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Lift enhancement in flying snakes ANUSH KRISHNAN, Boston University, JOHN SOCHA, Virginia Tech, PAVLOS VLACHOS, Virginia Tech, Purdue University, LORENA BARBA, Boston University, George Washington University — Flying snakes use a unique method of aerial locomotion: they jump from tree branches, flatten their bodies and undulate through the air to produce a glide. The shape of their body cross-section during the glide plays an important role in generating lift. We present a computational investigation of the aerodynamics of the cross-sectional shape. We performed two-dimensional simulations of incompressible flow past the anatomically correct cross-section of the species Chrysopelea paradisi, which show that a significant enhancement in lift appears at an angle of attack of 35 degrees, for Reynolds numbers 2000 and above. Previous experiments on physical models also demonstrated an increased lift and at the same angle of attack. The simulations point to the lift enhancement arising from the early separation of the boundary layer on the dorsal surface of the snake profile, without stall. The separated shear layer rolls up and interacts with secondary vorticity in the near-wake, inducing the primary vortex to remain closer to the body and thus cause enhanced suction, resulting in higher lift. In physical experiments, the flow is inherently 3-D due to fluid instabilities, and it is intriguing that the enhanced lift also appears in the two-dimensional simulations.

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