

A problem connected with the study of doubly curved thin elastic shallow shells in the theory of nonlinear elasticity is considered. The equations of equilibrium are derived in the form,

$$\nabla^4 \Psi_1(x,y) + Eh \nabla^4 \Psi_2(x,y) = 0$$

$$D \nabla^4 \Psi_2(x,y) - \nabla^4 \Psi_1(x,y) = P(x,y).$$

in the domain of m , the shape of the shell. Here

$$\nabla^4(\dots) = \nabla^2 \nabla^2(\dots) = (\partial_x^4 + 2\partial_x^2 \partial_y^2 + \partial_y^4)(\dots)$$

∇^4 is the pucher's operator,

$$\nabla^4(\dots) = (2\partial_x^2 \partial_y^2 + \partial_x^2 \partial_y^2)(\dots)$$

$$(\partial_x^2 \partial_y^2 + \partial_x \partial_y \partial_x \partial_y + \partial_y^2 \partial_x^2)$$

E: Young's modulus of elasticity of the material of Ω

h : The uniform thickness of the shell Ω

$D = \frac{Eh^3}{12(1-\mu^2)}$ is the flexural rigidity of the material

μ : poisson's ratio

The entire boundary of the shell, in the form $\partial \Omega$ is assumed clamped so that the deflections and slopes are zero on these boundaries.

$\Psi_1(x,y)$ is the stress function and

$\Psi_2(x,y)$ is the deflection function

$P(x,y)$ is the external force on the projection of the shell Ω , on xy plane.

The entire domain of the shell Ω is bounded in R^3 having its middle surface $F(x,y,z) = 0$, which is the most general noncentral quadric with surface $F(x,y,z) = 0$, which is the most general quadric with respect to an orthogonal cartesian coordinate system x,y,z and the equation to this middle surface is reduced to the explicit form $z=f(x,y)$. Galerkin's orthogonality conditions are applied to solve the equilibrium equations. The appropriate form of orthonormal Fourier's double series are formulated for the functions $\Psi_1(x,y)$ and $\Psi_2(x,y)$ to satisfy the boundary conditions. Galerkin's equations for generalised orthonormal series are established, such that the mean square errors in the calculation of Fourier's constants are minimum when finite number of terms are considered. the function $\Psi_1(x,y)$ and $\Psi_2(x,y)$ and $f(x,y)$ are substituted in the equations and solved. The expressions for the normal stresses, shearing stresses, bending moments, displacements in the direction of x,y and z axes rotations about x and y axes are determined.

The magnitude of the maximum values of these quantities and the points where they occur are also determined.

The existence and uniqueness of the solutions are established. Some applications for particular type of shells, whose middle surfaces are anticlastic, synclastic, developable or surfaces of revolution, under specific loading on the surface of the shell are considered.