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2nd International Conference on
Design and Production Engineering
&
International Conference on
Mechatronics, Automation and Smart Materials
November 13-14, 2017 Paris, France

Sergey M Afonin, J Appl Mech Eng 2017, 6:6(Suppl)
DOI: 10.4172/2168-9873-C1-015

Structural-parametric model of electroelastic actuator for nano- and microdisplacement in mechatronics

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The electroelastic (piezoelectric) actuator for nano- and microdisplacement solves problem of the precise matching in the mechatronics systems for nanotechnology and adaptive optics, compensation of temperature and gravitational deformations, atmospheric turbulence by wave front correction. Piezoactuator is a piezomechanical device intended for actuation of mechanisms, systems or management based on the piezoeffect. It converts electrical signals into mechanical movement or force. Piezoactuator for nano- and microdisplacement provide the movement range from several nanometers to tens of microns, the sensitivity of up to 10 nm/V, the loading capacity of up to 1000 N. Piezoactuator provide high stress and speed of operation and return to the initial state when switched off. Piezoactuator is used in the majority of the mechatronics systems for the scanning tunneling microscopes, the scanning force microscopes and the atomic force microscopes. By solving the wave equation using the Laplace transform and taking the equation of the electroelasticity, the boundary conditions on loaded faces of electroelastic actuator the strains along the coordinate axes, it is possible to construct its structural parametric model. Effects of geometric and physical parameters of the electroelastic actuator and external load on its dynamic characteristics are determined. For calculation of the mechatronics systems the generalized parametric structural schematic diagram Figure 1 and the transfer functions of the electroelastic actuator are obtained. The static and dynamic characteristics of piezoactuator are determined. The decision wave equation, the generalized structural-parametric model, the generalized parametric structural schematic diagram, the generalized transfer functions of electroelastic actuator are obtained. The parametric structural schematic diagrams, transfer functions piezoactuator for transverse, longitudinal, shift piezoeffects are determined from the generalized structural-parametric model of the electroelastic actuator for the mechatronics systems. The generalized structural-parametric model of the electroelastic actuator provides the determination of its transfer functions and calculation of its static and dynamic characteristics.

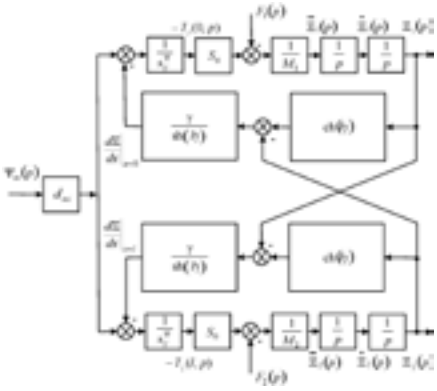

Figure 1: The generalized parametric structural schematic diagram of the electroelastic actuator for nano- and microdisplacement

Recent Publications

1. Schultz J, Ueda J, Asada H (2017) Cellular Actuators. Oxford: Butterworth-Heinemann Publisher, 382.
2. Afonin SM (2006) Solution of the wave equation for the control of an elecromagnetoelastic transduser: Doklady mathematics 73, 2: 307-313, doi:10.1134/S1064562406020402.
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Biography

Sergey M Afonin (PhD) is an Associate Professor of Department of Intellectual Technical Systems of National Research University of Electronic Technology (Moscow Institute of Electronic Technology MIET). He is a graduate of the National Research University of Electronic Technology MIET; Engineer in Electronic Technology 1976; PhD in Electronic Technology Engineering and Control Systems received in National Research University of Electronic Technology MIET 1982. Academic title of Senior Researcher received in MIET 1991. Aspirant MIET 1976–79, Junior Researcher MIET 1979–82, Senior Researcher MIET 1983–93, Associate Professor at MIET since 1993 to present time. His contribution: more than 200 scientific papers to professional publication, recipient of Silver medal and two Bronze medals VDNKH Russia.

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