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AIN–SHAMS UNIVERSITY
College for Women

Solution of some Torsion Problems for Nonhomogeneous Elastic Bodies of Revolution

A Thesis presented by

Fayez E. K. RAFAEEL

For

THE DEGREE OF DOCTOR OF PHILOSOPHY IN MATHEMATICS

Under the supervision of

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ABSTRACT

The Thesis is devoted to the study of the influence of non-homogeneity on the stressed state of elastic bodies subjected to torsion, in particular bodies of revolution under mixed boundary conditions. In some cases, the body may include a crack. We obtain analytical expressions for some quantities of physical importance such as the applied torque and the stress intensity factor in terms of auxiliary functions to be determined from the mathematical solution. Each problem leads to one or two coupled Fredholm integral equations of the second kind, the solutions of which are obtained either numerically or by using Poincaré expansions in a small parameter determined from the geometry of the body.

We analyze the obtained results for the numerical values for the stress intensity factor at the points of discontinuity of the boundary conditions. We also compare our results with those known in the literature.

KEYWORDS

Elasticity, Axisymmetric torsional problems, Bodies of revolution, Nonhomogeneous elastic bodies, Half–space with surface constraint, Crack problems, Elastic layer.