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Computational Analysis of Vortex Formation Over a Plunge Oscillating Flat Plate with Various Slip Conditions[1] JOHN PALMORE, MUHAMMAD SHARIF, AMY LANG, University of Alabama — A thorough understanding of small scale aerodynamics is important for the design of micro air vehicles. Since they fly in the same Re regime as that of insects, these animals can provide biologically inspired designs. This study looks at how an alteration to the surface slip condition affects the aerodynamic flow over a wing at low Re. Butterflies have small scales (on the order of 100 microns in length) that line the surface of their wings, and it is hypothesized that these scales can affect the slip condition over their wings altering vortex formation and possibly leading to improved flight characteristics. As an initial test to this hypothesis, the flow over an infinitely thin, two-dimensional flat plate was studied using the CFD software FLUENT. The no-slip condition was modified by directly altering the shear stress distribution over the plate. In addition, the action of flapping was simulated by varying the angle of attack as a function of time between -60 and 60 degrees. Multiple shear stress distributions, varying from shear free to no-slip, and multiple flapping frequencies were tested to discern the effects on vortex formation; lift and drag were also analyzed.

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