Abstract Submitted
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Unsteady aerodynamics of dragonfly using a wing-wing model from the perspective of a force decomposition[1] CHIN-CHOU CHU, National Taiwan University, CHIEN C. CHANG, National Taiwan University and Research Center for Applied Sciences, Academia Sinica, CHEN-TA HSIEH, National Taiwan University — The lift and thrust associated with insect flight strongly depend on the complex wake patterns produced by wing-wing and wing-wake interactions. We propose to investigate the aerodynamics of dragonfly using a simplified wing-wing model from the perspective of many-body force decomposition (JFM 600, p95) and the associated force elements. The aerodynamic force, lift or thrust, of the wing-wing system is analyzed in terms of its four constituent components, each of which is directly related to a physical effect. These force components for each individual wing include two potential contributions credited to the wing motion itself, contribution from the vorticity within the flow, and contributions from the surface vorticity on its and other wing's surfaces. The potential contribution due to added-mass effect is often non-negligible. Nevertheless, the major contribution to the forces comes from the vorticity within the flow. The relative importance of these components relies heavily on the motions of the two wings such as the respective angles of attack, the amplitude and speed of translational motions, and the amplitude and speed of wing rotations. In addition to the dynamic stall vortex, several important mechanisms of high lift or thrust are also identified.

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