Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Aerodynamic tricks for pitching oscillation and visual stabilization in a hovering bird JIAN-YUAN SU[1], SHANG-CHIEH TING, JING-TANG YANG, Department of Mechanical Engineering, National Taiwan University, Taipei 10617, Taiwan, BEAM LAB TEAM — We experimentally investigate how small birds attain a stabilized vision and body posture during hovering. Wing-beats of finches and passerines executing asymmetrical hovering provide lift merely during the downstroke. The downstroke lift is significantly greater than the bird weight, thereby causing a pitch-up swing of the bird body. A hovering bird skillfully and unceasingly tunes the position and orientation of lift force to stabilize its vision, so that the eye displacement is approximately one-tenth less than the tail, causing an illusion that the bird body is rotating about the eye. The hovering birds also spread and fold periodically their tail with an evident phase relationship with respect to the beating wings. We found that hovering birds use their tail to intercept the strong downward air-flow induced by the downstroking wings, and sophisticatedly spread their tail upon the arrival of the downward air-flow, rendering a pitch-up moment that effectively counteracts the pitch-down body rotation. Hence during hovering the bird essentially undergoes a dynamically-stable pitching oscillation, and concurrently attains a stabilized vision.

[1]+886-2-3366-2722

Jian-Yuan Su
Department of Mechanical Engineering,
National Taiwan University, Taipei 10617, Taiwan

Date submitted: 09 Aug 2010 Electronic form version 1.4