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STRESS ANALYSIS OF BIMATERIAL BODIES WITH BRIDGED CRACKS UNDER THERMOMECHNICAL LOADING

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To analyze the stress-strain state and fracture parameters of bimaterial bodies with bridged interface cracks under steady-state or transient thermal and mechanical loading the singular integral-differential equations (for an junction of two semi-infinite plates) and the direct boundary integral equations (for bodies of a finite size)are used. In the both cases the bridged zones of cracks are considered as parts of cracks and it is supposed that nonlinear distributed spring-like bonds with the given bond deformation law link the cracks surfaces. For mathematical description of the interaction in the bridged zone we consider the bonds stresses as distributed tractions applied to the cracks surfaces at the bridged zone and it's supposed that these tractions depend on the bond stretching. The system of the singular integral-differential equations relative to the bond stresses at the interface crack end zone is obtained based on the derivative of the fundamental solution for an interface crack between two semi-infinite plates and the system is solved numerically. In the frames of the boundary elements approach the multi-regions technique is used for modeling cracks with bridged zone. Time stepping convolution formulation is used for solution of transient heat conduction problems. Volume integrals for calculation of the domain thermal effects are converted into equivalent boundary forms. Results of a thermal problem are used as the initial data for a stress problem. The special quadratic crack elements for modeling of displacements and stresses asymptotic are used near of the crack tips and the stress intensity factors (SIF) are computed. The values of the displacements of the crack surfaces are considered as unknown parameters at the bridged zone. For nonlinear bond deformation law the iterative procedure is used. The results for different properties of materials, bonds and crack sizes are presented. It is observed that SIF in the presence of bridged zone is decreasing with the increase of the crack length in contrast to well-known results without of bridging effect. The comparison of the boundary elements results with the results obtained by the singular integral-differential equations is made.
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