THE FORMING OF SERVICEABILITY'S ESTIMATION PARAMETERS OF NONLINEAR EXECUTIVE DEVICES

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The efficient condition of technical devices (TD) assumes these devices' performance of set functions, keeping key parameters (KP) within the limits, established by normative and technical documentation. When defining the TD working capacity, on the basis of straight (and also possibly indirect) measurements, there are defined the quantity of efficient N1 and disabled N2 conditions of the given TD. In the situations, when the corresponding measurements represent certain difficulties, then, in defining the working capacity are also used other ways. One of them assumes the KP definition on the basis of existing dependences between these parameters and temporary characteristic parameters of transients, or on the basis of dependences between KP and parameters of peak-frequency or peak phase-frequency characteristics. Another way is the defining of some integral parameters, which as a result also reflect the KP condition. The mentioned approaches are acceptable and are used both at test and at functional diagnostics. [1] Both in first and second cases, it is important for the used mathematical device to be adequate both for TD working capacity estimation, and for the analysis of their functioning. In the case of linear technical objects (LTO) the dependences between parameters of temporary and frequency characteristics and their KP are established without special difficulties. It has predetermined the wide use of the mentioned dependences at designing the diagnostic systems. [1]

However, in the case of nonlinear technical objects (NTO) mentioned above, the dependence between parameters of corresponding characteristics and KP meanings are determined with certain difficulties. The availability of modern hardware and software does not represent special difficulties for determining the mentioned laws. For example, on the basis of numerical methods. Use of this approach would mean, that for defining of NTO working capacity it is used a mathematical device (numerical methods), but for the analysis of their functioning - another (calculation method and analysis of dynamic systems).

By developing the mathematical models of diagnosing systems such way is not comprehensible. Even so, there show up some gathering complexities of diagnosing systems by hardware, and software development, and also will cause additional time expenses that will affect the economic indices at designing and operating of these systems.

The stated above, demands to use the same mathematical device for the solution of two different problems. It is possible, if dependences which describe NTO are linearized. It is proved [2] that for NTO description and analysis it is applied the method of harmonic linearization (MHL). The use of this method does not exclude certain difficulties at establishing of laws between parameters of above mentioned characteristics and level KP, which reduce them considerably.

For this purpose it is necessary to present the investigated NTO with corresponding statistical characteristics. Below, there are presented nonlinear static characteristics (NSC) for some widespread devices.

1. **Relay characteristics**. These characteristics describe, for example, the change of voltage Uñ which is applied to the engine, depending on the managing I_y of the relay; the condition of two-position polarized relay; the step dependence which displays the functioning of a sectionalized potentiometer. Also, some other special cases of these characteristics take place.

2. **Characteristics with a zone of tolerance and saturation.** On such dependence, for example, there are changed: the pressure differential ΔP in membranous executive element depending on a turning angle $\alpha_п$ of managing element shutter; the output signal of some kinds of amplifiers which depend on an entrance signal; input - output dependences of some measuring converters; dependence with a zone of insensitivity without saturation, describing the functioning of the hydraulic amplifier; input - output dependences of some devices in which is stipulated the switching transfer number.

3. **Characteristics with hysteresis loops.** On such dependences it is changed, for example, the rod S traversing, which depends on a turning angle of shutter α in executive membranous device, caused by the overlap angle of shutter $\alpha_п$ and dry friction between the rod and membranous box. Such characteristics may be both with saturation, and without it. To this type of characteristics belong the characteristics of gap type, describing in the executive device, depending on the turning angle of the output shaft from the turning angle of the input one.

4. **Power nonlinear characteristics**. They describe the presence in executive devices of viscous friction forces, which at big speeds may be proportional to the square or cube of speed.

5. **Hysteresis loops of electric circuits with iron**. Under such law in executive devices there are changed the magnetic induction of magnetic conductor, depending on the barn-floor of its winding. Such dependence takes place also in electric machine amplifiers of executive driving devices.

6. **Nonlinearity of dry and square-law friction types.** These characteristics reflect the change of dry friction force or its moment depending on the speed of movement. In other situations these characteristics have similarity with hysteresis characteristics.

The above mentioned characteristics are described by a line of parameters: в – operate current; m – reset ratio; c or - c – the level of switched voltage (signal) etc. These parameters at synthesis and designing of technical objects are accepted as some constants. During the technical objects functioning under the influence of revolting factors the mentioned parameters of characteristics of technical objects vary. Change of these parameters also will reflect the change of a technical condition of object. In other words, the change of TD serviceability can be estimated by parameters of static characteristics which vary or some integral parameters, which are determined by the above mentioned parameters.

Literature

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