ABSTRACT

An appropriate electric field when applied to a dielectric body produces a deformation which is an even function of the intensity. This electro-restrictive effect is generally studied in classical literature from the principles of circuit theory. Dielectric materials although isotropic in character in the absence of Electric Field becomes anisotropic when strained and Pizoelectric effect comes in. For this electromechanical interaction, the stress function and the electric potential have to satisfy simultaneous differential equations, which are highly nonlinear in character. These electromechanical phenomena have wide applications in acoustic electronics, particularly in DELAY LINES, which are devices for storing information in the form of pulses, in ultrasonics as transducers and in particular foreign materials of high capacity condensers.

The conception of boundary value problems with material parameters being constant or variable with respect to spatial or temporal or being inhomogeneous due to different Specific Inductive Capacities, in static or dynamic cases, which has a resemblence with the practical situations.

The present investigation deals with the new idea of solving such problems on the point of view of "MECHANICS OF CONTINUOUS MEDIUM" a very recent concept with the help of

equations of elasticity and electricity together with the constitutive equations of electromechanical interaction and to present simultaneously the computerised results and simulations whenever possible.

It is known that dielectric in presence of electric field exhibits elastic properties. A mathematical model of displacement and stresses of dielectric are being set up following the principles of electrostatics. The dielectric under investigation is formed by two concentric spherical surfaces at constant potential and heterogeneous in character. The S.I.C. of the dielectric varies as any function of the distance from the centre. The bounding surfaces are subjected to internal and external mechanical pressure of unequal magnitudes.

A mathematical model of longitudinal deformation of a prismatic electrostrictive heterogenous dielectric bar subjected to mechanical and electrical constraints are being set up, following the principles of electrostatics.

The behaviour of the electrostatic voltage and stress generated in an inhomogeneous piezoelectric bar of considerbale length subjected to finite bending moments at its ends is analysed in a relatively simple and accurate manner. The Seth's theory of finite deformation approach is used in conjunction with the Maxwell's Electromagnetic equations and the consitutive equations of elasticity and piezoelectric quartz. The governing differential equations are solved by an exact method and by numerical method together with multivarious regression analysis. Some comparisons are made with previously obtained results as available in the literature. Numerical results show the accuracy and efficiency of this new approach through tables and graphs.

Computerised simulation for the stresses and voltages developed in an inhomogeneous piezoelectric quartz bar due to finite bending have been studied. The describing differential equations are being solved with the help of Newton's numerical technique to form a compact data set. These data sets are then processed in the form of computerised parabolic regression analysis. The regression equations thus formed are once again refined introducing a computerised technique to minimise the deviation of the regression co-efficient. The results are most satisfactory and displayed by Tables and Graphs.