Abstract Submitted
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Sectional lift coefficient of a rotating wing at low Reynolds number[1] JIEUN KIM, JIHOON KWEON, HAECHEON CHOI, Seoul National University — We investigate the characteristics of sectional lift force on a rotating wing at low Reynolds number using three-dimensional numerical simulation. Three different types of flat plate wings (fruit-fly, rectangular and triangular wings) are considered but keeping their aspect ratio (wing span/wing chord) the same at 3.74. The wings rotate at a constant angular velocity and the angle of attack is fixed during rotation ($5^\circ \sim 45^\circ$). The Reynolds number is 136 based on the wing chord length and the translational velocity at the wing tip, corresponding to that of the flapping fruit-fly wing in hovering flight. An immersed boundary method in a non-inertial reference frame (Kim and Choi, JCP, 2006) is used to simulate the flow. During the first rotation, the sectional lift coefficient decreases from the wing root to the wing tip for all cases. After several rotations, however, the sectional lift coefficient becomes nearly constant except near the wing root and tip at low angles of attack ($\leq 15^\circ$), but maintains a similar behavior to that of first rotation at high angle of attack ($\sim 45^\circ$). Finally, the wing shape does not significantly change the spanwise distribution of sectional lift coefficient.

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