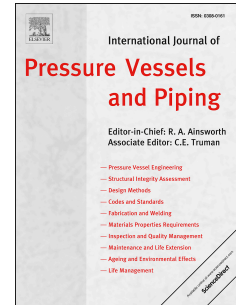


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A global limit load solution for plates containing embedded off-set rectangular cracks under combined biaxial force/stress and through-thickness bending

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Abstract

A global limit load solution for plates containing embedded off-set rectangular cracks under combined biaxial force/stress and through-thickness bending moment is derived based on the lower bound limit load theorem and the Mises criterion under a plane stress assumption. The limit load solution is validated using 3D elastic-perfectly plastic finite element (FE) analyses. The results show that the predictions using the solution developed in this paper are close to the FE results and slightly conservative. From the solution, limit load solutions for some other defect types in plates, such as extended surface cracks, through-thickness cracks, off-set extended embedded cracks and surface cracks under combined bi-axial force/stress and through-thickness bending are obtained.

Keywords: embedded off-set crack, limit load; combined loading; plate; finite element

Nomenclature

a half depth of crack

A, B, C, A', B', C' parameters used to define limit load solutions

A_e area of part of the rectangular crack in the region of σ_1^-

c half-length of crack

L half-length of plate

LPF load proportionality factor

LPF_c critical LPF value for limit load

$LPF_{c,r}, LPF_{c,\phi}$ LPF_c values obtained from $LPF-T$ and $LPF-\Phi$ curves

m_{1L} normalised limit through-thickness bending moment

M_1 applied through-thickness bending moment

M_{1L} limit through-thickness bending moment

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