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On the correlation between force production and the flow field around a flapping flat-plate wing SÖREN ÖZ, Leibniz Universität Hannover, SWATHI KRISHNA, Syracuse University, KAREN MULLENERS, EPFL — One of the several sophisticated flight skills that insects exhibit is hovering, which is accomplished largely by modulating the wing kinematics and thereby the flow field around the wings. Along with the prolonged attachment of the leading edge vortex, the wing reversal mechanisms form the basis by which insects regulate the magnitude and direction of forces produced. The duration and starting point of these directional flips are studied in the current experimental investigation. Particle image velocimetry is conducted to evaluate the flow features inherent to changes in wing reversal during the stroke of a flat plate, which is modelled based on hoverfly characteristics. The duration of rotation is one-third of the total time period. A +10% phase shift is used for delayed rotation, a -10% phase shift for advanced rotation. Phase-averaged data is analysed to understand the influence of a delayed or advanced rotation on the formation and evolution of large and small scale structures, their interactions with the wing, and disintegration. Additionally, force data is used to quantify the effects of phase-shift in terms of lift and drag variation and is correlated with the vortex dynamics.

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