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Effect of High-stress Triaxiality on Yield and Ultimate Tensile Strength of E250 Structural Steel

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Abstract

The study focuses on evaluating the effect of the high-stress triaxiality on the tensile strength at yield and ultimate stage of commonly used structural steel, E250. Three circumferentially notched specimens with varying radii of curvature are selected to cover a specified range of stress triaxialities. The selected specimens are extracted from a 25 mm thick structural steel plate of E250 grade. The extracted specimens are subjected to uniaxial tensile tests for evaluating the engineering stress-strain curves, using which the mechanical strength at yield and ultimate stage of all the specimens are determined. The yield and ultimate tensile strength of specimens with notches are compared to those of specimen without notches, and the percentage increase in tensile strength is reported. The tensile strength noted at both stages is observed to linearly increase with increasing stress triaxialities of study specimens. The results obtained through experiments and sophisticated finite element models are used to propose equations in terms of stress triaxiality employed in predicting the increased tensile strength of E250 structural steel at yield and ultimate stage.

Keywords: Stress triaxiality, Lode angle, Fracture initiation, Steel fuse element