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Vortex Formation on a Plunging Plate with Butterfly Inspired Surface Patterning[1] PRESTON POWELL, AMY LANG, MICHAEL BRADSHAW, University of Alabama — Previous research has shown that butterfly wings are covered in scales (100 microns in length) that are aligned in rows. When these scales are removed, butterflies require more energy and flaps per second to fly. These scales are pivotal to a butterfly's flying efficiency and are the inspiration for this study. This study examined whether improved efficiency is a result of the prolonged attachment of the leading-edge vortex (LEV) due to the arrangement of these rows. Efficiency is important for any system, however, this type of flight is quite similar to that of an MAV. A long flat plate was lifted at various Reynolds numbers to generate tip vortices on the bottom side. Three test plates were used: one flat plate as a control, one with length-wise ridges, and one with width-wise ridges. These ridges act as a simplistic model of butterfly scales while maintaining flow similarity. DPIV was used to measure the circulation and attachment of the leading-edge vortex for each plate. This experiment tested the hypothesis that the width-wise ridges will exhibit the longest attachment of the LEV which corresponds to increased lift. Also, the plate with length-wise ridges will have the quickest shedding of the LEV and decreased lift.

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Amy Lang
University of Alabama

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