

Reverse Engineering of a Secondary Structure of a Helicopter: A Study Case

Authors : Jose Daniel Giraldo Arias, Camilo Rojas Gomez, David Villegas Delgado, Guillermo Idarraga Alarcon, Juan Meza Meza

Abstract : The reverse engineering processes are widely used in the industry with the main goal to determine the materials and the manufacture used to produce a component. There are a lot of characterization techniques and computational tools that are used in order to get this information. A study case of a reverse engineering applied to a secondary sandwich- hybrid type structure used in a helicopter is presented. The methodology used consists of five main steps, which can be applied to any other similar component: Collect information about the service conditions of the part, disassembly and dimensional characterization, functional characterization, material properties characterization and manufacturing processes characterization, allowing to obtain all the supports of the traceability of the materials and processes of the aeronautical products that ensure their airworthiness. A detailed explanation of each step is covered. Criticality and comprehend the functionalities of each part, information of the state of the art and information obtained from interviews with the technical groups of the helicopter's operators were analyzed, 3D optical scanning technique, standard and advanced materials characterization techniques and finite element simulation allow to obtain all the characteristics of the materials used in the manufacture of the component. It was found that most of the materials are quite common in the aeronautical industry, including Kevlar, carbon, and glass fibers, aluminum honeycomb core, epoxy resin and epoxy adhesive. The stacking sequence and volumetric fiber fraction are a critical issue for the mechanical behavior; a digestion acid method was used for this purpose. This also helps in the determination of the manufacture technique which for this case was Vacuum Bagging. Samples of the material were manufactured and submitted to mechanical and environmental tests. These results were compared with those obtained during reverse engineering, which allows concluding that the materials and manufacture were correctly determined. Tooling for the manufacture was designed and manufactured according to the geometry and manufacture process requisites. The part was manufactured and the mechanical, and environmental tests required were also performed. Finally, a geometric characterization and non-destructive techniques allow verifying the quality of the part.

Keywords : reverse engineering, sandwich-structured composite parts, helicopter, mechanical properties, prototype

Conference Title : ICCM 2017 : International Conference on Composite Materials

Conference Location : London, United Kingdom

Conference Dates : January 19-20, 2017