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CRACK INTERACTION IN PLANE MAGNETOELECTROELASTIC SOLIDS UNDER DYNAMIC LOADING

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ABSTRACT

In this paper, the dynamic behavior of interacting cracks in 2-D magnetoelectroelastic media is investigated. Several impermeable cracks configurations subjected to time-harmonic incident L- and SV- waves are analysed by means of a hypersingular BEM formulation. The dynamic time-harmonic Green’s functions derived by Rojas-Díaz et al. [1] for 2-D fully anisotropic magnetoelectroelastic media are implemented. This dynamic fundamental solution is presented as the sum of singular plus regular terms, the singular terms corresponding to the static magnetoelectroelastic Green’s functions [2,3]. In this manner, integrals containing the singular and hypersingular kernels arising in the displacement and traction boundary integral equations are computed following the same procedure developed by the authors for statics [4], so that subsequently only regular terms need to be added in order to solve the dynamic problem.

The aim of this study focuses on analysing the effect of the magnetoelectromechanical coupling on the dynamic crack interaction and to evaluate the dependence of the fracture parameters (stress intensity factors –SIF–, electric displacement intensity factor –EDIF– and magnetic induction intensity factor –MIIF–) on:

- the coupled magnetoelectromechanical load,
- the crack geometry and
- the characteristics of the incident wave motion.

Numerical results will be presented and discussed to illustrate the significant effect of the magnetoelectromechanical coupling upon such fracture parameters. To illustrate the solution method, P-wave scattering by two parallel cracks in an infinite magnetoelectroelastic $BaTiO_3$-$CoFe_2O_4$ composite with a volume fraction V_f=0.5 is considered. Material properties can be found in reference [4]. The geometry of the problem is shown in Fig. 1. Figure 2 shows the behavior of the mode I and mode II SIF at the first crack versus the dimensionless frequency for different crack separations. Figure 3 illustrates the behavior of the EDIF and MIIF with the frequency.

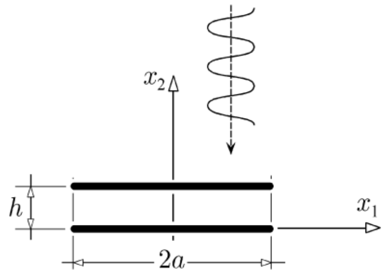

Figure 1. Parallel cracks under P-wave impinging normally.

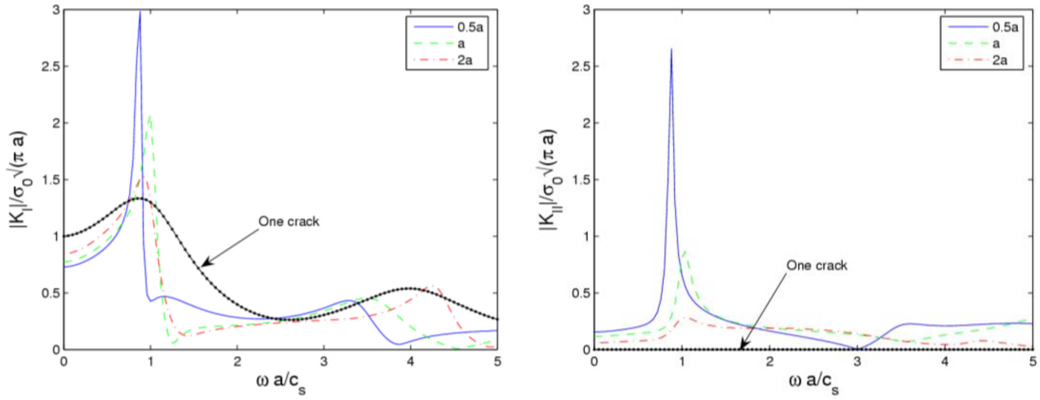

Figure 2. Normalized mode I and mode II SIF vs dimensionless frequency.

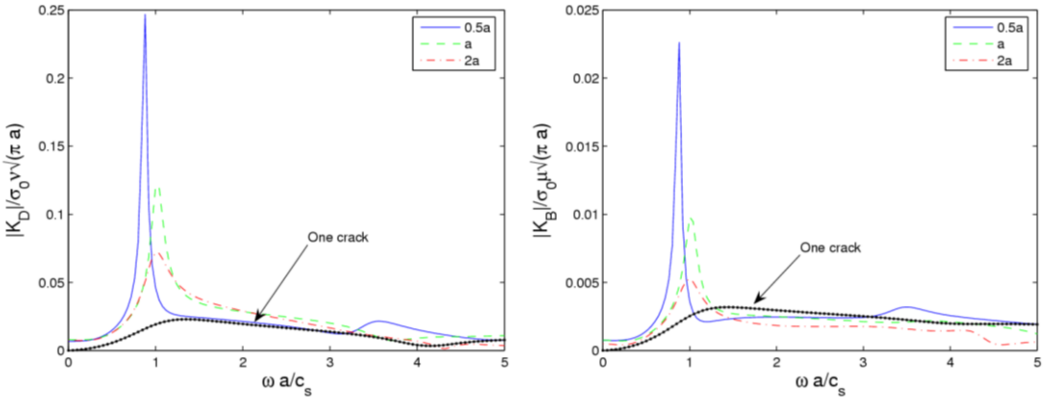

Figure 3. Normalized EDIF and MIIF vs dimensionless frequency.

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