New Modelling Approach for Edge Cracking Simulations

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The use of new high strength sheet materials still represents a challenge to the manufacturing sector. It faces serious industrial problems to reach defect-free production as well as productivity losses due to the unpredictable occurrence of edge cracking and lack of overall formability during forming.

In most of the cases, the contour or even the tool itself must be modified and sometimes, the sheet material has to be changed. This results in high additional costs and delays in part delivery programs or can even impede the manufacture of parts with high-strength materials. Traditionally, sheet formability has been addressed through tensile tests and forming limit curves (FLC), with good enough results. However, such tests do not allow understanding crack-related problems, which remain as still unsolved issues in the sector and hamper the use of new materials and the development of high-performance parts at reduced costs. Accordingly, FormPlanet addresses the urgent need for accurate material characterization tests and new modelling approaches to predict defect generation at an early design state, as well as to prevent and to solve it during industrial manufacturing, covering the whole value chain.

In this framework, a new approach to define the ductile damage model based on the toughness in terms of essential work of fracture (EWF) obtained by doble edge notched tension test [1] (DENT) is presented. This methodology allows improve the finite elements analysis (FEA) showing a good edge cracking prediction on forming operations of AHSS. Both laboratory tests and forming of industrial parts were analyzed using the proposed method.

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