Aerospace Engineering Thesis Defense

Early Wing Structural Design for Stiffness and Frequency Response

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abstract

This paper describes an effort to bring wing structural stiffness and aeroelastic considerations early in the conceptual design process with an automated tool. Stiffness and aeroelasticity can be well represented with a stochastic model during conceptual design because of the high level of uncertainty and variability in wing non-structural mass such as fuel loading and control surfaces. To accomplish this, we improve upon existing design tools utilizing rule based automated design to generate wing torque box geometry from a specific wing outer mold-line. Simple analysis on deflection and inferred stiffness shows how early conceptual design choices can strongly impact the stiffness of the structure. The impacts of design choices and how the buckling constraints drive structural weight in particular examples are discussed. The model is then carried further in future research to include a finite element model (FEM) to analyze resulting mode shapes and frequencies for use in aeroelastic analysis.

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