



ANALYSIS OF STRESS FUNCTIONS IN THIN CIRCULAR DISC

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drmwarbhe@gmail.com**Abstract:**

In this paper, an attempt is made to determine the temperature, displacement and stress functions, in thin circular disc of thickness $2h$ occupying the space $D: a \leq r \leq b, -h \leq z \leq h$ by applying finite Marchi-Fasulo integral transform and laplace transform.

Keywords: Circular disc, Marchi-Fasulo transform, laplace transform

Introduction:

Nowacki (1957) has determined unsteady state thermal stresses in circular disc subjected to an axisymmetric temperature distribution on the upper face with zero temperature. On the lower face and the circular edge. Further Roychoudhari (1972) succeeded in determining the quasistatic thermal stresses in a thin circular plate subjected to transient temperature along the circumference of circular plate over the upper face with lower face at zero temperature and fixed circular edge thermally insulated. Wankhede (1982) determined the quasi static thermal stresses in a thin circular plate subjected to arbitrary initial temperature on the upper face with lower face at zero temperature. Ishihara et. al. (1997) considered a circular plate and discussed the transient thermo elasto plastic bending problem making use of the strain increment theorem. In this problem an attempt has been made to solve the transient state problem of thermoelastic deformation of thin circular disc where homogeneous boundary condition of third kind is maintained at $g(z)$. And temperature displacement and stress functions of circular disc of thickness $2h$ occupying the space $D: a \leq r \leq b, -h \leq z \leq h$ is found out. This result is more useful in engineering problem.

Material Methods:

STATEMENT OF THE PROBLEM Consider a thin circular disc of thickness $2h$ occupying the space $D: a \leq r \leq b, -h \leq z \leq h$. The D.E. governing the displacement function $U(r, z, t)$ is given by (2.1) With $U=0$ at $r=a$ and $r=b$ (2.2) ν and α are the Poisson's ratio and the linear coefficient of thermal expansion of the material of the disc respectively and $T(r, z, t)$ is the temperature of the disc satisfying the D. E. (2.3) subject to the initial condition $T(r, z, 0) = 0$ (2.4) And the boundary conditions (2.5) (2.6) (2.7) (2.8) Stress functions are given by (2.9) (2.10)

Where λ is the lame's constant while each of the stress functions are the zero within the disc in the plane state of stress. The equations (1) to (10) construct the mathematical formulation of the problem under consideration. 3. SOLUTION OF THE PROBLEM Applying the finite Marchi-Fasulo integral transform to equations (3), (4), (5), (6) and using equations (7), (8) gives (3.1) (3.2) (3.3) (3.4) Where denotes the Marchi-Fasulo transform of T and n is the Marchi-Fasulo transform parameter are constant. Applying laplace transform and their inverse on equation (3.1) to (3.4), one obtains the temperature $T(r, z, t)$ as $x - x - x - x$ (3.5)

Result and Discussion:

4. DETERMINATION OF THERMOELASTIC DISPLACEMENT Substituting the values of $T(r, z, t)$ from equation (3.5) in equation (3.1) one obtains $x - x + x - x$ (4.1) 5. DETERMINATION OF STRESS FUNCTION Using (3.6) in (2.9), (2.10) one obtains the expression of stress functions $x - x - x - x$ (5.1) $x - x - x - x$ (5.2) 6. SPECIAL CASE Set (6.1) (6.2) Applying finite Marchi-Fasulo integral transform to the equation (6.1) and (6.2), one obtains $=$ (5.3) $=$ (5.4) Substituting the values of from (5.3) and from (5.4) in equation (3.5) $x - x - x - x$

Conclusion:

In this problem, I discussed completely the transient state problem of thermoelastic deformation of thin circular disc where the homogeneous boundary condition of third kind is maintained on the plane surface of disc on the inner curved surface, the third kind boundary condition is maintained at $g(z)$ which is known function of Z . The finite Marchi-Fasulo integral transform and laplace transform technique is used to obtain the numerical result. The temperature, displacement and thermal stresses that are obtained can be applied to the design of useful structure or machines in engineering application.

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