World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:18, No:02, 2024

Effects of Repeated High Loadings on the Performance of Adhesively-Bonded Single Lap Joints

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Abstract : This study aims to investigate the effects of repeated high loadings on the performance of adhesively-bonded Single Lap Joints (SLJs) by employing both experimental and numerical approaches. A projectile with a mass of 1.25 gr and density of 11.3 gr/cm3 was fired at the joints with a velocity of about 280 m/s using a specially designed experimental set-up, and the impact was recorded via a high-speed camera. The SLJs were manufactured from 6061 aluminum adherend (AA6061) material and an adhesive film. The joints, which have an adherend thickness of 4 mm and overlap length of 15 mm, were subjected to up to 3 shots for the ballistic test, followed by quasi-static tensile testing. The impacted joints, then, were compared to the non-impacted and one-shot impacted ones, which was a subject of investigation carried out before. It was found that while the joints subjected to 2 shots mechanically deteriorated, those subjected to 3 shots experienced a complete failure at the end of the experiment. A numerical study was also conducted using an ABAQUS package program. While the adherends were modelled using the Johnson-Cook deformation parameters, an elastoplastic behavior of the adhesive was used as input data in the analyses. It seems the experimental results confirm the numerical ones.

Keywords : ballistic tests, adhesive joints, numerical analysis, SLJ
Conference Title : ICAA 2024 : International Conference on Aeronautics and Aeroengineering
Conference Location : Istanbul, Türkiye
Conference Dates : February 12-13, 2024