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Investigation into the Role of Dragonfly Wing Flexibility During Passive Wing Pitch Reversal[1] YOUSAF BAJWA[2], VENTRESS WILLIAMS[3], YAN REN[4], HAIBO DONG[5], University of Virginia, FLOW SIMULATION RESEARCH GROUP TEAM — Wing deformation is a characteristic part of flapping wing flight. In dragonflies, a torsion wave can be observed propagating from the tip to the root during stroke reversal. In this paper, we utilize high-speed photogrammetry and 3d surface reconstruction techniques to quantify wing deformation and kinematics of a dragonfly. We then use finite elements in the absolute nodal coordinate formulation to estimate strain energy in the wing during wing pitch reversal. We use this data to analyze the role of wing structure in facilitating wing rotation and bringing about the characteristic torsion wave. The influence of the elastic force in facilitating wing rotation is then compared with inertial and aerodynamic forces as well. A quantitative look into the variation of strain energy within the insect wing during wing rotation could lead to more efficient design of dynamic wing pitching mechanisms.

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