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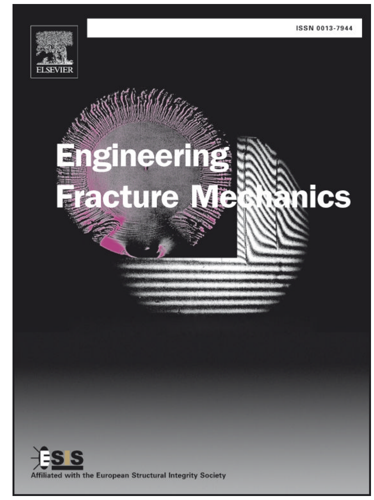

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XFEM analysis of a 2D cracked finite domain under thermal shock based on Green-Lindsay theory

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Abstract

In this paper, the extended finite element method is implemented to extract stress intensity factors (SIFs) for a stationary crack in an isotropic 2D finite domain under thermal shock. The fully coupled generalized thermoelasticity theory based on Green- Lindsay (G- L) model is considered. The interaction integral is developed to compute the stress intensity factors in which the dissipated part of the strain energy density is accounted to preserve domain-independency of. The Newmark time integration scheme is used to solve semidiscrete governing equations. According to the results, the speed of stress and temperature waves controls the time variations of stress intensity factors especially at early times of the thermal shock.

Keywords: thermal shock, Green- Lindsay model, eXtended Finite Element Method (XFEM), interaction integral, stress intensity factors.

1. Introduction

In the classical thermoelasticity theory (CTE), the conventional Fourier heat conduction and the Neumann-Duhamel hypothesis are considered as the heat flux and stress constitutive equations, respectively which accompany with the entropy constitutive equation as a linear function of temperature and strain lead to the parabolic nature of the energy equation and consequently,

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