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A CFD simulation of a flying snake gliding with body undulations[1] YUCHEN GONG, JUNSHI WANG, HAIBO DONG, University of Virginia, ISAAC YEATON, JOHN SOCHA, Virginia Tech — Flying snakes are the only species of snakes on Earth capable of gliding, taking advantage of fluid dynamic principles to leap from point to point among the trees. Because they undulate in the air, their unsteady vortex dynamics are critical to understanding their aerodynamics. However, no detailed flow field information can be obtained due to the limitations in experimental flow visualization techniques. In this study, a combined motion capture technology and numerical study has been conducted to study the fluid dynamics of a flying snake gliding. With the high-speed video of the snake gliding shot, its body and kinematic model was reconstructed for computational fluid dynamic (CFD) simulation. An immersed-boundary-method (IBM)-based direct numerical simulation (DNS) flow solver along with adaptive mesh refinement (AMR) was used to simulate the corresponding unsteady flows around the snake body and its flying path. Analysis has been performed on vortex dynamics and spanwise velocity feature. Results from this study are expected to bring more comprehensive understanding of flying snakes' gliding pattern and its flow field and further provide insights into the design and optimization of bio-inspired robots from an aerodynamic perspective.

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