

FINITE ELEMENT METHOD APPLIED TO MECHANICAL ANALYSIS OF AERONAUTICAL RIBS IN CARBON FIBER AND 7075 ALUMINUM ALLOY

Congresso Brasileiro De Gestão Da Qualidade Industrial., 1ª edição, de 16/11/2020 a 18/11/2020
ISBN dos Anais: 978-65-86861-55-6

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RESUMO

Introduction: The aeronautical industry is increasingly demanding lightweight materials with good mechanical properties in order to improve aircraft performance. The carbon fiber associated with the epoxy resin generates a composite with high structural performance and lower mass values when compared to aluminum alloys. This work aimed to compare the mechanical performance of a carbon fiber rib and a rib made of 7075 aluminum alloy (AA7075). The analyzes were made using the finite element technique. **Materials and methods:** The rib was developed in the Autodesk Inventor Professional 2021 software with a rope length of 1 m and height of 0.2 m, considering it as close as possible to a real aircraft. Then, separate files were generated in order to establish the materials used. The data regarding the mechanical properties of each material were entered manually into the software. It is noteworthy that the data referring to the carbon fiber were obtained through studies carried out in the laboratory, since these values may change according to the manufacturing process developed. **Results and discussions:** The main data to be identified in the two simulations are the Von Mises stresses, main stresses and maximum displacement of the element. The Von Mises values for the element made with AA7075 used in this study. The results indicates that the maximum stress is at the point of contact where the thickness of the rib is less, increasing the possibility of material failure at this point. The minimum tension is identified on the front of the rib. This is one of the most important results in the analysis of metallic and plastic components. The von Mises tension, as its name implies is a tension, it has the property of being a number (a scalar) that is obtained by combining the "beam" of all the stresses in space (stresses in the x, y, z directions). **Conclusion:** Based on the presented study, it can be said that the use of carbon fiber for the production of aeronautical ribs is more advantageous than the aluminum alloy 7075, since it has mechanical properties superior to metal and less mass. However, the metal alloy presents deformations superior to the composite material, which makes carbon fiber more prone to critical failures. It is also worth noting that the quality of a rib made of carbon fiber or other composite material is directly related to its production process, so that in the end it is necessary to carry out tests to determine the mechanical properties. Finally, the selection of the type of material must take into account the aircraft's characteristics, such as its load capacity, mass, among others, seeking to obtain the most suitable material.

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PALAVRAS-CHAVE: Composite materials, carbon fiber, Aluminum alloy 7075.

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