Evaluation of the functional suitability of the device considering the technological parameters of random deviations from the nominal component aging processes

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Abstract **One of the main parameters of the device is its functional suitability. During operation device components under environmental change their parameters, ie, the process of aging. Under these conditions, there is a problem of evaluating functional fitness device taking into account the real processes of aging.**

Keywords **functional suitability, aging processes, dispersion ellipsoid, drift**

I. INTRODUCTION

Functional device suitability - a complicated complex concept whereby assess such key characteristics of devices like performance, durability, reliability, recoverability, and others., that is a property of the device to perform specified functions, while maintaining their operational performance within specified limits for the required period of time.

In the writings of [1,2] are presented the analysis of the device functional suitability under conditions of technological random deviations of the radioelement parameters from the nominal values and with considering of component parameters random deviations in the process of exploitation. It was expected that both in the manufacturing process, and during the operation of the random deviation of device parameters are distributed according to a normal or lognormal distribution law. If the assumptions of the distribution of deviations from the nominal process parameters largely true in practice, the performance deviation rather rarely shared the normal law. In the operation of the device components under environmental change their parameters, i.e., the process of aging components. Aging component is irreversible change in the properties of elements, nodes and devices in general toward their deterioration as compared with primary or established requirements of technical documentation.When the value of degradation reaches a critical value, failure occurs - a phenomenon that arises from the fact that the product ceases to partially or fully perform its basic function [3]. It is known that the aging process component device can be described temporal dependencies distributed exponentially, which is typical of most complex devices that contain a large number not reparable elements and are generally sudden failure [4].

Under these conditions, there is a problem of evaluating functional fitness device taking into account the real processes of aging.

II. STATEMENT OF THE PROBLEM AND APPROACHES TO ITS SOLUTION

For the solution of the problem of functional suitability assessment device taking into account the actual aging process at work was considered two basic approaches. The first is based on the hypothesis of addiction, describing the aging process component. Functional fitness device in that case sought from incorporating in the tolerance region device parameter deviations from nominal dispersion ellipsoid of the form:

$$Q(\alpha, m) = \{\vec{\delta b} \in R \left| \vec{\delta b}^{\,T} \cdot D(\vec{\delta b}) \cdot \vec{\delta b} \le \chi^2(\alpha, m)\right\} \quad (1)$$

where $D^{-1}(\vec{\delta b})$ is the parameters covariance matrix of the possible deviations due to the action of environmental factors; $\chi^2(\alpha, m)$ -table values χ^2- distribution. The basic requirement for a fit in the tolerance region of the ellipsoid (1) is known to the variance covariance matrix of the parameters from the nominee and lack of technological deviations of parameters provides the key centers of the ellipsoid and the tolerance area in the zero point.

The second approach is based on the definition of dependency, which describes the processes of aging is based on analysis of interval data obtained experimentaly. In this case, instead of using ellipsoid described by (1) in process of exploitation we will use drift character, i.e. change parameter values from the nominal radioactive over time usage. In this case, the functional suitability of the device will look with dissipation analysis ellipsoid in the following form:

$$Q(\alpha, m) = \{\vec{\delta b} \in R \left| (\vec{\delta b} - \vec{\delta b}(t))^T \cdot D(\vec{\delta b}) \times \right. \\ \left. \times (\vec{\delta b} - \vec{\delta b}(t)) \le \chi^2(\alpha, m)\right\} \quad (2)$$

where $\vec{\delta b}(t)$ - functions, that describe the processes of changes in time related to the influence of the environment (aging, temperature drift etc.).

III. CONCLUSION

It is shown that taking into account the trend of aging components makes it possible to increase the functional suitability of device. Are two main approaches to solving the problem of evaluating functional fitness device during operation under ambient

IV. REFERENCES

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