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The mechanism of body rotation in the flapping flight of butterflies YUEH-HAN FEI, JING-TANG YANG, Department of Mechanical Engineering, National Taiwan University — The aerodynamic effects of the body rotation on the flapping flying of butterflies are experimentally and numerically investigated. We first observe and record the flying motion of a butterfly (*Kallima inachus*) in free flight, focusing especially on the body rotation, via two high speed video cameras and PIV. The body rotation is found in phase with wing flapping while the abdomen is out of phase with wing flapping. Further, we establish the model of flexible wings of a butterfly and exploit the fluid dynamics analysis via the dynamic mesh technique to study the contribution of body rotation to the lift. The results reveal that the body rotation is capable of strengthening the vortex ring structure and correspondingly enhancing the efficiency of lift production. Our simulation model shows the body rotation contributes 15% of total lift. The results of this study may serve as a useful guide for designing insect-like MAVs in the future.

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