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Wing Warping and Its Impact on Aerodynamic Efficiency BEN LOH, JAMEY JACOB, Oklahoma State University — Inflatable wings have been demonstrated in many applications such as UAVs, airships, and missile stabilization surfaces. A major concern presented by the use of an inflatable wing has been the lack of traditional roll control surfaces. This leaves the designer with several options in order to have control about the roll axis. Since inflatable wings have a semi-flexible structure, wing warping is the obvious solution to this problem. The current method is to attach servos and control linkages to external surface of the wing that results in variation of profile chamber and angle of attack from leading edge or trailing edge deflection. Designs using internal muscles will also be discussed. This creates a lift differential between the half-spans, resulting in a roll moment. The trailing edge on the other half-span can also be deflected in the opposite direction to increase the roll moment as well as to reduce roll-yaw coupling. Comparisons show that higher L/D ratios are possible than using traditional control surfaces. An additional benefit is the ability to perform symmetric warping to achieve optimum aerodynamic performance. Via warping alone, an arbitrary span can be warped such that it has the same aerodynamic characteristics as an elliptical planform. Comparisons between lifting line theory and test results will be presented.

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