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P-7.3

Calculation of the pre-fracture plastic frontier zone at the end of a crack at the media-separating boundary

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A static problem about calculation of a pre-destruction initial plastic zone near the end of a crack at the interface of two different homogeneous isotropic media is being considered under conditions of a plain strain. The materials of bodies in contact are supposed to be much harder than the material of adhesive layer that is more plastic. In this case this initial plastic zone is also situated at the media-separating boundary. This very strip zone is being modeled as a slip line emerging from the end of the crack. Only the tangential displacement rupture is allowed at the slip line when the tangential stress equals to the shear yield point. Taking into account the small size of the plastic zone we come to the plane static problem of theory of elasticity for the piece-homogeneous isotropic plane that contains at the straight lined interface a semi-infinite crack and a slip line in the end. At infinity a condition which allows us to account for the external field influence is formulated.

With the Mellin's integral transform the problem is reduced to the Wiener-Hopf functional equation in the rectilinear region of the complex plane containing the imaginary axis: A precise solution of the equation is constructed expressed via the Cauchy integrals and gamma functions. The factorization of the equation's coefficient at the imaginary axis is being implemented by splitting the coefficient at an elementary factorized function that may be expressed via gamma-functions and a function factorized with the use of Gahov's formula. At the base of the solution of the Wiener-Hopf equation a formula for the stress intensity factor at the end of a slip line is being derived. The length of a slip line is got from the condition of it that this factor should equal zero.