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A bi-directional leading-edge vortex in slow-flying bats SHIZHAO WANG, LNM, Institute of Mechanics, Chinese Academy of Sciences, XIN ZHANG, GUOWEI HE, LNM, Institute of Mechanics, Chinese Academy of Science — A leading-edge vortex (LEV) is crucial to bat afloat, since a LEV could generate high lift which could not be predicted by the conventional aerodynamics theories. The LEV usually exhibits an intensive spiral vortex of a unidirectional axial flow on the top surface of wing. In this study, we numerically simulate a slowing-flying bat using immersed boundary method. The morphology and kinematics of bat are taken from experimental measurements. It is observed from our simulation that the stretching and collapse motions of wing could induce a bi-directional axial flow. The bi-directional axial flows stabilize the LEV and enhance its intensity. The observation is further investigated by using a simple model: the flows around a spanwise oscillating plate. The spanwise oscillation could enhance the LEV and make its more stable. This result implies a link of bat kinematics with its unusual aerodynamic performances.

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