Abstract Submitted
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Computational modeling of aerodynamics in the fast forward flight of hummingbirds[1] JIALEI SONG, HAOXIANG LUO, Vanderbilt Univ, BRET TOBALSKE, Univeristy of Montana, TYSON HEDRICK, University of Noth Carolina at Chapel Hill — Computational models of the hummingbird at flight speed 8.3 m/s is built based on high-speed imaging of the real bird flight in the wind tunnel. The goal is to understand the lift and thrust production of the wings at the high advance ratio (flight speed to the average wingtip speed) around 1. Both the full 3D CFD model based on an immersed-boundary method and the blade-element model based on quasi-steady flow assumption were adopted to analyze the aerodynamics. The result shows that while the weight support is generated during downstroke, little negative weight support is produced during upstroke. On the other hand, thrust is generated during both downstroke and upstroke, which allows the bird to overcome drag induced at fast flight. The lift and thrust characteristics are closely related to the instantaneous wing position and motion. In addition, the flow visualization shows that the leading-edge vortex is stable during most of the wing-beat, which may have contributed to the lift and thrust enhancement.

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