# Influence of the Characteristics of the 3D FE Mesh on the Evolution of Variables Used to Characterize the Stress State

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**Abstract.** The study of ductile fracture in sheet metal forming process has gain increased importance in recent years due to the introduction of new materials with higher strength-to-weight ratio, but reduced ductility. Moreover, it has been experimentally verified that fracture can occur without necking, which makes the common usage of the well-known Forming Limit Diagrams unfeasible. Thus, it is important to develop reliable numerical tools that accurately describe failure of ductile materials, either by necking onset or premature ductile fracture. To achieve this, the damage models must be able to capture the characteristic load-path dependent failure behaviour of the materials. Such models should not present an overly complex formulation, which would lead to increased difficulties in their numerical implementation and in the calibration of the model parameters through experimental tests. In this context, the models that employ conventional non-porous plasticity models in conjunction with a damage indicator framework to predict ductile fracture have gain increasing interest. These models normally predict the equivalent strain at the instant of fracture as a function of variables that characterize the stress state, such as the stress triaxiality and the Lode angle parameter. It is known that the prediction of ductile fracture requires very fine three-dimensional solid element models, particularly if it is preceded by necking, since the stress state becomes fully three-dimensional. The aim of this work is to analyse the influence of the discretization adopted in the gauge area of specimens, commonly used to calibrate ductile fracture models, in the evolution of variables used to characterize the stress state. The specimens selected are discretized with linear and quadratic solid elements, considering different mesh sizes and integration rules. All numerical simulations are performed with the in-house solver DD3IMP. The results allow to establish some guidelines for improving the computational efficiency of the numerical models.