Crush simulation of woven c-glass/epoxy unmanned ariel vehicle fuselage section

ABSTRACT

A quasi-static crush analysis of an unmanned aerial vehicle (UAV) fuselage section made of woven c-glass/epoxy has been conducted using the finite element simulation via ABAQUS. The main material and strength properties of the c-glass/epoxy (200 g/m2) which were needed in the ABAQUS analyses were obtained from standard material characterization tests. A progressive damage methodology using ABAQUS has been employed in order to simulate the non-linear material behaviour of the composite fuselage section. Two stress based failure theories were programmed in the user subroutine code (USDFLD) and linked with ABAQUS in order to predict the damage of the composite materials. Satisfactory level of agreement between simulation and test results were obtained regarding the main crushing characteristics of the tested woven c-glass/epoxy fuselage sections such as peak compressive load, crush energy absorption and the overall crushing response. It has been observed that the predicted peak load are found to agree with the experimentally recorded peak load within an accuracy of 3.44% and 4.09% for Tsai-Hill and Tsai-Wu Failure criterion, respectively. In addition, the simulated crushing energy absorption results show reasonable accuracy with the experimental values. This confirms the accuracy of the progressive damage methodology implemented in FE analysis for the woven glass/epoxy fuselage sections.

Keyword: Crush analysis; Woven glass/epoxy; Progressive damage analysis; Stresses based failure theory; UAV fuselage section