Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Bats dynamically change wingspan to enhance lift and efficiency
SHIZHAO WANG, XING ZHANG, GUOWEI HE, Institute of Mechanics, Chinese Academy of Sciences, TIANSHU LIU, Western Michigan University, TURBULENCE TEAM — Bats can dynamically change the wingspan by controlling the joints on the wings. This work focuses on the effect of dynamically changing wingspan on the lift and efficiency in slow-flying bats. The geometry and kinematics of the bat model is constructed based on the experimental measurements of Wolf et al. (J. Exp. Biol. 213, 2142–2153). The Navier-Stokes equations for incompressible flows are solved numerically to investigate the 3D unsteady flows around the bat model. It is found that the dynamically changing wingspan can significantly enhance the lift and efficiency. The lift enhancement is contributed by both lifting surface area extended during the downstroke and the vortex force associated with the leading-edge vortices intensified by the dynamically changing wingspan. The nonlinear interaction between the dynamically changing wing and the vortex structures plays an important role in the lift enhancement of a slow-flying bat in addition to the geometrical effect of changing the lifting-surface area in a flapping cycle.

Guowei He
Institute of Mechanics, Chinese Academy of Sciences

Date submitted: 30 Jul 2016 Electronic form version 1.4