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IDENTIFICATION OF THE METROLOGICAL CHARACTERISTICS TRANSMITTERS

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Modern line of development of Information and Communication technologies has made necessary to create of measuring devices which have high accuracy and stable, effective converting characteristic. A problem of measurement of technological parameters with required accuracy in difficult metrological conditions and planning in completely new structure of measuring devices which should control them operatively has appeared. The wide solution of this problem basically is carried out in two directions: The first is a technological method. Recently to this method had pay attention very much and devices in this area have found wide applications. The western firms at the expense of the big capitals have chosen and developed this area. A few moments that lay beyond this technological potentialities bring out the necessity of providing high metrological characteristics which meet severe requirement and that in turn emphasizes the importance of using more progressive and correct methods. The second way consists of supplying the creation of ways which have the complete structure, carrying out intellectual researches using elements and modules of modern electronics, using mathematical methods in specification and development of information, making clever decisions in present situations and finding the optimum decision. Using cleverly the opportunities of a structural - algorithmic method, the problem can be successfully solved. This approach is more effective than a technological method.

In this article the choice of mathematical methods against a background of researches carried out by the last directions, the way they are used, creation of algorithm of simple software and its application to solve this problem is brought up. In many technical literatures is given to application of algorithmic-structural method the preferences and their definitions is opened. [1, p. 31-35].

From static researches it is possible to assume that, devices created at the expense of the big investments and difficult technologies do give required accuracy, but are not able to keep the valid characteristics in difficult metrological conditions. The creation of devices which have high intellectuality and accuracy and which are able to keep the invariance (stability) in heavy deserted conditions, the application of a structural - algorithmic method gives more effect. Parameters changes of measuring device under the environmental influents make the interference to its structure and other parts impossible. But in this case we get the opportunity to control parameters of transforming characteristics of converters and their current values.

As microprocessor devices have modular structure, electronic blocks can be easily extended and changed. And it gives us the big opportunities to supply the measuring method with completely new mathematical algorithms and software.

In spite of the fact that the ratio (mathematical dependence) between all possible physical parameters sensory parts of converter and its features is known data, they are closely studied, results of research are gathered as a base of statistical values and are effectively used in the future measuring operations. As a result, by making concrete decisions the structure and current values base of measuring algorithm of the device and its mathematical model are defined. For each concrete structure the corresponding algorithm and software are developed.

To define exact converting characteristics of the device and its parameters the output signal of the sensor and its structure is studied. The information is allocated in structure of a signal by entropy altitude (probability) of the carrier and by other features. Determining separately each signal and its parameters we get curves (schedules), and they separately represent the converting characteristic corresponding to the certain condition. This approach as against classical methods very largely prevents the loss of informative signals [2, p. 163-193]. In result we get more exact, stable and reliable metrological characteristic.

In the certain interval each signal actually represents one converting characteristic. From this point of view, the disclosing of the exact form of each signal, determining of its values and variables represents the problem solving. The curve representing the signal in coordinate planes starts from zero and consist of geometrical place of points representing a pair of values - an entrance signal taking place on the abscissa axis (x) and all values taking place on the ordinate axis (y). The accuracy of identification depends on accuracy of determining the position of each point (coordinates) and on very small distance (by to zero) between them. Taking in the account the mathematical dependence representing the relation between values (coordinates) representing each point consisting, the curve, a method of potential function has been chosen and the operation with its application is considered.

The method of potential function is represented as follows [3, p. 124]:

$$\mathrm{K}(x,y) = e^{-\alpha R^2(x,y)} \tag{1}$$

Here $R(x,y)$ – the distance between the x and y points on *X* Euclid plane, which represents the measuring distance, α – is a free value and represents the direction of the chosen value. As we see from these functions each geometrical point on signals is characterized in respect to these two values. So to following points pair of completely different, but very close values are present. And so, the geometrical place corresponding to pair of values of both parameters will represent the converting characteristic of the device. In article the analysis of curve of different forms with the help of these algorithms and different approaches of specification of their mathematical view is considered.

The potential is determined in two views:

1) The closed for realizing by machine, i.e. not parted view:

$$f^{n+1}(x) = q^n f^n(x) + r^n K(x_{n+1}, x) \tag{2}$$

2) Parted, for the apparatus:

$$\widetilde{c}_i^{n+1} = q^n \widetilde{c}_i^n + r^n \psi_i(x_{n+1}), \qquad i = 1 + N \tag{3}$$

Here q^n and r^n – The sequence of values satisfying the certain limits; $f^{n+1}(x)$ and $f^n(x)$ – the values of result function on x point, accordingly, at the (n+1) and n-th approaches; $\widetilde{c}_i^{n+1}$ and $\widetilde{c}_i^n$ – accordingly, the values of (n+1) and n-th approaches, the partition of i-th coefficient for result function $f(x) = \sum_{i=1}^{\infty} \widetilde{c}_i \psi_i(x)$.

