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Drag reduction variation with respect to changes in cavity geometry for a butterfly-inspired surface SASHANK GAUTAM, AMY LANG, The University of Alabama — Monarch butterfly wings are covered with small scales arrange in a pattern that resembles roof shingles, with the tips pointing up forming low-profile cavities. As the flow passes over the wing, the skin friction drag depends on the direction of flow with respect to scale orientation. When the flow is transverse to the cavity orientation, a single vortex forms inside each of the cavity. Previous studies have documented this phenomenon as roller bearing effect which results in sub-laminar drag for very low Re. Previous work focused on rectangular cavities with an aspect ratio 2:1. This study aims to replicate the butterfly-inspired geometry with slanted wall cavities, specifically cavity models of AR 2:1 and AR 3:1 with cavity wall inclination angles of 22, 45 and 90 degrees, with the hope of optimizing the drag reduction. We hypothesize that models with AR 2:1 with 45 degrees cavity inclination angle and AR 3:1 with 22 degrees inclination angle will result in higher drag reduction. As all solid surfaces exert a no-slip condition, because of the formation of secondary vortices in the corners the primary embedded vortex will be in less contact with the cavity walls and thus be able to maintain a higher partial slip velocity as it interacts with the boundary layer.

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