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Condition of absolute stability for control system with electromagnetoelastic actuator for nanotechnology

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The electromagnetoelastic actuator is using in the control system in the scanning tunneling microscopes, the scanning force microscopes and the atomic force microscopes for moving and aligning in the nanotechnology and the nanobiology. The analytical expressions for the sufficient absolute stability conditions of the system with hysteresis nonlinearity of the electromagnetoelastic actuators are written using the Yakubovich absolute stability criterion with the use of the derivative for the characteristic deformation of the piezoactuator. The Yakubovich criterion is the development of the Popov absolute stability criterion. In the condition of the absolute stability of the control system for the deformation the piezoactuator is used the value of the tangent of the angle of the tangent line to the hysteresis nonlinearity for the piezoactuator. The characteristics of the electromagnetoelastic actuators are the alternating-sign hysteresis type for the piezoactuators and the constant-sign butterfly type for the electrostriction actuators [1-4]. For the magnetostriction and electrostriction actuators their initial operating point is chosen on one wing of the butterfly in the first quadrant, the deformation range to be symmetric at both sides of the initial point. For the butterfly characteristic the initial working point is displaced by the half deformation range. The values of the tangents of the inclination angles of the tangent line to the hysteresis nonlinearity on the butterfly wing for the actuator are determined similar to the hysteresis characteristic. The stationary set of the control systems of the deformation the piezoactuator is the segment of the straight line. The correcting devices are chosen the high quality of the control systems of the deformation the piezoactuator. The conditions of the absolute stability of the control systems with the piezoactuator in the case of longitudinal, transverse and shift piezoeffect for the hysteresis characteristic of the piezoactuator are obtained.

Biography

Sergey Mikhailovich Afonin (PhD) now is associate professor of National Research University of Electronic Technology (Moscow Institute of Electronic Technology MIET). A graduate of the National Research University of Electronic Technology MIET, engineer in Electronic Technology 1976. Degree PhD in Electronic Technology Engineering and Control Systems received in 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. More than 200 scientific papers to professional publication and 16 inventions. Recipient Silver medal VDNKH and two Bronze medals VDNKH Russia.

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