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Vortex structure comparison between experimental and computational studies on a hovering hawkmoth. YUN LIU, Purdue Uni, CHENGYU LI, Villanova University, ANGEL DAVID LOZANO, Purdue University Northwest — In this work, the first full vortex structure comparison between experiments and computations is carried out. From a high-speed *Schlieren* photography on a freely flying hawkmoth, salient flow structures were successfully visualized and captured. In the down-stroke, a vortex loop structure was created on each wing. It was formed by the leading-edge vortex, the tip vortex, the starting/stopping vortex, and the root vortex. In the up-stroke, after wing supination, the vortex loop was shed into the wake, while two significant tip vortices were created from the tips of fore- and hind-wings with ends connecting to the previously shed vortex loop. Concurrently, on each wing, a root vortex was created and linked to the shed vortex loop. The vortex structures are late reconstructed three-dimensionally utilizing the Direct Linear Transformation. On the other hand, an immersed boundary method based numeric computation is conducted on a hovering hawkmoth and resolves the same vortical flow phenomena on hovering hawkmoths. Meanwhile, the vortex structures are compared quantitatively from estimating the vortex loop areas formed in down- and up-strokes, showing good agreements between the experiments and numeric simulations.

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