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NUMERICAL PREDICTIONS OF DUCTILE FRACTURE LIMITS IN DEEP DRAWING PROCESSES

Hocine Chalal(*), Farid Abed-Meraim

LEM3, UMR CNRS 7239 - Arts et Métiers ParisTech, 4, rue Augustin Fresnel, 57078 Metz Cedex 03, France

(*)*Email:* hocine.chalal@ensam.eu

ABSTRACT

In this work, two numerical ductile fracture criteria based on finite element (FE) simulations are proposed for the prediction of ductile fracture limits (DFLs) for sheet metals. An elastic–plastic model coupled with the Lemaitre continuum damage theory has been implemented into the ABAQUS/Explicit software to simulate simple sheet stretching tests as well as the Nakazima deep drawing tests with various sheet specimen geometries. The first numerical criterion is based on the analysis of the thickness strain concentration and damage evolution in the central part of the specimens in order to determine the occurrence of ductile fracture. The second numerical criterion relies on a damage threshold at which is associated the occurrence of ductile fracture. The DFLs thus predicted by numerical simulations of simple sheet stretching with various specimen geometries and Nakazima deep drawing tests are compared with the experimental results.

Keywords: sheet metal forming, finite element simulation, damage, ductile fracture limits

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