Simulation of ductile failure in pre-notched cylindrical test specimens using continuum damage mechanics model

Ductile fracture occurs due to micro-voids nucleation, growth and, finally coalescence into micro-cracks. These micro-cracks grow as the deformation progresses. Now a days, continuum damage mechanics model is employed as one of the tools to predict the micro-crack initiation. In this work, fracture initiation in different types of notched specimen in tension test is studied using this model. A new non-linear damage growth law proposed by the authors, based on the experimental results at IIT Kanpur, is used.

It is well-known that, in round (i.e. without a notch) specimen, the triaxiality increases at center but remain constant at the outer surface. However, in notched specimen, the triaxiality decreases at the center of specimen but increases at the outer surface as the notched radius increases. Therefore, the location of maximum damage and hence that of micro-crack initiation shifts from the center to the out surface as the notch radius is increased.

It also correctly predicts the failure strain, which is much less than the failure strain in the round specimen as reported in the literature.