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Unsteady lift of a flapping rectangular wing with spanwise stretching-and-retracting SHIZHAO WANG, GUOWEI HE, Institute of Mechanics, Chinese Academy of Sciences, TIANSHU LIU, Department of Mechanical and Aeronautical Engineering, Western Michigan University, XING ZHANG, Institute of Mechanics, Chinese Academy of Sciences — The unsteady lift acting on a bat-inspired flapping wing model at Reynolds number 300 is numerically investigated. The flapping wing model consists of a rectangular flat-plat with a sinusoidally varying wingspan. The wingspan reaches maximum at the middle of the downstroke, and minimum at the middle of upstroke. It is found that the spanwise stretching-and-retracting during the flapping can enhance lift acting on the wing. The enhancement of lift is not only caused by the difference of lift surface area between the downstroke and upstroke, but also benefits from the increase in the lift coefficient. The enhancement of the vortex force is investigated by examining the flow structures. The spanwise stretching-and-retracting during flapping affects the shedding of the tip vortices and evolution of the leading-edge vortex. The interaction between the detached tip vortices and leading-edge vortex causes a weak negative wake capture mechanisms during the upstroke, which results in a decrease in the magnitude of the minus lift and a increase in the average lift coefficient.

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