RESEARCH OF THE OBJECT OF AUTOMATIC CONTROL OF TECHNOLOGICAL PROCESSES

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Annotation
This article covers the issues of improving the methodology for researching the adaptability of the object model through automatic control of technological processes.

Keywords: Automation, adjustment object, adequacy, approximation, interpolation.

Introduction

Automation of production processes will mainly consist of three stages:
The first stage-in this, the placement of tools near the machine and apparatus-almost caused difficulties. During this period of automation, large-sized instruments are used, the scale of which looks good. In this case, a measuring instrument, a regulator and an assignment device are placed in one housing.
The second stage is the complex automation of certain processes. In this case, the adjustment is carried out according to the tools installed in a separate niche. The use of large-sized tools leads to the fact that this Shchit stretches for several meters, and it becomes difficult to control the Shchit, during this period of automation there is a need to reduce the size of the tools in the Shchit. To solve this issue, small-sized secondary instruments are used.
The third stage (stage of full automation)-characterized by the automation of aggregates and workshops to mint. A characteristic feature of this period is that control is centralized to a single checkpoint. At the same time, the need to use dwarf secondary instruments arises. Measuring and adjusting instruments (large-sized), which require constant control, are installed outside the Shchit.
Each technological process is characterized by variable physical and chemical quantities (pressure, consumption, temperature, humidity, concentration, etc.), which are called technological process parameters. In order for the technological apparatus to ensure different flow of the process, it is necessary to keep the parameters characterizing a particular process at a given value [1].
The parameter to which it is necessary to ensure that its value is stabilized – or changed evenly-is called the adjusting magnitude. An instrument designed to stabilize the value of a adjusting magnitude or to carry out a change according to a certain law is called an automatic regulator. The measured value of the adjusted magnitude at the moment is called the current value of the adjusted magnitude. The value of the adjusted

magnitude, which must be kept constant at the same time according to the technological regulation, is called the given value of the adjusted magnitude. The technological regulation requires that the current and given values of the adjusted magnitude be equal at each moment of time. But due to changes in internal or external conditions, the current value of the adjusted magnitude may deviate from the given value. The difference in values formed at this time is called error or imbalance.

A technological process in which an error or a non-point value is zero is called a stagnant regime. In a stagnant mode, material and energy balances are strictly maintained.

For any technological process, there are optimal conditions that ensure the best quality of the product and the required efficiency at the lowest costs. The unity of these conditions is called normal technological conditions. The technological process is called an industrial equipment adjustment object, which is automatically adjusted. Any technological process is characterized as an object of adjustment through the main group of the following variables (fig. 1).

1) Variables characterizing the state of the process (we designate their unit through the vector $y(t)$). In the process of adjusting these variables must hold a position or change according to a given law. The accuracy of stabilizing variables can vary depending on the technology and the requirements that the possibilities of the adjustment system require. Variables that are usually part of the $y(t)$ vector are measured directly, but in some cases they can be calculated by supporting the object model over other directly measurable variables. The $y(t)$ vector is usually called the vector (or working parameter) of the adjusting quantities. In most cases, the working parameters indicate physical quantities such as speed (linear and rotational), temperature, pressure, linear and angular displacement [2].

2) Through the change of the adjustment system variables that can affect an object in order to control it. The unit of these variables is defined through the vector $u(t)$ and is referred to as the vector of adjusting effects. Material flow charges or energy flow fluctuations usually serve as adjusting effects.

3) In practice, changes in the consumption and composition of raw materials, temperature in the apparatus, pressure, etc.are often observed. Variables that have the opposite effect on the purposeful flow of the technological process, as well as disrupting the material and energy balance in the systems, are called upheavals. Riot effects are divided into measurable and non-measurable Oaks in their place. The mode of the technological process in which an error occurs under the influence of upheavals is called the non-stagnating mode.

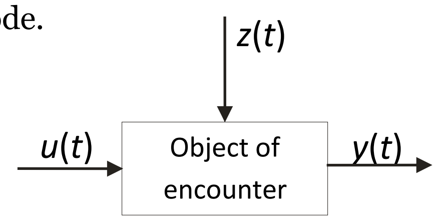

Figure 1. Variables affecting the adjustment object

Thus, one of the most important requirements of the industry is to maintain a stagnant regime of the technological process. A machine or apparatus that follows the material and energy balance is called a adjusting object.

The task of automatic control of technological processes is to automatically maintain the necessary technological conditions in the adjusted object using a regulator, and if these conditions are violated, then it is better to restore it. At the time of automatic adjustment (due to the influence of the regulator on the adjusting object), the current value of the adjusting magnitude will be equal to or close to the given value.

