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THE EXACT SOLUTION OF THE PLANE ELASTICITY PROBLEMS FOR THE AIRFOIL CRACK WITH TWO CUSPS

E. A. Shirokova and N. A. Ivan'shin
Department of Mechanics and Mathematics, Kazan University,
Kazan, 420008, Russia

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Introduction

The first and second basic problems are solved simultaneously by the method used in [1] for the symmetric airfoil crack with one cusp The form of the crack depends on some parameters and its exterior is the image of the unit disk exterior under the mapping by the function (8).

Analysis

The elasticity first and second basic problems [2] for an unbounded domain D can be reduced to finding two analytic functions

$$f(z) = \Gamma z - \frac{X + iY}{2\pi(1+\kappa)} \ln z + f_0(z), \tag{1}$$

$$g(z) = \Gamma' z + \frac{\kappa(X - iY)}{2\pi(1+\kappa)} \ln z + g_0(z), \tag{2}$$

Γ and Γ' being known ($Im\Gamma = 0$ for the first basic problem), $f_0(z)$ and $g_0(z)$ being analytic in D, $X + iY$ is known for the second basic problem and is defined via the boundary condition for the first basic problem The boundary condition is

$$\{kf(z) + z\overline{f'(z)} + \overline{g(z)}\}\big|_{z=z(t)} = R(t), \tag{3}$$

here $z = z(t)$, $t \in [0, T]$, is the equation of the boudary curve ∂D:$k = 1$, $R(t) = f_1(t) + if_2(t) + const$ is the external stress vector acting on the arc correspondent to $[0, t]$ for the first basic problem; $k = -\kappa$.