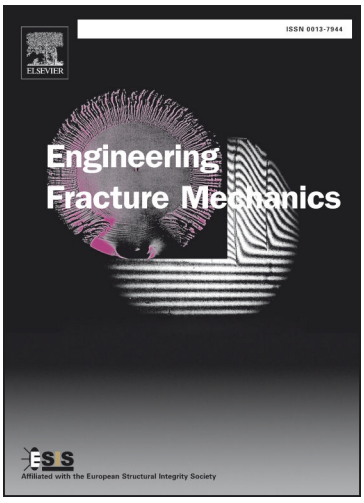

Fracture analysis of load-carrying cruciform fillet welded joints with multiple cracks

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Fracture analysis of load-carrying cruciform fillet welded joints with multiple cracks

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Abstract

Load-carrying cruciform fillet welded joints configuration is frequently encountered in many welded structures. Different from non-load-carrying joints, the crack in load-carrying joints can propagate from the weld root or from the weld toe. Hence, the crack propagation location is critical for a given weld size, transverse and main plates thickness. In this study, a finite element (FE) mesh generator developed previously is extended to generate 3-D models of load-carrying joints containing cracks at the weld root and the weld toe. Then, extensive parametric study is carried out to calculate the stress intensity factors (SIFs). Corresponding SIF equations are proposed according to multiple regression analysis. Based on these equations obtained for the weld root and weld toe cracks, the critical crack and weld sizes at which the crack propagates from the weld root to the weld toe are determined.

Keywords**:** Crack propagation; Load-carrying cruciform joints; Stress intensity factor; Weld root crack; Weld toe crack

1. Introduction

Cruciform fillet welded joint is a common connection encountered in many welded structures. They are classified as non-load-carrying and load-carrying. For the non-load-carrying joints, the crack always propagates from the weld toe [1,2]. However, the crack may propagate from the weld toe [3] or the weld root [4-9] for the load-carrying joints. This is mainly due to the presence of non-penetrating region between the transverse and main plates. For the past decades, considerable research works have been performed to evaluate the fatigue and fracture strength of