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Condition of absolute stability for automatic control system of deformation piezo actuator for nanotechology

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The piezo actuator is using in the automatic control system in the scanning tunneling microscopes, the scanning force microscopes and the atomic force microscopes for the nanotechnology. The piezo actuator is the piezo mechanical device intended for the actuation of the mechanisms, the systems or the management based on the piezo effect, converts the electrical signals into the mechanical movement and the force. The correcting devices are chosen the high quality of the automatic control systems of the deformation the piezo actuator. The analytical expressions for the sufficient absolute stability conditions of the system with the hysteresis nonlinearity of the electro-magneto-elastic actuators are written using the Yakubovich absolute stability criterion with the use of the derivative for the characteristic deformation of the piezo actuator. The Yakubovich criterion is the development of the Popov absolute stability criterion. For the stable control system on Lyapunov, the Yalubovich absolute stability criterion for the systems with the single hysteresis nonlinearity provides the simplest and pictorial representation of results of the investigation of the stability and the possibility of the synthesis of the correcting devices of the system ensuring the stability of the strain control systems with the piezo actuator. In the condition of the absolute stability of the control system for the deformation the piezo actuator of the nanomanipulator is used the value of the tangent of the angle of the tangent line to the hysteresis nonlinearity for the piezo actuator. The stationary set of the automatic control systems of the deformation the piezo actuator is the segment of the straight line. The conditions of the absolute stability of the automatic control systems with the piezo actuator in the case of longitudinal, transverse and shift piezo effect for the hysteresis characteristic of deformation of the piezo actuator are obtained. The obtained absolute stability condition with the use of the derivative for the characteristic deformation of the piezo actuator for the automatic control system with the piezo actuator allow one to estimate and calculate the characteristics of the correcting devices of the control system of the deformation the piezo actuator.

Biography

Sergey Mikhailovich Afonin 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. He has completed his PhD in Electronic Technology Engineering and Control Systems from MIET 1982. He has received academic title of Senior Researcher from MIET 1991. He has received different positions such as: Aspirant MIET 1976–79, Junior Researcher MIET 1979–82, Senior Researcher MIET 1983–93, Associate Professor at MIET since 1993 to present time. He has more than 200 scientific papers to professional publication and 16 inventions. He is the Recipient of silver medal and two bronze in VDNKh Russia.

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