Numerical simulation of crack growth in welded joints in the presence of multiple defects

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ABSTRACT

Simulation of crack initiation and propagation which occurred during the tensile testing of real welded joint specimens made of low-alloyed low-carbon structural steels is presented in this paper. Welded joints in questions were made with a number of different defect combinations [1-3], such as excess weld metal, undercuts, vertical misalignment and incomplete root penetration. Tensile tests were performed on specimens divided into four groups according to their defect combinations, along with numerical simulations using finite element method [4-6]. Once numerical models which were valid in terms of stress and strain distribution were obtained, cracks were introduced in the most critical locations, which corresponded to the real specimen locations were failure of specimens initiated. The goal was to observe the behaviour of models in the presence of these cracks, since in the case of experimental specimens, fracture behaviour was often unconventional, due to complex geometry which caused them to deform in unexpected manner. This geometry was influenced by the presence of multiple different defects in the welded joint, and in some cases even resulted in stress states that were not uniaxial, as is usually the case with experiments and simulations like the one presented here.

To be presented by Simon Sedmak