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THE FIRST BASIC PROBLEM EXACT SOLUTION FOR A RIGHT-ANGLED V-CRACK ON THE PLANE

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Introduction

The first basic problem of elasticity is reduced to the boundary-value problem for unit disk exterior. The exact solution of this problem is obtained by singularities separation and meromorphic functions reconstruction, using the boundary values of their real or imaginary parts. This method is applicable to arbitrary V-cracks.

Analysis

It is well-known [1], that the first basic problem for an unbounded domain D can be reduced to finding two analytic functions

$$\Phi(z)=\Gamma+\frac{a}{z}+\ldots,\ \Psi(z)=\Gamma'+\frac{b}{z}+\ldots \qquad (1)$$

in D, Γ and Γ' being known ($\mathrm{Im}\,\Gamma=0$). The boundary condition has the form

$$\Phi(z)+\overline{\Phi(z)}+e^{-2i\arg z'(t)}\cdot[z\cdot\overline{\Phi'(z)}+\overline{\Psi(z)}]=T_n(t)-iT_s(t), \qquad (2)$$

here $z=z(t)$, $t\in[t_1,t_2]$, is the equation of the boundary curve ∂D, T_n and T_s are the surface normal and shear tractions, respectively.