Methods and Ways of Piezoelectric Accelerometers Fastening on the Objects of Research

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The piezoelectric measuring converters (PMC) are most often used for measurement of dynamic processes [1], mechanical parameters (efforts, pressure, accelerations, deformations) [2], thermal devices (sensors of thermal streams), devices to control the structure and concentration of gases. In many cases, PMC surpass the sensors made on other physical principles in the accuracy and scopes of usage. PMC are used in mechanical engineering, medicine, industrial systems of measurement and management, inertial systems of navigation, aircraft, geological researches, telecommunication and in many other spheres of human life. The PMC sensitive element is single-crystal or polycrystalline materials with piezoelectric properties. The principle of operation is based on the physical phenomenon of a direct piezoeffect, i.e. the ability of piezoelectric materials to generate electric charge under the impact of mechanical forces [1].

PMC for measurement of mechanical oscillations and impacts are most widely used. The piezoelectric accelerometers (PA) differ from other types of sensors of acceleration and vibration by the wide operating frequency band and dynamic ranges, small sensitivity to the influence of magnetic fields, linear characteristics in these wide ranges, reliability of a design and rather long-term stability of parameters. As PA are active sensors which generate the electric signal proportional to mechanical oscillations, so at their operation the power supply isn't required. Lack of mobile elements of the design excludes the possibility of wear-out and guarantees durability of PA. Besides, the signal which an accelerometer gives, can be integrated for the purpose of measurement and analysis of speed or shift of mechanical oscillations. Piezoelectric accelerometers are sensors of a contact type, they have a mechanical contact with the object of research. The peculiarity of such connection is the fact that the object immediately has an influence on the output signal of the accelerometer. Therefore, study of methods and ways of PA fastening on the objects of research is, undoubtedly, topical [3].

The modern stabilization systems, using the spring, string, quartz, magnetic, and gyroscopic accelerometers cannot provide the required speed of response and accuracy [4]. Therefore, the urgent scientific and technical challenge is to improve the accuracy and speed of response when measuring the acceleration values by increase precision of a piezoelectric sensor for the automatic weapons stabilization system.

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