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Optimization Study for Hovering Flapping Flight[1] HUMBERTO BOCANEGRA EVANS, JAMES J. ALLEN, New Mexico State University, B.J. BALAKUMAR, Los Alamos National Laboratory — A scaled robotic hummingbird model was used to perform a flow analysis of hovering flight at a range of Reynolds numbers (1,750< Re <25,000). The flow structure was analyzed using Particle Image Velocimetry and force data was acquired through a strain gage load cell. An attached leading-edge vortex (LEV) consistently appears at the mid-downstroke on the PIV data, which differs from the notion of LEV shedding at higher Reynolds numbers. The coefficient of lift was calculated through the circulation of the flow and compared to the values yielded by the load cell. A peak in the coefficient of lift calculated from PIV data through circulation is in agreement with the Reynolds number at which a rufous hummingbird hovers ($Re \approx 3600$), which suggests that hummingbirds hover in a highly efficient manner.

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