Malaysian Journal of Mathematical Sciences

Journal homepage: https://einspem.upm.edu.my/journal

Hypersingular Integral Equation for Triple Circular Arc Cracks in an Elastic Half-Plane

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Received: 30 March 2020
Accepted: 19 June 2021

Abstract

Triple circular arc cracks problems subjected to shear stress in half-plane elasticity is investigated. Modified complex potentials (MCP) with the free traction boundary condition are applied to formulate the hypersingular integral equation (HSIE) for the problems. The unknown crack opening displacements (COD) of the HSIE are solved numerically by using the appropriate quadrature formulas. Mode I and Mode II of nondimensional stress intensity factor (SIF) at all cracks tips are presented for the problems of three adjacent circular arc cracks, three circular arc cracks with dissimilar radius and three circular arc cracks in series in a half-plane. The results exhibit that as the crack opening angle increases and the distance of cracks closer to the boundary of half-plane, the nondimensional SIF increases. This indicates that the strength of material becomes weaker and the tendency of material to fail is higher.

Keywords: half-plane; hypersingular integral equation; stress intensity factor; triple circular arc cracks.