Automatic systems are connected to each other in a certain sequence, each of which consists of individual elements performing the corresponding task. A part of the content of an automatic system that performs an independent function is called an automatics element. It is advisable to classify the elements of automation according to their functional task. And the scheme that represents the functional link that is part of the elements of the automatic system is called the functional scheme. In addition, it is also possible to describe this automatic system in the form of simple zvenos that have different dynamic characteristics and are connected to each other [3]. The scheme of the automatic system in this case reflects the connection of the zvenos and is called the structure scheme of the system (fig. 2).

The adjusting object and the automatic adjusting unit form the ACS to form an adjacent chain named the adjusting contour. This chain will belong to the functional scheme of the ACS, and not to the structural scheme.

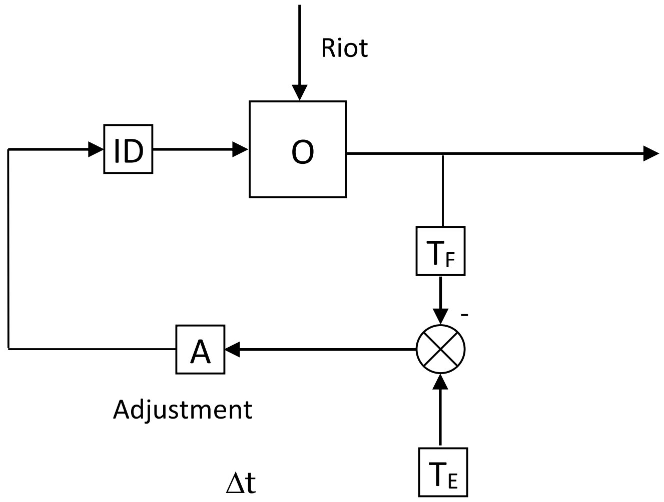

Figure 2. Structure scheme of the ACS.

Basic principles of management

The following principles of management theory are used in the design of ACS:

The principle of compensation. On the basis of this principle, the output coordinates are controlled on the basis of an open cycle [4]. But to implement the required control software, a channel is added that compensates for the provoking effects that will be on the object from the outside (fig. 3).

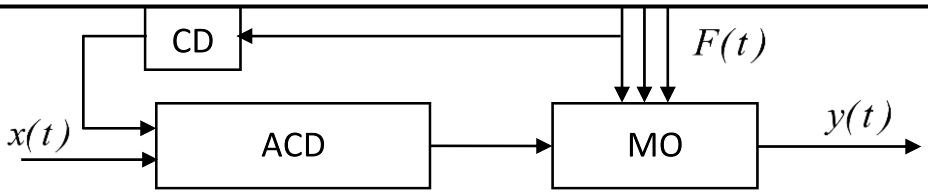

Figure 3.

Here: CD – compensating device; $F(t)$ – provoking effect.

The principle of deviation. Unlike the control compensation principle, control systems operating according to the closed cycle (deviation principle) are used to eliminate the external triggering effect that everyone needs. Because it seeks to eliminate the difference between the size that controls the operation of such systems and the size of the input (fig. 4): $\Delta x = x(t) - y(t) \to 0$.

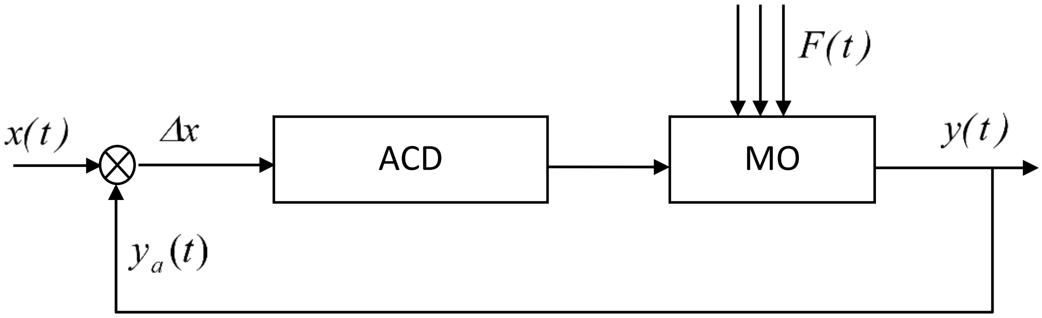

Figure 4.

Combined system. Combinirlashgpn principle is used to solve the accuracy and stagnation issues needed. In systems built on this principle, there will be an open cycle with a compensating device, as well as a closed cycle based on the principle of deviation [8]. In Scientific Technology, a technique usually built on this basis is called invariant (fig. 5).

