Abstract Submitted
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New Insights on Insect's Silent Flight. Part I: Vortex Dynamics and Wing Morphing[1] YAN REN, GENG LIU, HAIBO DONG, University of Virginia, BIAO GENG, XUDONG ZHENG, QIAN XUE, University of Maine — Insects are capable of conducting silent flights. This is attributed to its specially designed wing material properties for the control of vibration and surface morphing during the flapping flight. In current work, we focus on the roles of dynamic wing morphing on the unsteady vortex dynamics of a cicada in steady flight. A 3D image-based surface reconstruction method is used to obtain kinematical and morphological data of cicada wings from high-quality high-speed videos. The observed morphing wing kinematics is highly complex and a singular value decomposition method is used to decompose the wing motion to several dominant modes with distinct motion features. A high-fidelity immersed-boundary-based flow solver is then used to study the vortex dynamics in details. The results show that vortical structures closely relate to the morphing mode, which plays key role in the development and attachment of leading-edge vortex (LEV), thus helps the silent flapping of the cicada wings.

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