Abstract Submitted
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Reduced-order vortex modeling of unsteady non-linear aerodynamics[1] JEFF ELDREDGE, DARWIN DARAKANANDA, Mechanical and Aerospace Engineering, University of California, Los Angeles, MAZIAR HEMATI, Mechanical and Aerospace Engineering, Princeton University — Non-linear fluid dynamic phenomena are inherent both to flapping wings and to fixed wings during rapid maneuvers. These phenomena, manifested in the interactions of shed vortex structures, are central to the generation of forces and moments. In previous work, we have presented the development and optimization of a low-degree-of-freedom model that captures such phenomena in the motions of point vortices of time-varying strength. Here, we present several extensions of this model toward more complex physics. The model construction is informed from a combination of results from experiments, high-fidelity Navier-Stokes computations, and inviscid vortex sheet simulations. A window-stitching technique is used to develop optimized point vortex models for longer-duration maneuvers. Self-sustained vortex shedding from a wing at large angle of attack is captured with point vortices – one per shed vortical structure – using a simple criterion based on the dynamics of the re-attachment point. Finally, the ongoing extension of the model to finite aspect ratio wings is presented.

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