

Title:

Mechanical characterization of aluminum 7075 using digital image correlation and finite element method

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Abstract:

Numerous empirical and numerical studies have been carried out on the mechanical characterization of ductile materials. The application of digital image correlation (DIC) equipped with three-dimensional measurement analysis was used to examine the mechanical characteristics of aluminum alloy (AL 7075). Then, the DIC outcome with finite element simulation results will be compared with the experimental results to measure the performance of the DIC. A tensile specimen of AL 7075 is tested under constant loading with a 2 mm/min displacement rate until fracture. Strain gauge and extensometer are used along with DIC monitoring technique to capture the structural deformation of the specimens. The specimen and test are simulated in ABAQUS software, in which the results are compared with experiment and DIC data, indicating a good correlation between the results. Limited data in the form of average deformation and strain of the experiments are not applicable to the plastic and necking process. In this respect, the 3D DIC results are used to analyze the strain field throughout the test, including specimen necking, and predict fracture location. Moreover, the outcome of DIC and finite element simulation are employed to examine the characteristics of AL 7075 about the large plastic deformation and mechanical behavior. The proposed 3D DIC methodology in providing insight into the characteristic mechanical behavior of ductile materials is highlighted in this paper.