

Guest Speaker:
Dr. David Doman, AFRL



A new method of controlling a flapping wing micro air vehicle by varying the velocity profiles of the wing strokes will be presented. An exhaustive theoretical analysis along with simulation results show that this new method, called Split-Cycle Constant-Period Frequency Modulation with Wing Bias, is capable of providing control over vertical and horizontal body forces as well as pitching, rolling, and yawing moments, using only two physical actuators, whose oscillatory motion is defined by six parameters. A general method for deriving sensitivities of cycle-averaged forces and moments to changes in wing-beat kinematic parameters will be presented. These sensitivities are used in the formulation of a cycle-averaged control law that successfully stabilizes and controls two different simulation models of the aircraft. One simulation model is driven by instantaneous aerodynamic forces derived from blade-element theory, while the other is driven by an empirical representation of an unsteady aerodynamic model that was derived from experiments. Simulation results will be presented that reveal that a model-based control law, derived from a cycle-averaged blade element aerodynamic model, can successfully control simulation models that include unsteady aerodynamic effects. The method also has the desirable feature that cycle-averaged forces and moments can be analytically related to the wingbeat kinematics and vehicle design parameters, a feature that facilitates multidisciplinary design efforts where controllability must be considered from the outset.

Dr. David Doman is a Senior Aerospace Engineer at the Air Force Research Laboratory. He has co-authored over 120 publications and is an AIAA Associate Fellow, an Associate Editor for the Journal of Guidance, Control and Dynamics, and the recipient of the 2008 Silver Medal of the Royal Aeronautical Society. Dr Doman has also recently received the AIAA Sustained Service Award.

Time: 11:45 am

Location:
China Garden Buffet
112 Woodman Dr.
Dayton, OH 45431

Lunch:
*You will be able to
purchase the buffet*

