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10. Partial Differential Equations

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On the location of fail points in Torsion Problem

Let $u(x, y)$ be the stress function of torsion problem.

$$\Delta u = -1, \quad \text{in}\, D, \quad u|_{\Gamma} = 0,$$

where D is the plane convex domain – cross section of the elastic bar and Γ is the boundary of D. The point $M \in \Gamma$ is named the fail point, if $|\nabla u(M)| = \max_{\Gamma} |\nabla u|$. We obtain the new results on the location of the fail points on Γ. For example, the point of the maximal curvaty of Γ is never be the fail point. The more precise results are obtained by comparison the solution u and the solution of the torsion problem in the rectangle.

Reference: B. Kawohl, On the location of maxima of the gradient for solutions to qusilinear elliptic problems and a problem raised by Saint Venant, J. of Elasticity 17: (1987), 195 – 206.