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Automatic Adjustment of Electromotor Speed

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Abstract: *It is designed to automatically adjust the frequency of electromotors and maintain the invariant value of systems that allow you to accurately change the adjustable size in control according to the voluntarily required law, or to produce the necessary law of their change in order to make processes acceptable at the objects being controlled.*

Key words**:** *Electromotor, frequency, adjustment system, amplifier, loading moment, Control effect, functional circuit, comparator..*

The shunting motor speed of an independent annular reciprocating current operating when there is a constant voltage on the electromotor clamps changes in a straight line as the loading moment on its shaft changes (Figure 1). Let the rate reduction value corresponding to the Nominal moment be greater than Δn_1 had and not comply with technical requirements. The accuracy of the descriptions in accordance with these requirements should be very large, that is, the change in speed should be very small. To solve this, an automatic engine speed adjustment system can be used [1].

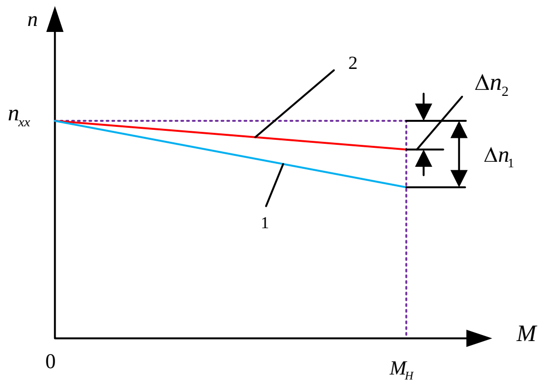

Figure 1. Dependence of engine speed on loading torque:
1-without a straightener; 2-with a straightener.

The simplest system is shown in Figure 2. In order to adjust some size, it will first be necessary to measure it. In this case, an electric machine – tachogenerators *Tg* is used, whose voltage is mutonosib to the speed of rotation *n* to determine the speed. The tachogenerators voltage is comparable to e_{tg}

mounted voltage e_0, and their $e=e_0-e_{tg}$ difference is transmitted directly to the amplifier (K). The magnitude of the voltage exiting the amplifier is transmitted to the Lamb of the generator;the transmitter is transmitted to the Marsh.

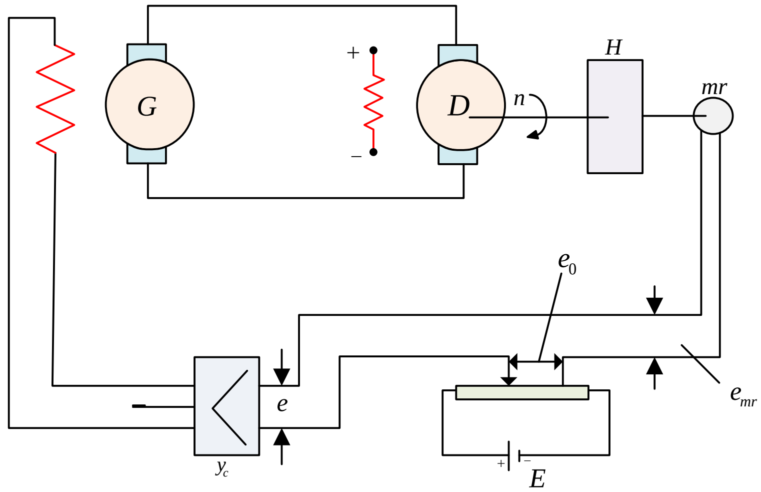

Figure 2. Electromotor speed automatic adjustment system;
g – generator; Dv – engine; YU – download; Tg – tachogenerator; K – amplifier.

The electromotor automatic adjustment system works in principle as follows. Suppose that some fixed loading engine speed has a fixed value. If we change the load for the analysis of the adjustment system, that is, increase, then initially the speed decreases according to Description 1 (Figure 1). The tachogenerators voltage drops, and the voltage at the amplifier output increases e – this leads to an increase in the generator voltage. This results in an increase in engine rpm. When the load changes as a result of the operation of the system, the engine's rotational speed is restored to the initial value, and the system description is characterized by 2 curves (figure 1.6). For this curve, Δn_2 Δn_1will be much smaller [2].

