Structural-Parametric Model of Electroelastic Actuator for Nano- and Microdisplacement in Mechatronics

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INTRODUCTION

For the control systems in the mechatronics, the adaptive optics, the nanotechnology, the nanobiology, the astronomy is promising for use of the electroelastic actuator based on the electroelasticity. Piezoactuator is the piezomechanical device intended for the actuation of the mechanisms, the systems or the management based on the piezoeffect, converts the electrical signals into the mechanical displacement and force.

AIM

This study focuses the attention to construct the structural-parametric model, the parametric structural schematic diagram, the transfer functions of the electroelastic actuator for the nano- and microdisplacement in the mechatronics.

MATERIAL AND METHOD

In the present work the generalized structural-parametric model and the generalized parametric structural schematic diagram of the electroelastic actuator are constructed by solving the wave equation with the Laplace transform for the equation of the electroelasticity, the boundary conditions on loaded working surfaces of the actuator, the strains along the coordinate axes. The structural-parametric model of the actuator are determined in contrast electrical equivalent circuit for calculation of piezotransmitter and piezoreceiver. The investigations of the static and dynamic characteristics of piezoactuator are performed for the calculation of the control systems in the mechatronics.

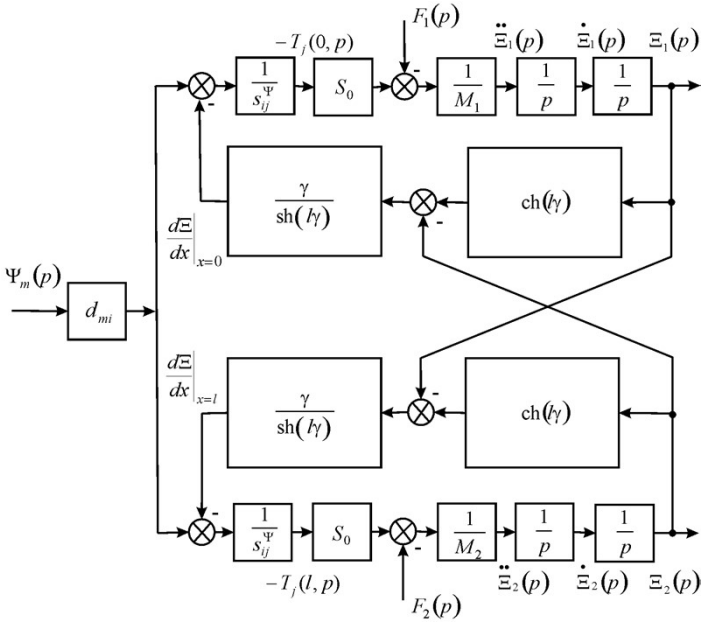
RESULT AND DISCUSSION

The generalized parametric structural schematic diagram and the generalized structural-parametric model of the electroelastic actuator are obtained from decision wave equation with the Laplace transform. The the generalized parametric structural schematic diagram of the electroelastic actuator are shown in Graph. 1. The transfer functions of the piezoactuator are constructed from the generalized structural-parametric model of the electroelastic actuator after algebraic transformations. The parametric structural schematic diagrams and the transfer functions of the piezoactuator for the longitudinal, transverse and shift piezoelectric effects are determined from the generalized structural-parametric model of the electroelastic actuator for the nano- and microdisplacement in the mechatronics.

CONCLUSION

The parametric structural schematic diagram, the structural-parametric model, the solution of wave equation, the transfer functions of the electroelastic actuator for for nano- and microdisplacement are obtained. Using the obtained solution of the wave equation and taking into account the features of the electroelasticity and the deformations along the coordinate axes, it is possible to construct the generalized structural-parametric model and the parametric structural schematic diagram of the piezoactuator for the control systems of the mechatronics and to describe its dynamic and static properties. The transfer functions of the piezoactuator in the mechatronics for the transverse, longitudinal, shift piezoelectric effects are obtained from the structural-parametric model of the electroelastic actuator.

GRAPHS



Graph. 1. The generalized parametric structural schematic diagram of the electroelastic actuator for the nano- and microdisplacement.