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Inertial and Fluid Forces during Bat Flight Maneuvers ATTILA BERGOU, JENNIFER FRANCK, GABRIEL TAUBIN, SHARON SWARTZ, KENNETH BREUER, Brown University — Flying animals generate forces to move through the air with the coordinated movement of their wings. Bats have evolved a particularly impressive capacity in flight control. With more than 24 wing joints bats are able to manipulate wing area, angle of attack, and camber to control their flight through altering aerodynamic forces on their wings. Here we use a model-based tracking framework to reconstruct the highly articulated wing and body kinematics of maneuvering bats from high-speed video. Using this data, we extract a simplified wing geometry and kinematics during various flight maneuvers. The time-dependent fluid flow and resultant forces on the wing are computed with CFD using a direct numerical simulation, and then used in a low-order model of the bat dynamics. This reconstruction identifies the relative importance of both inertial and aerodynamic forces during flight maneuvers.

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