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Large-Eddy Simulations of Flapping-Induced Lift Enhancement
JENNIFER FRANCK, SHARON SWARTZ, KENNETH BREUER, Brown University — This work isolates the heaving motion of flapping flight in order to numerically investigate the fluid-structure interaction at Reynolds numbers relevant to birds and bats. Although there has been much focus on insect flight, larger vertebrates fly at a higher Reynolds number, which leads to different dynamics in terms of flow separation, reattachment, and high-lift mechanisms. In this work, an incompressible large-eddy simulation is used to simulate the periodic heaving of a flat plate at various angles of attack. It is found that the heaving motion can increase the average lift when compared with the steady flow, more so than is expected from the relative angle of attack. The additional lift is attributed to the vortex dynamics at the leading edge. The lift enhancement and flow features are compared with experimental results.

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