On The First and Second Fundamental Thermoelastic Problems Of Infinite Plate With A Curvilinear Hole Having Arbitrary Shape

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Complex variable methods has been applied to transform the first and second fundamental thermoelastic problems to an integro-differential equation in the complex plane. The soultion of this equation gives the complex potential functions $\phi_0(z)$ and $\psi_0(z)$ at any point $z = x+iy$ within an infinite region bounded by an arbitrary hole in quadrature. This region can be mapped conformally on the region outside the unit circle $|\zeta| = 1$ by the general mapping function $z = c\omega(\zeta), c > 0, \zeta = \rho e^{i\theta}$, where $\omega^{'}(\zeta) \neq 0$ or ∞ outside $|\zeta| = 1$. The closed expressions for the complex potentials and consequently the tangential thermoelastic stresses at any point on the boundary of the hole of the infinite plate are obtained as a function of the complex variable ζ, the coefficient of the temperature expansion, the uniform heat stream and its angle of inclination with the horizon.

The interesting cases when the shape of the hole is hypitrochoid, an ellipse, a crescent or a cut having the shape of a circular arc are included as a special cases.