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Lift enhancement by spanwise oscillation in forward translation of a rectangular wing at low Reynolds number SHIZHAO WANG, XING ZHANG, GUOWEI HE, Institute of Mechanics, Chinese Academy of Sciences — The effects of bat-inspired spanwise oscillation on the aerodynamic performance of a translating rectangular wing at Reynolds number 300 are investigated numerically. The spanwise oscillation of the wing is in the sinusoidal form, with two control parameters being the amplitude and the frequency. Compared with the wings in pure translation, it is observed that in range of the parametric space considered in this work, spanwise oscillation is effective in enhancing lift, augmenting lift-drag ratio. To elucidate the mechanism of lift enhancement, the wake structure behind a wing in the combined motion of translation and spanwise oscillation is compared with that behind a purely translating wing. The phenomenon of lift enhancement in oscillating wings is also analysed by using an approximation formula that associates the lift force with Lamb's vector. It is found that spanwise oscillation produces compact and strong side-edge vortices (SEVs) which apply large downward induced velocity on the LEVs and press them onto the upper surface of the wing. The repositioning of LEVs (due to the presence of SEVs) benefits lift generation. The novel wing kinematics (combination of translation and spanwise oscillation) of this work has the potential for application in micro air vehicles (MAVs).

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