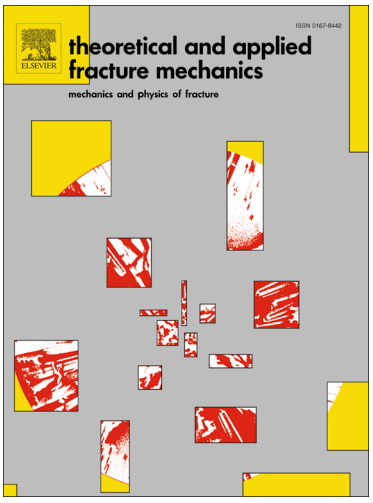

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On the Analysis of Structures with Cracks of Elliptical and Part-Elliptical Shapes

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Highlights
A new theoretical relationship for the distribution of SIF for elliptical and part-elliptical cracks was developed;
A new way for evaluating of the quality of alternative K-solutions and fitting equations was suggested;
The relationship proposed here can assist in the development of SIF parametric equations from FE results.

Abstract
Stress intensity factors for cracks of elliptical or part-elliptical shapes in structural components, e.g. plates, bars and pressure vessels, are normally obtained using numerical methods. Due to the lack of exact benchmark solutions, the evaluation of the accuracy and quality of the numerical results and the corresponding fitting equations are largely based on the comparison against the outcomes of the previous numerical studies. In this work, a new relationship for the exact distribution of the stress intensity factor along the crack front is derived based on the divergence theorem for the compliance function. The application of the developed theoretical relationship is demonstrated towards the evaluation of the quality of previously obtained empirical equations for elliptical, semi-elliptical and part-elliptical cracks.

Keywords: Stress intensity factor; Elliptical crack; Part-ellitical crack; Round bar; Compliance