

Abstract Submitted
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Butterfly scales and their local surface drag dependence on flow orientation AMY LANG, ROBERT JONES, University of Alabama — An experimental study was carried out to measure surface drag over embedded cavity models based on the geometry of butterfly wing scales. Monarch (*Danaus plexippus*) scales, each measuring about 0.1 mm in length, were observed using microscopy to evaluate the microgeometry. Two separate, fabricated models scaled up (300:1) the geometry for dynamically similar testing in a Couette flow oil tank facility. The drag induced over the patterned surfaces was measured using a force gauge. Flow transverse to the rows of scales resulted in a significant drag decrease ($> 30\%$), with dependence on Re . This drag reduction is attributed to the formation of embedded vortices forming between the rows of scales resulting in a “roller bearing” effect. Flow parallel to the rows, as expected, resulted in larger drag increases, especially at lower Re . Both effects may prove beneficial to the butterfly, during flapping and gliding flight, and will be discussed based on the observed orientation of the scales on real specimens.

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