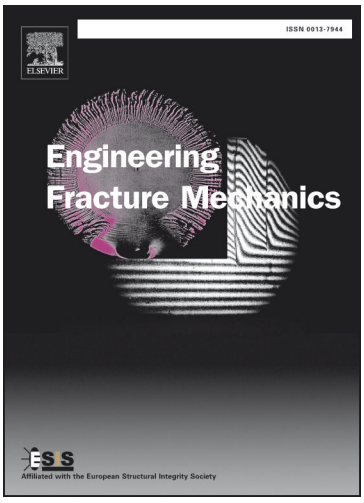

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Thermoelastic analysis of a cracked strip under thermal impact based on memory-dependent heat conduction model

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Abstract In this paper, by introducing memory-dependent derivative (MDD) into the Cattaneo and Vernotte (CV) heat conduction model, the thermoelastic problem of a thermally insulated crack parallel to the boundary of a strip under thermal impact loading is considered. Laplace and Fourier transforms are used to reduce the thermoelastic problem to a system of singular integral equations which are solved numerically. Numerical results are presented to illustrate the effects of time delay and kernel function on the temperature, intensity factors of temperature gradients, and stress intensity factors. The results are compared with those based on Fourier and CV model, which can be taken as two special cases of the present model. The results show that the responses are strongly affected by the two parameters, which can help understand the crack behaviors of materials under thermal impact loading.

Keywords Memory-dependent derivative; Singular integral equations; Stress intensity factors; Intensity factors of temperature gradients

1 Introduction

With the development of micro/nanoscale electromechanical systems and the wide applications of ultrashort pulse lasers, heat transfer at micro/nanoscale may have very different physical bases than that in macroscale. The Fourier law is the conventional