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The Rufous Hummingbird in hovering flight – full-body 3D immersed boundary simulation PAULO FERREIRA DE SOUSA, HAOXIANG LUO, Vanderbilt University, HUMBERTO BOCANEGRA EVANS, New Mexico State University — Hummingbirds are an interesting case study for the development of micro-air vehicles since they combine the high flight stability of insects with the low metabolic power per unit of body mass of bats, during hovering flight. In this study, simulations of a full-body hummingbird in hovering flight were performed at a Reynolds number around 3600. The simulations employ a versatile sharp-interface immersed boundary method recently enhanced at our lab that can treat thin membranes and solid bodies alike. Implemented on a Cartesian mesh, the numerical method allows us to capture the vortex dynamics of the wake accurately and efficiently. The whole-body simulation will allow us to clearly identify the three general patterns of flow velocity around the body of the hummingbird referred in Altshuler et al. (Exp Fluids 46 (5), 2009). One focus of the current study is to understand the interaction between the wakes of the two wings at the end of the upstroke, and how the tail actively defects the flow to contribute to pitch stability. Another focus of the study will be to identify the pair of unconnected loops underneath each wing.

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