World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:12, No:08, 2018

Numerical and Experimental Analysis of Stiffened Aluminum Panels under Compression

Authors : Ismail Cengiz, Faruk Elaldi

Abstract : Within the scope of the study presented in this paper, load carrying capacity and buckling behavior of a stiffened aluminum panel designed by adopting current 'buckle-resistant' design application and 'Post –Buckling' design approach were investigated experimentally and numerically. The test specimen that is stabilized by Z-type stiffeners and manufactured from aluminum 2024 T3 Clad material was test under compression load. Buckling behavior was observed by means of 3 – dimensional digital image correlation (DIC) and strain gauge pairs. The experimental study was followed by developing an efficient and reliable finite element model whose ability to predict behavior of the stiffened panel used for compression test is verified by compering experimental and numerical results in terms of load – shortening curve, strain-load curves and buckling mode shapes. While finite element model was being constructed, non-linear behaviors associated with material and geometry was considered. Finally, applicability of aluminum stiffened panel in airframe design against to composite structures was evaluated thorough the concept of 'Structural Efficiency'. This study reveals that considerable amount of weight saving could be gained if the concept of 'post-buckling design' is preferred to the already conventionally used 'buckle resistant design' concept in aircraft industry without scarifying any of structural integrity under load spectrum.

Keywords : post-buckling, stiffened panel, non-linear finite element method, aluminum, structural efficiency
Conference Title : ICAME 2018 : International Conference on Aeronautical and Manufacturing Engineering
Conference Location : Barcelona, Spain
Conference Dates : August 20-21, 2018