

Alternative numerical validation methodology for short-term development projects

ABSTRACT

Virtual prototyping has been increasingly taking over the process of sole physical tests. Companies are reporting up to 80% reduction in errors when using virtual tests through the design process. Conventional numerical validation methodology however, is not as beneficial for short-term projects because any new numerical scenario has to be validated before being used. Although during the conceptual stage, relative values can be sufficient. The alternative methodology proposed also uses realistic loads. It comprise applying these loads on a functioning structure to verify them. The modified version of the structure is then relatively validated by being tested under these verified loads. Thus, bypassing the physical tests requirement. Aerodynamic loads are acquired from simulating the Gulfstream IV-SP forward fuselage during climbing, cruising and landing. Mechanical loads are acquired from estimating structural weight and impact load during landing. In total, three finite element models were created. Autodesk softwares were used to perform CFD and FEA. Only greater loads were applied during FEA. Results simplified neglected cruising data for having lowest values. Comparing estimated weights of functional and modified structures showed a possible 15% weight savings. While the FEA results showed a promising 45% less inquired stress within the modified structure.

Keyword: Airframe; FEA; Innovation; Numerical; Structure; Validation