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Analysis of cracked bars with rectangular cross-section and isotropic coating layer under torsion

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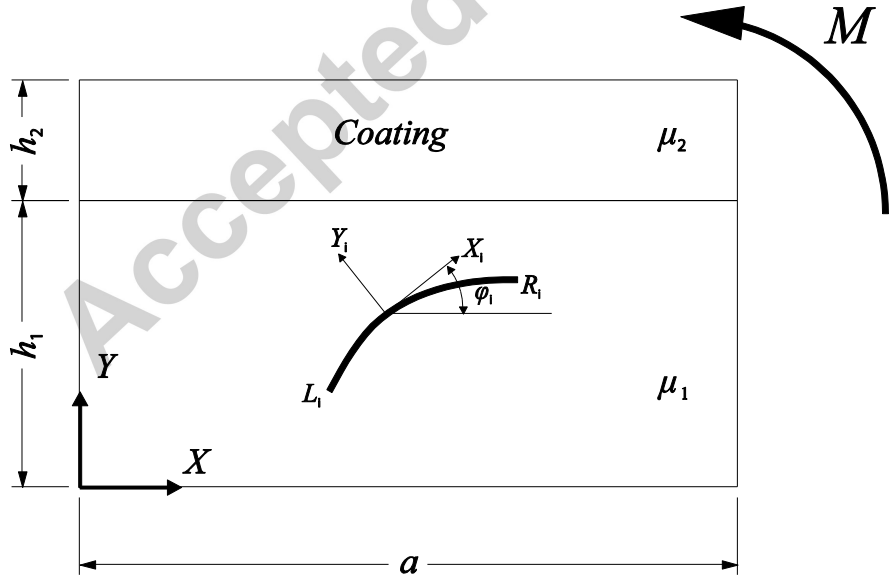
Abstract

The solution to problem of a Volterra-type screw dislocation in a rectangular cross section bar with an isotropic coating is first achieved by means of a finite Fourier cosine transform. The bar is under axial torque which is governed by Saint-Venant torsion theory. The series solution is then derived for warping function and stress fields in the rectangular cross section with an isotropic coating. The dislocation solution is employed to derive a set of Cauchy singular integral equations for the analysis of smooth cracks. The solution of these equations is used to determine the torsional rigidity of bar and the stress intensity factors for the crack tips. Finally, several examples are presented to show the accuracy and efficiency of the dislocation technique in Saint-Venant torsion problems.

Graphical abstract



Keywords: Rectangular cross section; Coating; Saint-Venant torsion; Stress intensity factors; Torsional rigidity; Dislocation density