Abstract Submitted
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Fast potential flow computations for low-order aerodynamic modelling[1] DIEDERIK BECKERS, JEFF D. ELDREDGE, University of California, Los Angeles — Lightweight aircraft are vulnerable to flow separation induced by gusts. For purposes of regulating flight in the presence of such gusts, it is important to estimate the flow behavior and the instantaneous aerodynamic forces. In previous work, it was shown (D. Darakananda et al., Phys. Rev. Fluids 3, 124701, 2018) that low-order vortex models can be assimilated with sensor measurements to achieve this estimation. However, traditional vortex element models using Biot-Savart interactions can be computationally inefficient, particularly for 3D models. This work addresses grid-based computations for potential flows in 2D and 3D with the goal of implementing a low-order vortex model for fast modeling of separated aerodynamic flows and gust interactions. The immersed boundary projection method is used to solve for the vector potential field subject to the constraints introduced by the presence of a body. The equations are discretized on a staggered Cartesian grid and solved using the lattice Green's function. The accuracy of these computations is demonstrated for singular vortex elements in 2D and the extension to 3D flows will be discussed.

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