

Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Controlling Pitching Instability in 3D Flapping Flight SONG
CHANG, Applied and Engineering Physics, Cornell University, Ithaca, NY 14853,
JANE WANG, Mechanical and Aerospace Engineering, Cornell University, Ithaca,
NY 14853 — Flying insects actively control their wings to maintain the stability in
steady flight as well as to execute maneuvers. The control strategies depend on the
coupling of sensory feedback loops of insects and the underlying dynamics of the 3D
flapping flight. In this talk, we first present a general method for efficiently simu-
lating the 3D flapping flight of the coupled wing-body system in the quasi-steady
limit. We then quantify the stability of the periodic solutions that correspond to
equilibrium flight. The analysis shows that the flapping system exhibits an inherent
instability in pitching, and this instability can be further understood in a reduced-
order model. We propose a simple control strategy for stabilizing the pitching by
modulating wing motions.

Song Chang
Applied and Engineering Physics, Cornell University, Ithaca, NY 14853

Date submitted: 07 Aug 2009

Electronic form version 1.4