Ductile failure modelling under different range of stress triaxialities

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ABSTRACT

The accurate prediction of fracture in sheet metal forming process has become an important subject, bringing new challenges to material characterization. During this process, the sheet metal can be subjected to large localized deformations with significant through-thickness necking in which 3D stress states develop and dictate the fracture event of the metal blank. The use of numerical methods such as the finite-element method, to handle large plastic deformations, has created the possibility to analyze, with a success, a forming process during its development stage, including damage and fracture [1].

The reliability of the numerical simulation to predict material behavior needs an accurate mechanical characterization. However, the increasing application of a new generation of materials, demands an analysis and development of new techniques to determine their mechanical behavior for different types of loads [2].

In order to investigate the fracture of sheet metal materials for different levels of stress triaxiality, a new experimental approach is considered, based on the specimen geometry developed by Alves *et al.* [3] for plate materials, designated by bi-failure specimen. Since a sheet metal is used in this work which has a low thickness, some changes were implemented on the specimen, such that cracks are most likely to initiate in different sections.

Different ductile damage models were implemented and numerically compared in this paper, to predict the damage in sheet metal sample. A comparison of punch force vs. displacement was made between the finite element results obtained from the damage models and the experimental data.

The numerical simulations show a good agreement with the damage location and punch displacement observed in the experimental simple.

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