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Bending of Thin Elastic Plates Containing Two Circular Holes

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Extended Abstract

The problem of a thin elastic plate containing holes subjected to bending or twisting is important in engineering applications because of the stress concentrations at the edge of the holes. Goodier [1] investigated the influence of circular and elliptic holes on the transverse flexure of isotropic elastic plates in various loading cases. Lekhnitskii [2] developed a complex variable method for anisotropic plates and provided explicit solutions for a circular hole in an orthotropic plate. Based on Lekhnitskii's method, Hsieh and Hwu [3] developed a Stroh-like formalism and derived analytical solutions for certain anisotropic plates. Exact solution for general anisotropic materials under arbitrary uniform loading conditions was derived by Wu and Hsiao [4]. Explicit expressions for the deflection and moments on the edge of an elliptic hole in an orthotropic plate subjected to bending or twisting moments were obtained. There are very few studies on interaction of multiple holes in infinite anisotropic plates under bending. In this work a new boundary integral equation [5] is used to analyze an infinite anisotropic plate containing two circular holes to investigate the interactions of the holes.

Specifically the moments at the edge of the holes were calculated for two circular holes with identical radius a and center-to-center distance d subjected to a remote uniform moment. The thickness was assumed as 3mm. T300 Carbon/5208Epoxy with $E_1 = 181\ \text{GPa}$ 、 $E_2 = 10.3\ \text{GPa}$ 、 $G_{12} = 7.17\ \text{GPa}$ 、 $\nu_{12} = 0.28$ was considered such that $D_{11} = 409$ 、 $D_{12} = 23.3$ 、 $D_{22} = 6.52$ 、 $D_{66} = 16.1\ (\text{GPa} \cdot \text{mm}^3)$; An isotropic material with $E = 300\ \text{GPa}$, $\nu = 0.3$ was also considered. It is found that the interactions of the holes are insignificant except in the regions between the holes when the holes are close.

References

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