UDC
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Appliance was purchasedATNE SUPPORT OF EXPERIMENTAL RESEARCH OF DYNAMICS MECHANISM OF CRANES VANATAZHOPIDYOMNYH

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The article describes the sensors used to determine the energy, dynamic and kinematic parameters of cranes. The process of calibration of each sensor. Obtained during calibration data processed using the method of linear regression. Shows the static characteristics of sensors that connect the input value of the sensor signal at its output. All static characteristics are obtained coefficient of determination is close to unity.

Sensors, experimental research, calibration, linear regression, static characteristics.

Resolutionska problem. Prand the study of dynamics of machines and mechanisms mechanisms is necessary to use various sensors (sensors). Direct reading sensor signals allow important information about the investigated processes. The information obtained is processed further statistical analysis and methods used to build or refine models of the processes that occur in the machines and mechanisms.

DFor in order to properly interpret the information from the sensor should perform its calibration. Some sensors do not require calibration because it carries the manufacturer and supplying the information (a calibration table or graph) in the sensor data plate. In the absence of such information is necessary to gauge user calibration yourself.

AnaLease Finalnnih dOSHidzhen. Dll abouttransaction containersof sensors using test input variables, the values of which are known in advance [1-3]. By changing the value of the variable read signal that corresponds to a particular value it. Thus forming an array of information that needs further processing to establish static characteristics of the sensor. Data processing is performed using linear methods [4] and nonlinear regression [5].

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The latter method is used in cases where known beforehand that the static nonlinear characteristic of the sensor.

Metand dperssurvey findings - tofrom-identification withtatychnyx charactersjunction sensors used for experimental studies of the dynamics of mechanisms vantazhoipydmnyh machines.

DTo achieve this goal it is necessary to solve the following problem: perform calibration of sensors: current, voltage, and speed up efforts; using a linear regression to determine the static characteristics of these sensors.

Rezultaty research. DA sensor calibration and stumu voltage toykoryStano numericaland multymetp Mastech MS8218 AC / AC + DC TRUE RMS (Ric. 1).

Ric. 1. Appearance digital multimeter Mastech MS8218 AC / AC + DC TRUE RMS.

Pislya calibration current sensor (Fig. 2) was found Equation its static properties (dependence describing compliance with the voltage sensor with a current flowing in the lumen of the sensing element of the sensor):

$$And = -118.51 + 19{,}73 U_{vyh.}, \quad (1)$$

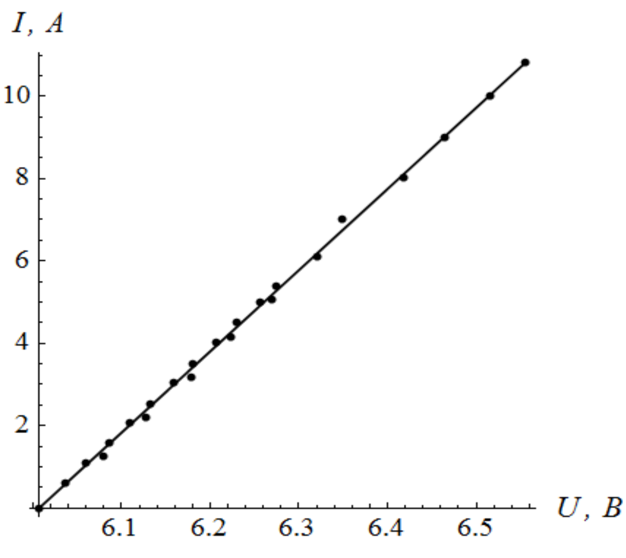
where *Uvyh.* - The value of the sensor output voltage, V; *I*- The power of the current flowing in the lumen of the sensing element of the sensor, A. Dependence (1) derived from regression analysis. The coefficient of determination of the regression relationship (1) is equal to 0.998.

Main specifications multimeter in the table. Fig. 3 shows a graph of the static characteristic of the sensor current, which is described by equation (1) and data obtained during the calibration current sensor.

TechNight characteristicsand digitallyth Multimeters Mastech MS8218 AC / AC + DC TRUE RMS.

