Stress Intensity Factors for Longitudinal Cracks at Branch Tee Connections in Pipes

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Abstract

Fracture mechanics analysis of a piping system requires knowledge of stress intensity factors for cracks at the branch Tee connections. The purpose of this paper is to study the influence of the branch pipe on the stress intensity factors for longitudinal cracks in the main and branch pipes. For this, branch Tee connections with through cracks are analysed using a finite element method. Doubly-curved triangular shell elements are used for the modelling. The stress intensity factors are calculated by the displacement method, the stress method and an approximate method using influence coefficients. The length of the crack in the branch pipe is varied to study its effect on the stress intensity factor at the crack tip in the main pipe. Different branch to main pipe diameter ratios are considered.

Results indicate that: (1) the stress intensity factor is significantly increased if the reinforcing effect of the branch pipe is not considered, and (2) the stress intensity factors, found by a simple influence coefficient method are in good agreement with those found using the finite element approach for cases of pipes with a hole.

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