

## A PIEZOELECTRIC BIMATERIAL WITH A SYSTEM OF ELECTRICALLY LIMITED PERMEABLE INTERFACE CRACKS

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A bimaterial with a system of collinear electrically limited permeable cracks along the material's interface of a piezoelectric space is considered. The distances between the cracks, their location and number can be arbitrary. The plane strain conditions are adopted. Remote mixed-mode mechanical loading and electric charge are prescribed at infinity.

Using the presentations of the electro-mechanical quantities via sectionally analytic functions, the problem of linear relationship is formulated. An exact solution of this problem is presented. The following algebraical equation with respect to the electric flux  $D$  over the crack regions  $L'$  if obtained

$$D = \varepsilon_a \frac{n_{43} \left[ \alpha(x_1) \sigma_1^* + \chi(x_1) \tau_1^* \right] - n_{13} \sigma_4^*}{n_{44} \left[ \alpha(x_1) \sigma_1^* + \chi(x_1) \tau_1^* \right] - n_{14} \sigma_4^*} \text{ for } x_1 \in L'.$$

This equation depends on the electric permittivity of the crack medium, electric loadings and material characteristics. Very small dependence on  $x_1$  of the parameters  $\alpha(x_1)$  and  $\chi(x_1)$  was found out and electrical flux  $D$  was determined analytically. The closed-form expressions for the stresses and electric displacement outside cracks and also for displacements and electric potential jumps over cracks regions are found. The energy release rates (ERRs) at the crack tips were also derived in an analytical form. Numerical analysis is performed for different electric loading, cracks permittivity, their number, length and location. Particular attention is devoted to the uttermost models of electrically impermeable and permeable cracks. A comparison of the last case with the special solution for electrically permeable crack is made and their excellent agreement is found out.

### П'ЄЗОЕЛЕКТРИЧНИЙ БІМАТЕРІАЛ ІЗ СИСТЕМОЮ МІЖФАЗНИХ ТРІЩИН ЗІ СКІНЧЕНОЮ ЕЛЕКТРИЧНОЮ ПРОНИКНІСТЮ

*Для довільної системи колінеарних міжфазних тріщин зі скінченою електричною проникністю у п'єзоелектричному біматеріалі п роблема зведена до задач лінійного спряження, для яких виписані аналітичні розв'язки. Знайдені необхідні електромеханічні величини на межі поділу матеріалів, а також швидкості звільнення енергії біля вершин тріщин.*