

Article

Performance Comparison between Optimised Camber and Span for a Morphing Wing

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Abstract: Morphing technology offers a strategy to modify the wing geometry, and the wing planform and cross-sectional parameters can be optimised to the flight conditions. This paper presents an investigation into the effect of span and camber morphing on the mission performance of a 25-kg UAV, with a straight, rectangular, unswept wing. The wing is optimised over two velocities for various fixed wing and morphing wing strategies, where the objective is to maximise aerodynamic efficiency or range. The investigation analyses the effect of the low and high speed velocity selected, the weighting of the low and high velocity on the computation of the mission parameter, the maximum allowable span retraction and the weight penalty on the mission performance. Models that represent the adaptive aspect ratio (AdAR) span morphing concept and the fish bone active camber (FishBAC) camber morphing concept are used to investigate the effect on the wing parameters. The results indicate that generally morphing for both span and camber, the aerodynamic efficiency is maximised for a 30%–70% to 40%–60% weighting between the low and high speed flight conditions, respectively. The span morphing strategy with optimised fixed camber at the root can deliver up to 25% improvement in the aerodynamic efficiency over a fixed camber and span, for an allowable 50% retraction with a velocity range of 50–115 kph. Reducing the allowable retraction to 25% reduces the improvement to 8%–10% for a 50%–50% mission weighting. Camber morphing offers a maximum of 4.5% improvement approximately for a velocity range of 50–90 kph. Improvements in the efficiency achieved through camber