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TYPES OF MEASUREMENT ERRORS AND METHODS FOR THEIR ELIMINATION

Annotation: system-specific errors are errors that change according to a certain law when measuring a constant or exactly one magnitude again. Detected system-specific errors can be eliminated from measurement results by making appropriate corrections. Random errors are errors that change at random when measuring exactly one magnitude again. The fact that the measuring instrument does not always show the same is that the errors produced by temperature fluctuations during the measurement process are random. Random errors cannot be predetermined, but multiple measurement data can be accounted for by probabilistic mathematical performance.

Keywords: system-specific error, random error, rough error, correction, fixed error

Introduction

Measurement errors are divided into system-specific errors, random errors, and coarse errors [1]. System-specific errors are errors that change according to a certain law when measuring a constant or an aruchynan magnitude again. Detected system-specific errors can be eliminated from measurement results by making appropriate corrections. An example of this is the error caused by incorrect markups on the scale, the errors related to the stones and other types of templates used to bring the tool to zero.

Random errors are errors that change at random when measuring exactly one magnitude again. The fact that the measuring instrument does not always show the same is that the errors produced by temperature fluctuations during the measurement process are random. Random errors cannot be predetermined, but multiple measurement data can be accounted for by probabilistic mathematical performance.

Gross errors are random errors that exceed the expected error under certain measurement conditions. Examples of reasons that cause gross errors include incorrect counting from the instrument scale, incorrect installation of the measurement detail [2].

Materials and methods

This includes empirical methods such as modeling, fact, experiment, description and observation, as well as theoretical methods such as logical and historical methods, abstraction, deduction, induction, synthesis and analysis. The research materials are: scientific facts, the results of previous observations, surveys, experiments and tests; means of idealization and rationalization of the scientific approach.

Measurement errors are bullied into a number of types according to one feature or another. According to the method of representing measurement errors:

absolute (mutlock) error;

relative error.

According to measurement conditions:

static errors;

dynamic errors.

According to the cause of origin (condition:

measurement errors that are characteristic under normal conditions specified for the measuring instrument;

additional errors (errors that occur when deviated from normal conditions).

Normal conditions mean air temperature 20 0S 2 0s (20m 0s 5 0s), air humidity 65% 15%, atmospheric pressure 750 25 mm s.u. (101,325-3.3 kPa), the supply voltage is understood to be 2% variable from the sample.

Results and discussion:

The absolute error (Δx) of the measuring instrument is said to be the difference between the real value (xu) of the magnitude measured by the representation (xi) of the same absolute:

$$\Delta x = xi - xu \qquad (1)$$

In this case, errors are expressed in units of magnitude with a hint of plus or minus. Is called absolute error (xn xnis). Relative error characterizing the degree of rigidity of orcal measurement is very laughable [2]:

$$\Delta x_{\text{нис}} = \frac{\Delta x}{x_u} 100\,\%, \qquad \Delta x_{\text{нис}} = \frac{xi - xu}{xu} \cdot 100\,\% \qquad (2)$$

To anchor the true value of the magnitude, a correction is made to the indication of the measuring instrument. Its numerical value is equal to the absolute value obtained by the opposite sign:

d = xu – xi or d = Δx.

where d is the correction.

The error of the instrument is expressed in percentages of the likala range. Such an error is called the quoted error and equals the ratio of the absolute error to the scale range (xN), i.e.

$$\delta = \pm \frac{\Delta x}{x_N} \cdot 100\,\%, \qquad (3)$$

example. The indication of a potentiometer with an upper measurement limit of xN =3000s is xi=2400s, let absolute, relative, quoted errors be found when the actual value of the temperature being measured is xu =241.20 S.

Absolute error Δx.=xi - xu = 2400s-241.2=-1.20 S, relative error

$$\Delta x_{нис}=\pm\frac{\Delta x}{xu}\cdot 100\%,=\frac{-1,2}{241,2}\cdot 100=0,5\%,\ \delta=\frac{\Delta x}{x_N}\cdot 100\%=\frac{1,2}{300}\cdot 100=0,4\%$$

The normalized (normalized) value of the measuring instrument is estimated as follows:

the scale is one-sided, i.e. the scale starting from zero is taken equal for the instrument-the limit (hew) above.

The scale is taken equal to the arithmetic sum of the upper and lower measurement limits for a two-sided measuring instrument.

$[\ |x_{yu}| + |x_q|\ ]$

- the scale is taken to be equal to the subtraction of the upper and lower upper and lower measurement limit wearers for a non-zero measuring instrument:

$(x_{yu} - x_k)$

The quoted error of the tool expressed from the differences detected under normal conditions is called the main error. this error is the chief benchmark in the design of measuring instruments. One of the ways to increase measurement accuracy is to measure the measured value many times over. In this case, a number of values of the measured magnitude are characteristic.

$x_1,\ x_2,\ x_3,\ \ldots\ldots,\ x_n.$

The average arithmetic mix of these values is measured, with the magnitude Value (x) being closest.

$$\bar{x}=\frac{x_1+x_2+x_3+\ldots..x_N}{n}=\sum_{i=1}^{K} xi/n \qquad (4)$$

Therefore, the absolute and relative error are subject to change, so the ham absolute error is considered to consist of two organizers. For example: the maximum value of an absolute error is expressed as:

$|\Delta x|\max=|a|+|bx|$

The first organizer of the error (a) depends on the value of the magnitude being measured does not bulge, and it is called an additive error. the second organizer, on the other hand, depends on the value (displacement) of the measured magnitude and is called a multiplicative error. for example, the multiclicative error of stencils, micrometers and similar instruments depends on the diameter of the measured detail, which is equal to 0,001 D [3].

Conclusion:

As a result of the measurement, a value is usually found that is different from the actual value of the magnitude being measured. Often the actual value of a physical magnitude is unknown, and instead of the value of that magnitude, its experimentally found values are used. This value is so close to the actual value of the magnitude that it can be used for the intended purpose. The value of the magnitude found by the measurement method is called the measurement result. The difference between the measurement result and the actual value of the magnitude being measured is called the measurement error. The measurement error expressed in units of measured magnitude is called the absolute error of measurement:

X= Xn - Xnh

where: X-absolute error

Xn-measurement result

Xnh is the actual value of the magnitude being measured

The ratio of the measurement absolute error to the actual value of the measured magnitude is called the measurement relative error [4,5].

References:

1. Tojiyev R.J., Yusupov A.R., Rajabova N.R. Qurilishda metrologiya, standartlash va sertifikatlashtirish [Matn]: darslik / R.J. Tojiyev, A.R. Yusupov, N.R. Rajabova. – Toshkent: «Yosh avlod matbaa», 2022 – 464 b.

2. Tojiyev R.J., Yusupov A.R.. Metrologiya, standartlashtirish va sifat nazorati. O`quv qo`llanma. Farg`ona.: FarPI,«Texnika» noshirlik bo`limi. 2003-328 bet

3. Сергеев А.Г., Крохин В.В.. Метрология. Учебное пособие. М.: Логос, 2001. -408 с.: ил.1S0 90012. Ulchash vositalarining sifatini ta'minlaydigan talablar.

4. O‘z RH 51-095:2000*. Методические указания по составлению карты технического уровня и качества продукии