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A lifting surface approximation for roll stall of Micro Aerial Vehicles MATT SHIELDS, KAMRAN MOHSENI, University of Florida — The lateral stability of Micro Aerial Vehicles (MAVs) has been known to be adversely affected by the low aspect ratio (LAR) nature of these aircraft. While this has typically been attributed to the small moments of inertia about the plane of symmetry, recent experimental results display the development of a significant roll stability derivative ($C_{l,\beta}$) for flat plate (0% camber) wings. The roll moment can be attributed to the asymmetric development of the tip vortices of a yawed wing and the resulting deviation from the wing loading at zero sideslip. Furthermore, results indicate that a harmonic yaw oscillation at increasing angular velocities results in a delay effect as the formation of the tip vortex is affected by the rotation of the wing; that is, the roll moment does not reach its steady value at a given yaw angle until after the model yaws past the angle. A model based on modified lifting surface theory is developed to determine the influence of the induced velocities of the skewed tip vortices on the lateral loading of both the static and oscillating wing; experimentally determined parameters are used to compensate for the separated flow experienced by MAV wings and not considered in conventional lifting surface methods.

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