The principle of building automatic adjustment

Systems are common that allow the technique to accurately change the adjuster size according to the voluntarily required law, or to produce the necessary legislation of their transformation in order to make processes acceptable in the objects being controlled. In accordance with the tasks performed by the system, the first enters automatic tuning systems, while the second enters its own self-tuning system.

Self-tuning systems are a broader class of automatic systems, which includes a tuning system. In this case, the adjusting system is the acting zvenos of its own self-adjusting system.

Thus, an automatic adjustment system may have independent application, or may also be part of a more complex self-adjusting system[3-4].

Depending on the given law of the change in the adjuster size, the class of automatic adjuster systems can be divided into three characteristic types:

- –automatic adjustment system designed to hold the constant value of the adjustable size;
- –software tuning system that allows the adjuster size to change according to the previously specified law;
- –observer system.

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Figure 3 presents a functional scheme of the observer system built on the deviation principle. In this functional scheme, the adjustable magnitude of the control object 1 x the controlling effect varies with the law $x_0(t)$ given at the input of the system. The deviation error Δx is calculated by the comparison device, that is, the difference between the actual value of the given x_0 and the size x is comparable: $\Delta x=x_0-x$.

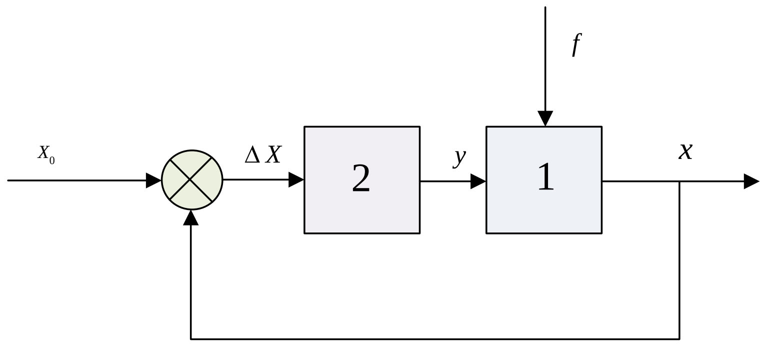

Figure 3. Functional scheme of the observer system, built on the principle of deviation
1 – managed object 2 – deviation neck control device.

This allows any law of adjuster magnitude change to be implemented without regard to the external effect character f imposed on the system controlled object. The principle of deviation has the same application for the control of stationary, neutral and non-stationary objects.

This principle leads to the construction of a closed system in which a controlled object and a controlling device successively affect one another. In this case, the circuit of the system is made with a negative inverse bond. For this reason, the difference between the actual values of the adjuster magnitude is brought to zero [4].

The Closed system has the ability to transmit effects in one particular direction, as shown by the arrow in Figure 3. Such a capability is called a detector, or a single directional capability.

The peculiarity of this property is that every subsequent element of the circuit contour is under the influence of the previous one, and at least one of the elements of the system does not directly affect the element that is ahead of it in the opposite way.

The deviation principle can be the basic principle of constructing Observer systems. Figure 4 presents a functional scheme of an observer system built on the principle of combined control. It differs from the scheme described earlier in that there is an additional controller device[5-6]. The effect of the $x_0(t)$ function given at the system input to 1 object controlled through this device is directly introduced. Thus, now the controlling influence is collected from the two organizers. One of them is that y_1 depends on Δx not matching as before, while y_2 depends on the law given x_0. Built on the principle of deviation, this device is designed to improve the quality of 3 systems.

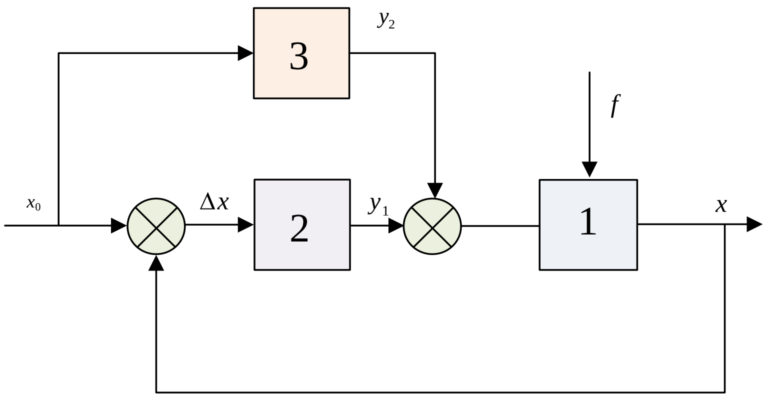

Figure 4. Functional scheme of the observer system built on the principle of combined control:
1-controlled object; 2 – Deviation control device; 3-riot control device.

