THERMAL STRESSES AROUND AN INTERFACE RIGID CIRCULAR INCLUSION IN A BIMATERIAL PERIODICALLY LAYERED SPACE

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It is the intention of this paper to calculate the distribution of thermal stresses in a periodic two-layer space containing an interface absolutely rigid circular inclusion under a vertically uniform heat flow (see Fig. 1). The corresponding problem involving thermal stresses induced by an interface crack was analyzed in [1].

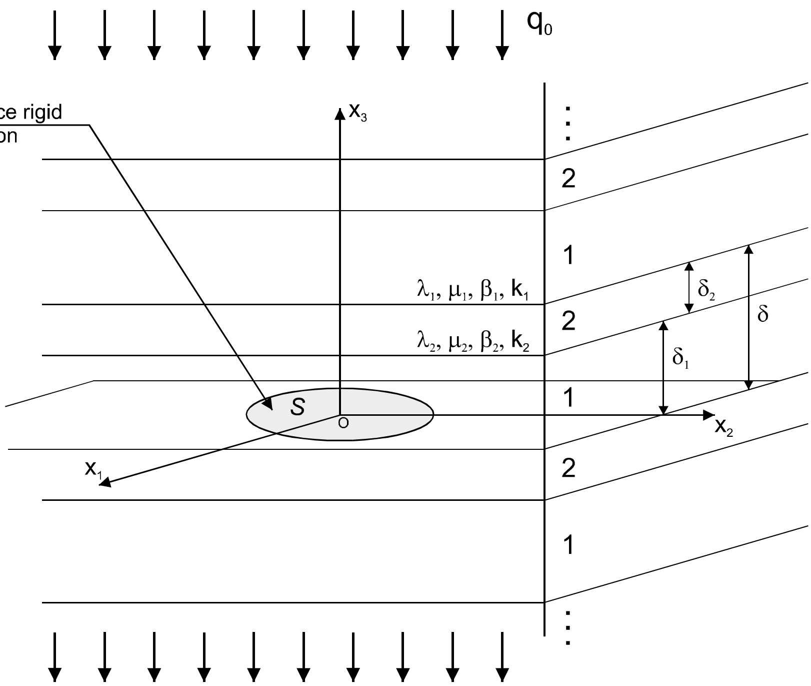

Fig. 1. An interface rigid sheet-like inclusion in a two-layered periodic space with heat flow.

An approximate analysis is carried out within the framework of linear stationary thermoelasticity with microlocal parameters [2]. The advantage of this approach is a relatively simple form of the governing equations appearing similar to the thermoelasticity for transverse isotropy, which makes it possible to construct the appropriate potentials and establish an analogy between the thermal crack problems and their mechanical counterparts.

A two-staged method for obtaining the solution is used. The steady-state temperature field is first determined taking into account the thermal resistance of the inclusion. Next, the associated induced thermal stresses perturbed problem is solved by using the potential method, developed in [3], and by reducing to one in the classical potential theory. A complete solution in elementary functions is given due to the results achieved in [4]. Exact expressions for the thermoelastic field at the plane of inclusion surface are explicitly derived . It is observed [5] that the thermal stress fields near the inclusion front at the inclusion surfaces have the typical (nonoscillating) inverse square root singularities. From the standpoint of classical fracture mechanics the results obtained suggest that failure of the material surrounding the inclusion border is described by two mechanisms: Mode II (shear) and separation of the material from the inclusion.

References

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