In simple cases division class $q' \equiv 1$ is accepted, but r'' is the regular sequence of "0" and 1". When $r' \equiv 1$, f"(x) resulting function after n-th step approaches couldn't proper classify of new (n+1)-th point's x_{n+1} knowing sequence. So studying comes to the end. Disadvantage of the expression [2] is when operation is carrying out with machine sequence studies point's numbers, also including n-th steps, all points including all values of q' and r' (j=1÷n) numbers will be saved.

Differing from separation carried out by existing structure, signals here subjecting to the theoretical separation, at first their values were computed, their character and composition are detected. After such mathematical separations by the timing commutators the filters are determined and their parameters are controlled automatically [4, pages 35-58]. The agreed components of the signal passing through the filter are estimated being compared with the results obtained by the potential function method. So, each point i.e. measured value of the expressed signal carries out separation of different parametrical signals more accuracy. As this method gives possibility to analyze the signals separately to all components, also helps with effective separation the important signals. The signals obtained by this method are

approximately more 10% high in comparison with the existing methods. So information carrying and detecting character of this method exceeds the existing ones.

Except above mentioned, expressions (2) and (3) allows, accordingly, comparison and estimation of the theoretical results with the machine computation.

With the help of the mathematical expression (1) the detected arbitrary signal's form having enough smooth curves is concrete information carrier and there is no need this function to be approximated.

It is possible to determine current values the device's functions by comparison them with standard signals translator.

Estimating the certain optimal interval rates of the translator function, the values base is created and enough statistic values corresponding to the measuring range are summarized.

By means of special algorithm at every interval measuring separate operation carried out. Conducting measuring by this way is increased the accuracy and sensitivity of measuring significantly. At the end the results of measuring, mathematical ratios corresponding to them and metrological characteristics other values saved as "values base", which is formed "statistic memory" reflecting devices passed history. Such approach to the devices structure allows determining its characteristics' errors with time, to carry out its automatic graduation-renewing metrological characteristics at the expense of accumulated statistic values not providing additional measuring.

As is known accumulated values base limited with certain statistic information determines sensor's current condition, special feature and character, creates foundation for intellectual making-decision and real translator characteristics with high accuracy of renewal [5, pages 60-74].

Such approach to a problem solution determines the position of the measuring device in a changeable structure, making-decision at the moment of measuring operation and reaches high metrological characteristics.

Even, having been prepared with high technology and having high metrology characteristics every translator is needed to be graduation in a concrete condition. Being the mass production product the metrology characteristics of any normal measuring device in operation in a certain time span and resulting impact of changeable environment changes gradually, measuring sensitivity and interval, also accuracy are increased; to keep the required accuracy of the measuring facility, manufacturing is needed.

As is clear from the statement, on the background of the suggested approach, existing measuring devices –translators does not interfere their main modules it is possible by means of structure-algorithmic methods to bring them to the high accuracy, stability and reliability measuring devices class.

In suggested by us new approach the adaptation principles for up-to-date measuring devices was taken into account and attributes belonging them was successfully used in this case.

- Due to the right chosen of function not only root-mean square value, also maximum deviations of the measuring results from real magnitude are decreased.
- Determining of every point of translator characteristics does not depend on their span time, carries out approaching to the real value.
- Right selection of function making less calculation ranges allows modeling of geometric interpretation in problem solution and values base forming.
- The suggested procedure is significant efficiency in function's smallest values, close to zero (but differs from zero) infinite time approaches conditions.

The results of research were tested concretely, in an example of mass produced intellectual devices-pressure translators and to put into practice in industry special software program was prepared. For their normal using in open air conditions in all seasons increasing of their stability and accuracy for several times was achieved, for clearness valuation of obtained results they were shown in the form of tables and charts. The efficiency of developed structures and algorithms were tested.

Successes obtained in this direction will promote the advanced firms' performances to be more efficiency and successfully used in manufacturing of these devices.

Package of suggestions are preparing for manufacturing firms.

An effective method for the specification of the measuring characteristic, for the recognition and restoration of all its points with high accuracy has been offered, the ways of stability preservation of the valid characteristics while using the device have been researched, and the problem of identification of maintenance of high measuring accuracy of its metrological characteristics, in all of range of measurement is considered.

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