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Deconstructing the Essential Elements of Bat Flight[1] DANESH TAFTI, Virginia Tech, KAMAL VISWANATH, Naval Research Laboratory, NAGENDRA KRISHNAMURTHY, Virginia Tech — There are over 1000 bat species worldwide with a wide range of wing morphologies. Bat wing motion is characterized by an active adaptive three-dimensional highly deformable wing surface which is distinctive in its complex kinematics facilitated by the skeletal and skin membrane manipulation, large deviations from the stroke plane, and large wing cambers. In this study we use measured wing kinematics of a fruit bat in a straight line climbing path to study the fluid dynamics and the forces generated by the wing using an Immersed Boundary Method. This is followed by a proper orthogonal decomposition to investigate the dimensional complexity as well as the key kinematic modes used by the bat during a representative flapping cycle. It is shown that the complex wing motion of the fruit bat can mostly be broken down into canonical descriptors of wing motion such as translation, rotation, out of stroke deviation, and cambering, which the bat uses with great efficacy to generate lift and thrust.

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