

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Investigation of sharp-turning mechanism of damselfly via motion kinematics and vortex dynamics YU-CHEN TSAI, JING-TANG YANG, Department of Mechanical Engineering, National Taiwan University — Damselflies often perform unconventional backward flight to make sharp turns while changing direction in forward flight. The mechanism of rapid transition between forward and backward flight of the free-flying damselfly (*Psolodesmus mandarinus*) is experimentally investigated in this study. The flapping kinematics of the damselflies during flight reversal is observed and recorded by using two high-speed cameras. The flow field is examined first and the vortex structure is further analyzed by using particle imaging velocimetry (PIV) technique. The relation between the kinematic parameters of a moving damselfly and its excellent turning ability is revealed; the damselfly makes a sharp turn in merely tens of milliseconds by altering body posture, flapping frequency, and angle of attack. The strong interaction between the wings and the surrounding vortices is proved crucial in producing forces needed for turning. This study provides insights into the maneuvering strategy of flying insects.

Yu-Chen Tsai
Department of Mechanical Engineering, National Taiwan University

Date submitted: 03 Aug 2013

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