

Phenomenological Ductile Fracture Criteria Applied to the Cutting Process

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Abstract : Present study is aimed on the cutting process of circular cross-section rods where the fracture is used to separate one rod into two pieces. Incorporating the phenomenological ductile fracture model into the explicit formulation of finite element method, the process can be analyzed without the necessity of realizing too many real experiments which could be expensive in case of repetitive testing in different conditions. In the present paper, the steel AISI 1045 was examined and the tensile tests of smooth and notched cylindrical bars were conducted together with biaxial testing of the notched tube specimens to calibrate material constants of selected phenomenological ductile fracture models. These were implemented into the Abaqus/Explicit through user subroutine VUMAT and used for cutting process simulation. As the calibration process is based on variables which cannot be obtained directly from experiments, numerical simulations of fracture tests are inevitable part of the calibration. Finally, experiments regarding the cutting process were carried out and predictive capability of selected fracture models is discussed. Concluding remarks then make the summary of gained experience both with the calibration and application of particular ductile fracture criteria.

Keywords : ductile fracture, phenomenological criteria, cutting process, explicit formulation, AISI 1045 steel

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