EFFICIENCY OF MICRO ELECTROMECHANICAL SYSTEM
IN CONDITION OF CASUAL AMBIENCE

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Technologies of fabrication MEMS allow to produce it is enough exact tiny sensors for measurement of mechanical values mobile object management (the robot, unmanned operated device etc.). However, in practice signals sensor are distorted hindrance that gives the significant level to inaccuracy in measurements. For weakening of hindrances necessary to use additional measures of transformation and processing signals.

In literature are actively discussed questions of development and studies MEMS for measurement of mechanical values [1 – 10], including in condition casual measured physical processes at influence of hindrances. For this purpose is already designed technologies of optimum processing signal, capable to function in condition of the casual ambience [4, 5, 9-12].

As it is noted in articles [1-8], MEMS, as a rule, are executed on integral technology and for provision of sufficient accuracy have a compensation scheme of the measurements. Their accuracy is defined steady-states and dynamics feature. Provision steady-states and dynamics accuracy MEMS are denoted an ensemble of the articles. In articles [2, 3] requirements were worded for different MEMS to parameter correcting device (KU) of type PID-regulator from condition of provision of minimum importances dynamic mistake. The Results on provision of accuracy concrete micro mechanical sensor, got in articles [2 – 5], applicable for big class MEMS regardless of their purposes and principle of the action.

The Conditions of the real ambience expect the casual deflections measured mechanical values from stationary importances, and influence of casual hindrances at measurements. Besides, at measurement of mechanical values possible to select mode slowly and quickly changing processes (that and other characteristic dynamic object of management). Amongst measuring noise particularly dangerous are a broadband casual vibrations (SHSV), having strong resemblance with white noise. In article [4] was traditionally researched problem to filtering under white noise solely.

The unknown hindrances usually consider At syntheses stochastic filter in manner of Viners process [11]. In article [9], where accelerometer with filter Kalmans was used for measurement longitudal and vertical speedup of car at service tests, power of hindrances, distorting information, enterring from sensor was considered it is enough small that does not give the possibility to draw a conclusion about inaccuracy in broad range of relations to powers of signal to hindrance.

In article [4] was noted efficiency of using traditional kalman algorithm to filtering for measuring useful processes in MEMS broad using (the accelerometer and sensor of angular velocities - DUS).

In continuation of studies of using filter Kalman in article [5] was researched reception optimum estimation at hindrance in manner of SHSV. The condition of provision Were determined to efficiency of micro electromechanical system (MEMS) - a micro gyroscope in condition broadband casual vibration (SHSV) on base of filter Kalman.

The Problem of study of filter Kalman consisted in determination of limiting mistake and factor of effect to filtering (on border of range) under different correlations of powers of signal to powers of hindrance. The Experimental study was conducted as well as in article [4] on base of software Matlab with use published earlier algorithm of modeling MEMS DUS with casual signal [7].

Conclusions:

The Got results prove efficiency of using the adaptive filter Kalman under different intensity of hindrances, both for quick, and for slow measured processes. However, for adjusting the filter in this case it happens to to conduct additional identification to powers of hindrance and signal.

REFERENCES:

1. Vavilov V.D. Volkov V.L., Ulyushkin A.V. The Optimization parameter micro mechanical accelerometer. / Works NGTU n.a. R.Y. Alexeev.- N. Novgorod: 2010. N 3.p. 308 - 314.
2. Volkov V.L.. The Motivation of the requirements to parameter micro mechanical accelerometer. // Works NGTU n.a. R.Y.Alexeev.- N.Novgorod: 2011. N 2. p. 288 - 295.
3. Volkov V.L., Chrisanova M.V.. Provision steady-state and dynamic accuracy micro mechanical sensor angular skorosti. // Works NGTU n.a. R.Y. Alexeev.- N. Novgorod: 2013. 2 (99 s. 329 - 338.
4. Volkov V.L., Zhidkova N.V., Zhidkov A.A. Efficiency of micro mechanical sensors in conditions of hindrances. Nizhny Novgorod state technical university n.a. R.Y. Alexeev. . Collection article, 2014. N 2. p. 302 - 313.
5. Volkov V.L., Ulyushkin A.V., ZHeltova N.N. Efficiency micro gyroscope in condition of casual ambience. The Works XI All-russian school-conferences "Management greater system", 2014.
6. Volkov V.L. The Measuring information systems. Scholastic posobie. / -N. Novgorod: NGTU, 2009. 243 p.
7. Volkov V.L.. Mathematical modeling in instrument system. / V.L. Volkov. -N.Novgorod: NGTU, 2014. 147 p.
8. Raspopov V.YA. Mikromehanicheskie instruments. Scholastic allowance - M.: Machine building, 2007. – 400 p.
9. Hernandez W. A survey on optimal signal processing techniques applied to improve the performance of mechanical sensors in automotive applications. / W. Hernandez // Sensors. - 2007. - Vol. 7. - p. 84-102.
10. Hernandez W. Improving the responses of several accelerometers used in a car under performance tests by using Kalman filtering. / W. Hernandez // Sensors. - 2001. -Vol. 1. - p. 38-52.
11. Papoulis A. Probability, random variables, and stochastic processes/A. Papoulis. -NY: McGraw-Hill, 2001. -571 p.
12. Welch G., Bishop G. An Introduction to the Kalman Filter. TR 95-041, Department of Computer Science, University of North Carolina at Chapel Hill. July 24, 2006.