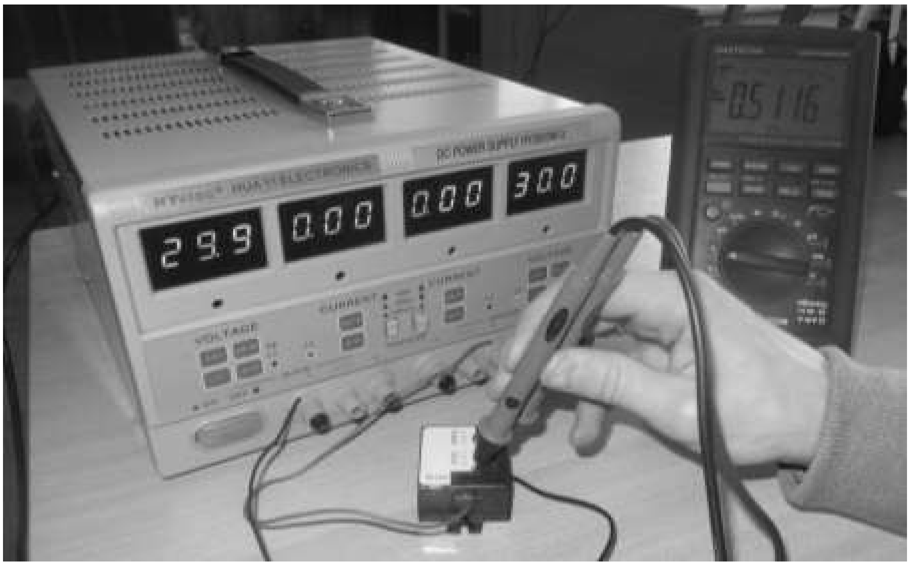
Parameter	In theelychyna
Restosna amperage measurement error:	0.75
-in the range of 0-500 mA%	
-A range of 0-5%	0.75
-in the range up to 10%	1.00
Restosna alternating voltage measurement error,%	0.5
Temperaturnyy range of the device, C	0-30
Restosnavolohistvykorystannyaprystroyu%	0-80

Ric. 2. The current sensor calibration.



Ric. Figure 3. Static characteristic current sensor, which is described by equation (1) and data obtained during calibration current sensor.

Taravoltage of the sensor, which is built on the voltage divider circuit, executed like sensor calibration current (Fig. 4). To increase the accuracy and coverage measurement voltage sensor has three channels.



Ric. 4. calibration sensor voltage.

In theidnoshennya resistances in each channel is different. This allows you to choose the output voltage of the sensor so as to ensure a sufficiently high accuracy measurements with variation of the input voltage. When choosing a channel through which the voltage measurement is performed, it is necessary to take into account the maximum input voltage of the device ADA-1406, the analog inputs which receives signals from the sensor. If the measured voltage maximum output voltage of a sensor channels more than the maximum allowable voltage device ADA-1406, it is necessary to switch to a less sensitive sensor channel.

Static characteristics of the sensor voltage obtained from regression analysis of data obtained during calibration, as follows:

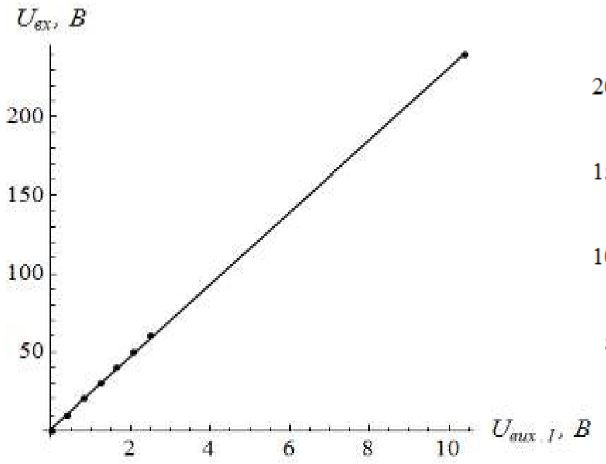
$$U_{entrance} = \begin{cases} 1.19 + 23.01 Uvyh_{.1}, & dlI \text{ The topMr. O channel for sensor;} \\ 108 + 49.37 U, & \text{Drud og O channel sensor;} \\ 1.28 + 112.32 Uvyh_{.3}, & dlI \text{ ThirdMr. O channel sensor,} \end{cases} \qquad (2)$$

where *Uvyh.1*, $U_{vyh.2}$, *Uvyh.3* - Output voltage of the first, second and third sensor channels, respectively, V; *Uin.* - Input voltage sensor V. graphics functions (2) are shown in Fig. 5.

