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MEASUREMENT OF THE PARAMETERS OF MECHANICAL STRUCTURES MOTION ON THE BASIS OF INTERCONNECTION OF A CAMCORDER AND AN ACCELEROMETER

Nowadays, there is a great need in controlling the parameters of mechanical structures motion, which are integral parts of the production equipment. The physical principles of measuring the movement of mechanical structures may be different. A more accurate measurement of motion parameters is achieved by interconnecting of various means of measurements. At present, there are no data on the use of a camcorder, which detects the motion of mechanical structures with low velocities, for solving the problems of interconnection. The highest accuracy is required for these modes of measurement and for the control of production equipment. Thus, the problems of synthesis and simulation of the algorithms of diverse sources interconnection for observation over the control of mechanical structures motion are important and actual. The aim of the work is the increasing of determination of the parameters of mechanical structures motion based on the interconnecting and modeling of optimal algorithms for estimating the motion parameters, which are derived from diverse measurements. To achieve this goal it is necessary to solve the following problems.

1. To synthesize the interconnecting of the sources for efficient estimating of motion parameters using filtering method.

2. To synthesize algorithms for estimation of motion parameters measurements of various mechanical structures, such as various differentiation methods, Kalman filtering and exponential smoothing.

In order to solve the first problem, we choose two devices: an accelerometer and a camcorder as the sources of measurement information. As the interconnection method we pick the interconnecting of the above-mentioned measurement devices in the filtering scheme. Filtering scheme is shown in Figure 1.
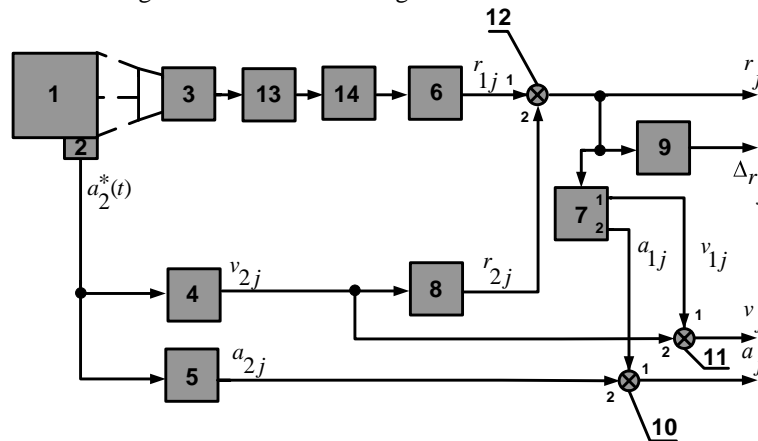

Fig. 1. Block diagram of the measuring complex

Notation of the blocks is shown in Table 1.

Table 1

1	object of measurements
2	accelerometer
3	device to generate the video image
4	first integrating element
5	low-pass filter
6	evaluator of on-line coordinates
7	evaluator of the velocity and acceleration
8	second integrating element
9	unit for movements calculating
10	third summator
11	second summator
12	first summator
13	analog-digital transformer
14	memory block

To solve the second problem, we will simulate the estimation algorithms of motion parameters measurements in the program Matlab using the package Simulink. Figure 2 shows the estimation algorithm based on exponential smoothing, it gives more accurate evaluation in comparison with the numerical method of differentiation and with Kalman filter.
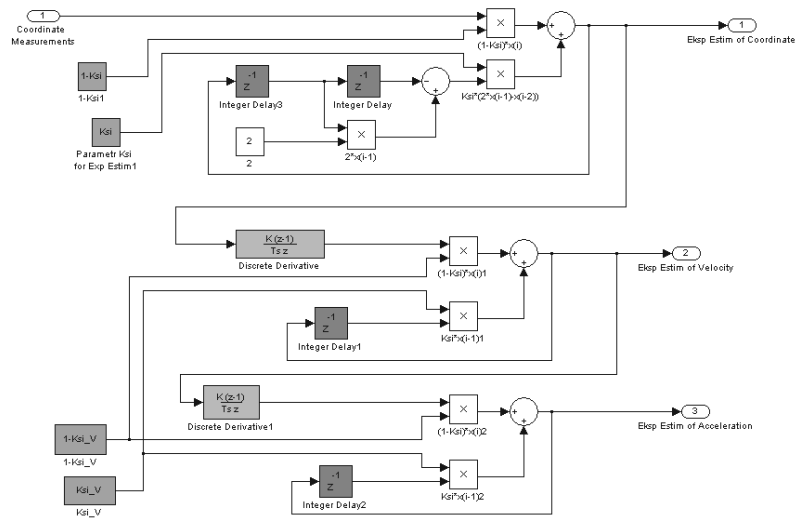
*Fig. 2. Diagram of numerical simulating system
of motion parameters*

The proposed diagram increases the precision in measuring the motion parameters of the mechanical structures. This result is obtained by the interconnection of a camcorder and an accelerometer. It is confirmed by numerical simulation method.