Contact Problems for Interface Cracks under Harmonic Loading

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The elastodynamic response of intra- and inter-component cracks to elastic waves is a topic of long standing interest in fracture mechanics. However, investigation of inter-component cracks received considerably less attention than the case of cracks in homogeneous materials.

The present study is devoted to application of boundary integral equations to the problem of cracks located on the bimaterial interface under time-harmonic loading. In order to take the contact interaction of crack faces into account the Signorini constraints are imposed for normal components of displacements and forces. The system of integral equations for displacements and tractions is derived from the dynamic Somigliana identity and the problem is solved numerically by the boundary elements method.

The distribution of the displacements and tractions at the bimaterial interface and the surface of the crack are obtained and analysed. The dynamic stress intensity factors (opening and shear modes) are also computed as functions of the frequency of the incident wave and properties of the upper and the lower half-spaces. The results are compared with those obtained neglecting the contact interaction.