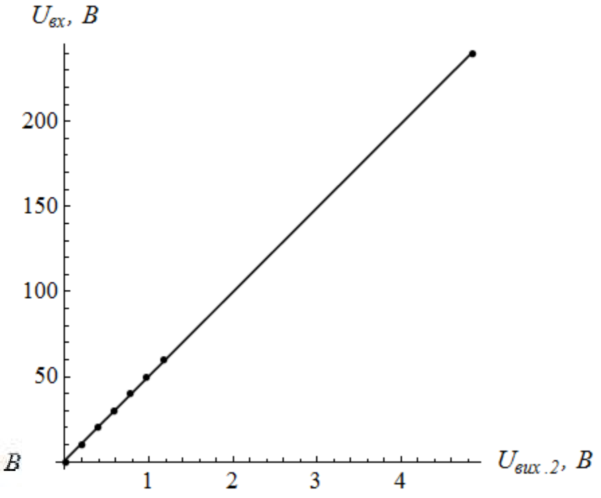
The coefficient of determination for all equations (2) is equal to 0.9998.

DA sensor calibration efforts hydraulic laboratory setup used for research gap metal samples (Fig. 6). Based on data obtained during calibration Strain gauge was
fromFound static characteristic of the sensor (regression), which

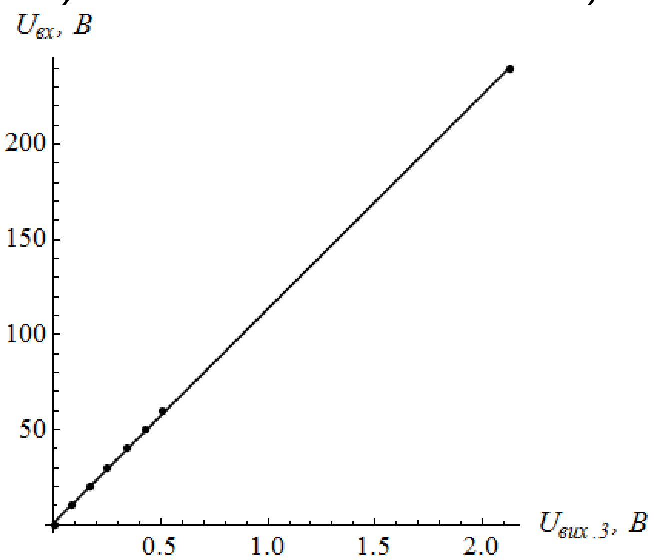
onv'yazuye efforts applied to stretch the sensor, and the output voltage of the sensor (Fig. 7).



and)



b)



c)

Ric. 5. Graphs static sensor voltage characteristics described by the equations (2) And denand asand obtainneither prand calibration Voltage sensor: a) for the first channel; b) for the second channel; c) for the third channel.

Pivnyannya static characteristic is as follows:

$$F = 35 + 4686 Uvy_x \tag{3}$$

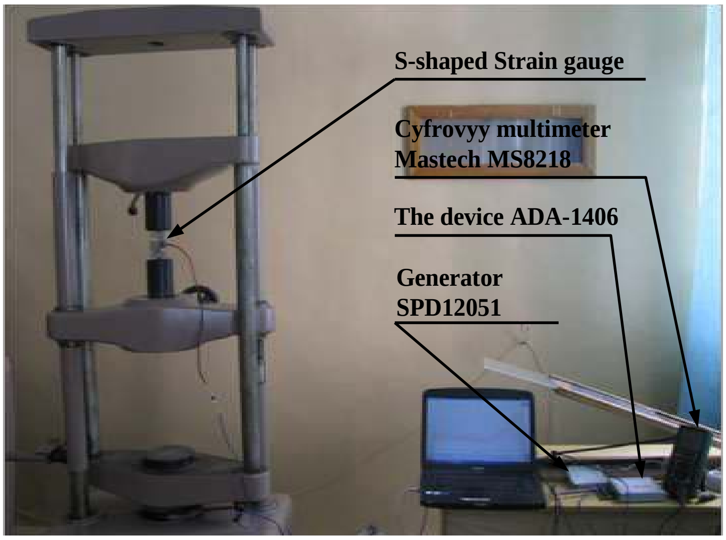
,

where F - zusyllya tension, asth prickmade up dabout S-onSimilarly thatnzometrychnoho sensor, N; U_{Closed} - Output voltage sensor V.

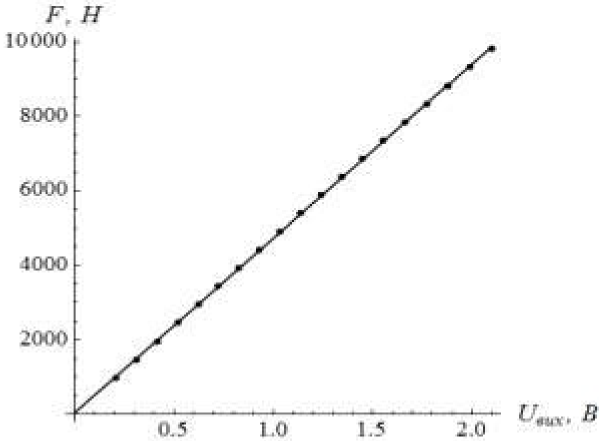
The coefficient of determination equation (3) is equal to 0.99991.

