A STUDY OF SOME SYSTEMS OF EQUATIONS OF NONLINEAR ELASTIC MATERIALS

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Being a thesis submitted in part fulfilment of the requirements for the degree of Doctor of Philosophy in Applied Mathematics of the University of Nairobi

JULY 1976

A B S T R A C T

We consider a problem connected with the study of shells in the theory of nonlinear elasticity. The nonlinear equations derived by A.S. Volmir [20] to describe this situation may be put in the form:

$$\begin{aligned} {}_{D}\Delta^2 w_1 &= N_1 + L_1 + p(x,y) + T_1 \\ {}_{H}\Delta^2 w_2 &= N_2 + L_2 + T_2 \end{aligned} \tag{1}$$

in the domain Ω, the shape of the shell. The entire edge of the shell, in the form of $\partial\Omega$, is assumed clamped. Here w_1 is the stress function, w_2 the deflection, p the load, N_1 and N_2 the nonlinear terms involving the second derivatives of w_1 and w_2, L_1 and L_2 the linear terms, T_1 and T_2 the temperature effects, and ${}_{G}\Delta^2$ is an algebraic expression in Δ^2 and a function G to be specified. Three problems are associated with this System (1) which result when the material of which the shell is made is considered. These are the non-homogeneous, orthotropic and isotropic shells.

W.L. Piechocki [14] has studied special cases of the three problems proving existence and uniqueness in certain cases. We utilise his method to obtain further results for the mathematical structure corresponding to a nonhomogeneous shell. We prove nonuniqueness of solutions to the system (1) using J. Cronin's [5] topological degree theory. This last proof assumes the loading and heating to be small enough in order to produce a small change in the geometrical object.