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Abstract: This paper assesses and evaluates the detrimental effect of standard and complex geometrical features on the static strength of samples made of Q460 steel. The experimental results generated by testing four types of notched specimens were analyzed using the Theory of Critical Distances (TCD). The considered configurations included uniaxial tension tests on standard notched round bars and double-side U-notched flat plate specimens. In particular, our attention was focused on the fracture behavior of two specimens containing complex geometrical features subjected to pure-shear and tensile-shear local stress states. The common feature of these two notched specimens was that cracks were seen to initiate, within the material, away from the stress raisers, even though obvious stress concentrations existed at notch tip. The performed validation exercise confirms the accuracy and reliability of the linear-elastic TCD in estimating the fracture initiation position and static strength of standard notched round bars and double-side U-notched flat plate specimens. In the meantime, the linear-elastic method proposed in this paper can also be used as an effective approach to assess the fracture behavior of metallic components having complex geometry.

Key words: notches; Theory of Critical Distances; static failure; fracture; structural steel