DTo calibrate the accelerometer (Fig. 8) used digital multimeter

Mastech.



Ric. 6. The sensor calibration effort.



Ric. Figure 7. Strain gauge static properties (3) and data obtained by its calibration.

Ric. 8. accelerometer calibration.

Pat vertical axes (*z*-aboutB) sensitive accelerometer operates the acceleration of gravity *g*And on the other coordinate axes (*x*-tand*y*-aboutsyam) at rest no acceleration. The signals in channels that correspond to the axes *x*tand*y*Equal to 1.65 V. The channel, which is responsible *z*-aboutB (vertical axis) accelerometer voltage equal to 2.44 V. When the sensor is rotated 180 degrees to *z*-aboutB (in the sensing element of the sensor now operates acceleration -*g*) Strain in the channel that matches *z*-aboutB, is equal to 0.9 V.

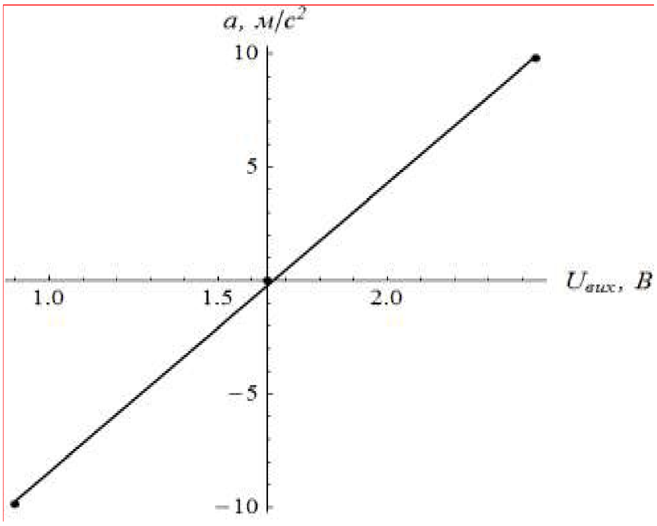
Stillm so obtained output voltage of the sensor, which correspond to acceleration -*g*,0 and *g.*These data obtained static characteristics of the sensor:

$$a = -21.16 + 12.74 Uvy_x \quad (4)$$

,

where *and*- Acceleration, which acts on *z*-aboutB accelerometer m / s2; *Uvyh* - Output voltage sensor V.

Earlfor equation (4) is shown in Fig. 9. The coefficient of determination equation (4) pivnyy 0, 9996. Dll thenFirst, thatto toIZnachyty static specifications for sensor channels that correspond to other axes, conducted a similar calibration. Established that static characteristic (4) is valid for all Cartesian axes sensor.



Ric. 9. Schedule static characteristics accelerometer (4) and data obtained by its calibration.

Conclusion. In this work the static characteristics of sensors: current, voltage, force and acceleration. Static characteristics obtained by the method of linear regression. The coefficients of determination that all dependencies are close to unity, which means fairly accurate representation of real data. Static characteristics of sensors used for processing experimental data (for installation of the shifts measured parameters). All received static characteristics described by the linear case, which greatly simplifies the processing of experimental data.

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In this article brought Description sensors, kotorыe yspolzuyutsya definitions for power machinery, Dynamic and kinematically parameters lifting cranes. The described process Weighting capacity kazhdogo sensor. Data Weighting capacity at Poluchennыe obrabotanы pomoshchju method with linear rehressyy. Powered statycheskye characteristics of sensors, kotorыe svyazыvayut vhodnuyu size sensor with signal OUTPUT at him. All poluchennыe statycheskye characteristics ymeyut Factor determynatsyy blyzkyy for units.

Sensors, Experimental Studies, taryrovka, lyneynaya rehressyya, statycheskaya characteristics.

The paper describes the sensors that are used to determine energy, dynamic and kinematic parameters of hoisting cranes. It describes how to calibrate each sensor. The obtained data are processed with calibrating method using linear regression. In paper showed static characteristics of sensors that connect input value of sensor and signal output. All static characteristics of coefficient of determination are close to unity.

Sensors, experimental investigations, calibration, linear regression, static characteristic.