Abstract Submitted
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A Computational Study of Transient Couette Flow Over an Embedded Cavity Surface[1] MICHAEL THOMPSON, Arizona State University, AMY LANG, WILL SCHREIBER, CHASE LEIBENGUTH, JOHN PALMORE, Univeristy of Alabama — Insect flight has become a topic of increased study due to bio-inspired applications for Micro-Air-Vehicles (MAVs). The complex yet efficient flight mechanism of butterflies relies upon flexible, micro-geometrically surface patterned, scaled wings. Effective vortex control, when flapping as well as low-drag gliding, may result from the wing's texture. This hypothesis was tested by focusing on the formation of embedded vortices between the rows of scales on butterfly wings. To calculate the total surface drag induced on the moving cavity surface a computational fluid dynamics study using FLUENT simulated the flow inside and above the embedded cavities under transient Couette flow conditions with Reynolds numbers varied from 0.01 to 100. The computational model consisted of a single embedded cavity with a periodic boundary condition. Based on SEM pictures of Monarch (*Danaus plexippus*) butterfly scales, various cavity geometries were tested to deduce drag reduction. Results showed that the embedded vortex size and shape generated within the cavity depended on which surface moved (top, flat wall or bottom, cavity wall) as well as aspect ratio. Surface drag reduction was confirmed over the cavity surfaces when compared to that of a flat plate, and increased with aspect ratio.

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