We note the specifics in comparison with the adjustment and software control systems of the tracking system. In the last two types of systems, the controlled object will be an aggregate (rocket, large-capacity electric motor) or a technological process (chemical reactor, dryer, etc.) The controlled object in the observer system is a large – capacity performing an electromotor 1 (circuit in Figures 3 and 4). The controlled object is the load connected to it by this engine [5].

Functional scheme of automatic adjustment system.

From the above we refer to the functional scheme of the observer system. We are not interested in the principle of building Observer systems, but in the elements that make it up. The function functional scheme of the Observing System is shown in Figure 5.

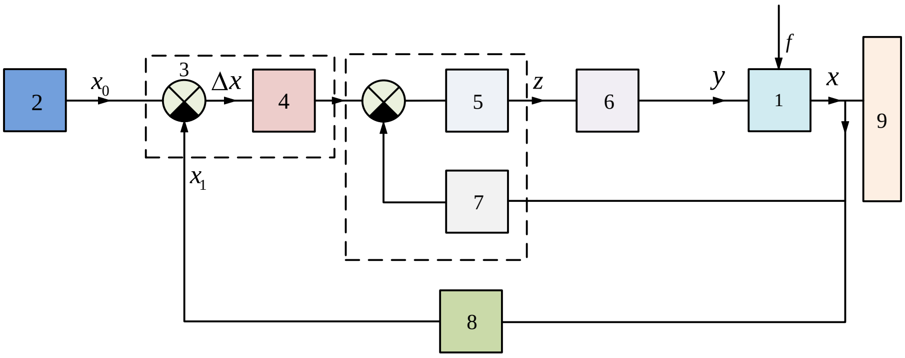

Figure 5. Functional scheme of the observer system.

1- control engine; 2- supply unit; 3- comparator; 4- primary amplifier; 5- and 7- sequential and parallel type obstetric unit; 6-power amplifier; 8- measuring unit; 9- guided object.

The law given the *x* coordinate is tightly coupled to the large-power acting Engine 1, controlled object 9, which must be changed in terms of *x*. The last is the load of a large-capacity engine, as described above. An engine of greater power is affected by external annoyance *f*, in addition to the reaction caused by the object to be executed. The appearance of this optional variable annoyance will depend on the specifics of the structure and the physical principle of Engine 1 Operation. The giving device 2 engine develops *x* coordinate change law x_0. Measuring device or sensor to another 8.... *x* performs magnitude measurement and converts *x* to magnitude x_1, which is convenient for transmitting it to a distance and has the same physical nature as the x_0 signal, representing the law of change. In a comparison device, subtracting the x_1 signal from the 3 x_0 signal and dressing the Δx mismatch signal occurs. Usually this signal has a small potential and capacity. Therefore, it must be strengthened, and this task is performed by the amplifier element 4. The amplified mismatch signal is changed to a 2 controller signal under a given law using corrective devices 5 and 7. It has been adopted that Element 5 is a sequential rectification device, and element 7 is a parallel rectification device.

Element 7 The Observer characterizes the inverse coupling, which contains some of the elements of the system.

The control signal is amplified by the power amplifier, which acts directly on the Z-acting engine.

It is worth noting that Δx and z can be a modifier of the physical nature of signals when 4 and 6 amplifiers are needed. In private cases, some elements in the scheme in Figure 5 may not exist, or they may be combined from a constructive typewriter into a single device. In low-power Observer systems, it is often sufficient to limit a single power amplifier to 6. In some cases, when the comparator 3 and the initial amplifier are combined from a constructive Jack, the system's toggle device will be composed of only one 5 or 7 element [6].

Conclusion

The proposed, electromotor speed automatic adjustment system allows you to save power consumption in the network and improve control. At the same time, it will also be possible to adjust the temperature of the electromotor due to its rapid as well as overheating when the load increases.

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