

Fatigue & Fracture of Engineering Materials & Structures

Consideration of the residual stress distributions in fatigue crack growth calculations for assessing welded steel joints

AM Al-Mukhtar

ABSTRACT

To better understand the crack closure and propagation, an analytical model is established. The residual stress effect on fatigue crack growth equations has been considered using the residual stress intensity factor (SIF) (K_{res}). The joint geometries, residual stress distributions (σ_{res}) and residual stress ratio (R_{res}) were considered also. K_{res} are calculated using the analytical weight function (WF) method and different residual stress distributions. It is to be emphasized that the current approach is little investigated. This is because the WF has already been developed to calculate SIF for an existing crack. The current approach calculates K_{res} for the crack that initiates and propagates until failure. Different stress distributions have been used, and R_{res} is defined. The validity of using the WF has been shown. SIF due to applied load (K_{app}) and applied stress ratio (R_{app}) have been considered. Fatigue crack growth rate was investigated in accordance with the current approach. The results have been verified and benchmarked.