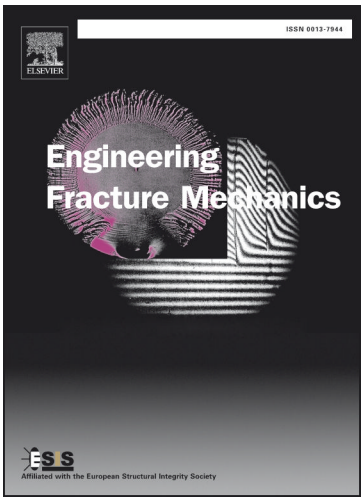

Stress Intensity Factor of Radial Cracks in Isotropic Functionally Graded Solid Cylinders

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PII: S0013-7944(16)30550-1
DOI: http://dx.doi.org/10.1016/j.engfracmech.2017.05.019
Reference: EFM 5545

To appear in: *Engineering Fracture Mechanics*

Received Date: 31 October 2016
Accepted Date: 16 May 2017

Please cite this article as: Mahbadi, H., Stress Intensity Factor of Radial Cracks in Isotropic Functionally Graded Solid Cylinders, *Engineering Fracture Mechanics* (2017), doi: http://dx.doi.org/10.1016/j.engfracmech.2017.05.019

Stress Intensity Factor of Radial Cracks in Isotropic Functionally Graded Solid Cylinders

H. Mahbadi [1]

Abstract

This paper estimates stress intensity factors of rotating solid disks or cylinders with a radial crack subjected to a uniform tension at their outer surface and a uniform temperature change through the body. Material properties of the cylinder are assumed to obey from the power law through the radius of the cylinder. The cracks are assumed to be small and located radially at center, inside or edge of the body. The stress intensity factors are obtained applying an approximate method and using the proper geometric functions for combination of the thermomechanical stresses. The method proposed in this paper is imposed to isotropic FG plates with an edge slanted crack to quantify the difference between present method and numerical methods given in the literature review. Also, the SIFs obtained for the non-homogeneous cylinder are reduced to the homogeneous one and are compared with the corresponding exact solution of isotropic materials.

Keywords:*FGM, Stress Intensity Factor, Mixed Mode, Central Crack, Edge Crack, Internal Crack*

1. Introduction

Researchers widely investigated stress intensity factor of various crack problems in disks and cylinders made of homogeneous materials. Due to the wide application of FG materials, the interest on problems of SIFs corresponding to these materials has grown. The SIF of the first crack mode in functionally graded solid and hollow cylinders including a penny shaped crack is presented by Li et al. [1, 2] using FE method. The same authors [3] considered the problem of SIF for a cylindrical crack in a functionally graded interlayer under torsional shock. They used a numerical Laplace inversion technique to solve the singular integral equation produced in the mixed boundary value problem. The FE method is used by Eshraghi and Soltani [4], Moghaddam et al. [5] and Nami and Eskandari [6] to obtain the SIF of FG cylinders with different crack geometries. Internal circumferential crack, surface crack and semi-elliptical crack are among the geometries which their SIFs are investigated by mentioned authors.

Dag et al. [7], determined SIF of a circumferential crack in a thin FG cylinder subjected to quasi-static thermal loading. To this aim the cylinder is modelled as a layer on an elastic foundation wherein the thermal and mechanical properties are exponential functions of the thickness coordinate. The problem of internal or external circumferential crack in a hollow disk is solved also by Chen [8] and the problem of interlayer

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