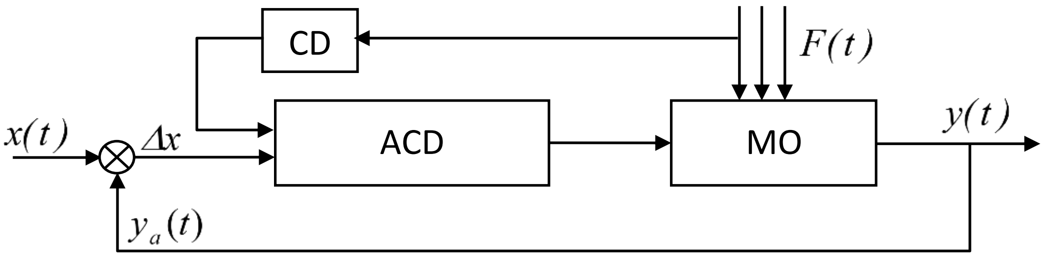

Figure 5.

Classification of automatic control systems

ACS are mainly divided into the following types according to the following two classification signs:

1. Depending on the information about the system and the object of management.
2. Based on the internal dynamic characteristics of the system.

Any set of information about the object whose primary source is being investigated based on experience is called information [5].
Information is divided into necessary primary information and working Information.
The necessary initial information is complete and incomplete (fig. 6).

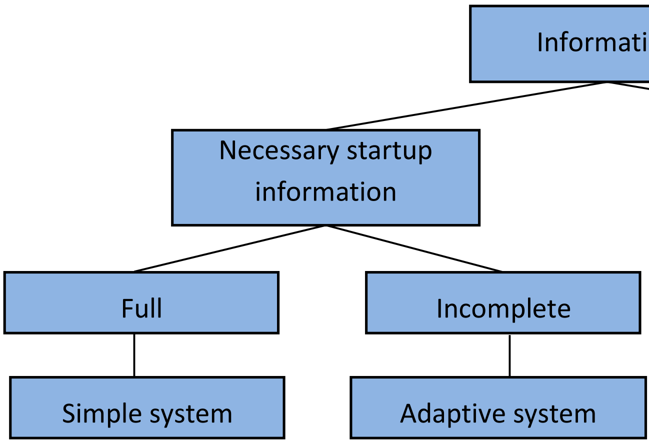

Figure 6. Classification of information about the system and the object of Management in relation to it.

Systems that have the property of adapting to external changes of influence are called self-automatically adjusting or adaptive systems. In such systems, the necessary initial information will be incomplete [6].
Systems in which the necessary initial information is complete are called Simple Systems, and they are divided into three types:
Stabilized system or automatic adjusting system. In such systems, the manageable size changes according to a previously known law (fig. 7).

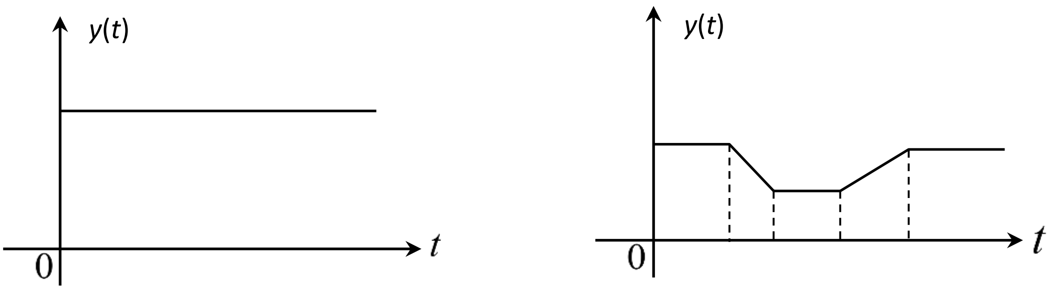

Figure 7. *a* - Stabilized system; *b* - Programmable control systems

Programmable control systems. In this case, the given value of the magnitude being controlled in the systems changes according to a predetermined program (fig. 7*b*). For example, an automatic lathe [7].
Tracking systems. The given value of the magnitude under control in these systems can vary by voluntary law within a very wide range (fig. 8). For example, a radiolakator antenna [9].

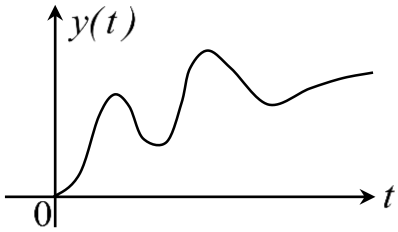

Figure 8. Tracking systems.

Types based on the internal dynamic nature of the system.

Such systems are divided into the following types:

a) linear and nonlinear;
b) stationary and non-stationary;
v) continuous and faceted (discrete);
g) collected and distributed parametric;
d) one-contoured and multi-contoured.

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