SM4S_12327

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

On the Modeling of the Pre-Fracture Zones for an Interface Crack in Anisotropic and Piezoelectric Bimaterials

Alla Shevelova(1), Volodymyr Loboda(2), Nataly Grebenez(2)

(1) *Dniepropetrovsk National University, Department of Computional Mathematics and Mathematical Cybernetics, Dniepropetrovsk, Ukraine*
(2) *Dniepropetrovsk National University, Department of Theoretical and Applied Mechanics, Dniepropetrovsk, Ukraine*

An interface crack in anisotropic and piezoelectric bimaterials under the action of mixed mode mechanical loading is studied. It is assumed that the pre-fracture zones at the crack tips arise and certain relations between the stresses in these zones are valid. Due to the last assumption the pre-fracture zones can be considered as the crack continuations and the problem of linear fracture mechanics with the unknown pre-fracture zone lengths and the stresses in these zones is formulated. Mathematically this problem is described by Hilbert problem of linear relationship which is solved exactly. From the condition of the stresses finiteness at the crack continuations the system of transcendental equations for the determination of pre-fracture zones lengths is derived. The solution of this system is defined numerically and afterwards the crack opening displacements at the initial crack tips are found. As a special case of this model the pre-fracture zones of the craze type are considered. For an arbitrary number of crazes and voids between them the exact analytical solution of the associated Hilbert problem is found and from the same conditions as above the equations for the pre-fracture zone lengths and the crack opening displacements are formulated. It is shown that for a particular case of the void lengths tending to zero the obtained results are in a good agreement with the associated results obtained for continues pre-fracture zones.

View the extended summary