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OPTIMIZATION OF CYLINDRICAL COMPOSITE MATERIAL GRID STRUCTURE

Abstract

The design of lightweight structures in aerospace industry has continued for the last several decades. There are many methods to reinforce cylindrical structure for lightweight design. Hence, new structural configurations and corresponding methods for fabricating high efficient load carrying structures are the goals of this research. The aim of this structure is to reduce the cost and weight while also enabling large structures to be fabricated. A grid Stiffened structure has been selected. Processes for manufacturing Grid Stiffened composite structures have been developed and shows promise in achieving these goals. Composite Advanced Grid Stiffened (AGS) structures have long been of interest as a replacement of metal grid and honeycomb sandwich structures. It is found that the grid stiffened structure concept is lighter and 30In this paper, design and analysis optimization methodology of Advanced Grid-Stiffened (AGS) cylindrical structures under axial compression is presented. Design and analysis has been broadly divided into two phases- initial phase and final phase. In the initial phase of design, two open grid types are assessed for the cylindrical grid structure. These are the axial grid and the hoop grid. The axial grid consists of axial stiffeners, which are parallel to the axis of the cylinder, and helical stiffeners. The hoop grid is made of hoop stiffeners which are circular and helical stiffeners.

The second optimization phase includes a detailed analysis of the parameters influence on the stiffness of a cylindrical grid structure. Given the length and radius of the structure, an optimal design exercise is essentially that of determining the design parameters that would resist the design load with desired factor of safety and minimum mass. The calculations and comparisons between different designs are based on parametric Finite Element Model and supported by empirical methods.