Master’s Thesis Defense Announcement

Mechanical and Aerospace Engineering Department

University of Texas at Arlington

Development of a 3D Printed Optimization-Driven Aeroelastically Scaled Wind Tunnel Model for High Aspect Ratio Flying Wings

By

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Abstract

Design optimization coupled with 3D printing and parametric CAD offers a unique approach to investigating flutter phenomena by creating low-cost iterative aeroelastic wind tunnel models. Recently, there is an interest in studying flutter phenomena at low air speeds in flying wing configurations. The X-56 experimental flying wing was designed to investigate flutter phenomena and flutter suppression, which makes the X-56 a logical choice for the full-scale model. The goal of this work is to optimize, physically print, and geometrically characterize a scaled aeroelastic wind tunnel model. The 18% reduced scale X-56 model was optimized by matching the mode shapes to the full-scale version to create structural similarity in the mode shapes and frequencies. Two feasible optimization solutions were found for nylon and HT23 materials. Next, parametric CAD was created to enable the 3D printing of the wing. The nylon wing skins are printed on the HP 580 MultiJet fusion 3D printer, while the spars are printed with the MarkForged Mark 2 continuous fiber composite 3D printer. The results show warping in the print, assembly issues, and a need to update the optimization model to reflect what was physically built. These iterative 3D printed models lay the groundwork for creating aeroelastic wind tunnel models.