CHAPTER 5

CONCLUSIONS

5.1 Summary

In this thesis, the electroelastic fields within a finite transversely isotropic piezoelectric cylinder subjected to axisymmetric end loading and electric field at the surface are examined. The general solution for the cylinder is derived by using the displacement potential functions to uncouple the governing differential equations. The general solution is presented in terms of Fourier-Bessel series, which is trigonometric and hyperbolic functions in the z-direction and Bessel functions in the r-direction. The boundary value problems corresponding to vertical loading and electric field at the top and bottom surfaces of the cylinder are presented and the arbitrary constants appearing in the general solutions are determined. For the electrical loading, two types of electrodes are considered, i.e., a flexible electrode with the smooth contact surface and a rigid electrode with the rough surface. Selected numerical results for electroelastic fields of a piezoelectric cylinder under both mechanical and electrical loading are presented to demonstrate influence of various governing parameters on the cylinder. The conclusions of this thesis can be summarized as follows:

1. Numerical results for a piezoelectric cylinder indicate that the three-dimension analysis is needed only if the shape factor of the cylinder is less than two. In the case of a long cylinder, i.e., the shape factor is greater than two, piezoelectric cylinder under mechanical or electrical loading yields the stresses, vertical electric displacement and electric field which are uniform and very close to the one-dimensional solutions. The maximum values for both vertical displacement and electric field are found near the loading surface under applied vertical load. In addition, the radial displacement is zero at the center and then linearly increases along the radial direction for a long cylinder.

2. For influence of the radius of electrode, it is found that all stresses are nearly zero when the variation of electrode is equal to that of the cylinder, i.e., $r_0 = R$.

In addition, electric displacement and electric field are nearly uniform along the middle plane of the cylinder for both flexible and rigid electrodes.

3. The variation of electric field does not depend on the rigidity of the electrodes and the contact condition between the electrodes and the cylinder.

5.2 Suggestion for Future Work

The general solution given in Chapter 3 is actually applicable for both solid and annular cylinders. However, only the case of solid cylinder is considered in the numerical study. The study as an annular cylinder under mechanical and electrical loading can be used in abroad class of problems such as a unit cell of a 1-3 piezocomposites and annular actuators and resonators.