Abstract Submitted
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Thrust performance and wake structure of a pitching flexible plate at low aspect ratio[1] PAULO FERREIRA DE SOUSA, HU DAI, HAOXIANG LUO, Vanderbilt University, JAMES DOYLE, Purdue University — Thrust performance and wake structure are numerically investigated for a rectangular plate (AR = 0.54) that pitches around the leading edge in a free stream. The plate is flexible and it may undergo large displacement. The simulations employ a newly developed fluid-structure-interaction code based on a sharp-interface immersed boundary solver for the flow and a nonlinear finite-element solver for the elastic plate. Implemented on a Cartesian mesh, the flow solver allows us to capture the vortex dynamics of the wake accurately and efficiently. The mass ratio of the plate is low so that the deformation is solely caused by the hydrodynamic force. The results will be compared with the experimental result for the rigid plate from Buchholz and Smits (J Fluid Mech 603, 2008). Both the thrust level and power efficiency will be used to evaluate the performance of the plate, and the results will be compared with those for the corresponding rigid plate with the same effective pitching angle. The effect of the active pitching angle, the bending rigidity, and the Strouhal number will be presented.

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