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MATHEMATICAL MODEL OF REGULATING THE RESERVE WATER LEVEL IN THE AUTOMATIC IRRIGATION SYSTEM.

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Annotations*. This article explains how to control the backup flow of water from an automated irrigation system and provides a mathematical model for it. In agriculture, it is important to use an optimal irrigation method in which the water level is constantly monitored. The project also uses level sensors and actuators.*
Keywords*: Control object, level sensor, actuator ,* model
Аннотации*. В этой статье объясняется, как управлять резервным потоком воды из автоматизированной системы полива, и приводится его математическая модель. В сельском хозяйстве важно использовать оптимальный метод полива, при котором постоянно контролируется уровень воды. В проекте также используются датчики уровня и исполнительные механизмы.*
Ключевые слова: *Объект управления, датчик уровня, исполнительный механизм*, модель

All management processes, including adjustment, have general laws that do not depend on a specific object or goal. In the arbitrary change in fluid flow, we see the process of adjusting the water flow in a tank as the first example explaining these general principles. Depending on the difference between the level and the set point, you can stabilize the level at the set point by changing the flow of liquid into the tank.
Assume that initially the power level is constant and equal to the set value. Let a random decrease in water flow cause the level to be higher than the set level. In this case, the valve must shut off the water outlet. If the level drops below the set value, the valve must be opened.

Thus, the configuration process consists of five tasks. The first is to obtain information about a given level of knowledge (in our case, this task is known in advance). The second is to have information about the actual level of the level, that is, its size. Thirdly, determine the magnitude of the difference from the given level and its sign. Fourth, set the required water flow rate depending on the quantity and sign of its differentiation. Fifth, change the water flow by opening or closing the valve.

In the above example, the control process is not automatic, since it involves a person. This is called manual control. In the ACS, the control process is performed automatically. The liquid level in the tank can be adjusted using the engine control unit shown in Figure 1.1. In this system, the sensor changes position along with the level, and the actuator changes the fluid flow. Considering the level in such an ACS, any deviation from the value occurs due to vibration of the fluid flow, which causes displacement of the sensor and the corresponding tattoo.

When the level is above the set value, the valve begins to close, and when it is below the set value, the valve begins to open. Thus, in this system, all the specified work of the adjustment process is performed automatically: when the level differs from the set value, the foam pushes the lever, and the movement of the stem changes the degree of opening of the valve, allowing the liquid to flow as required.

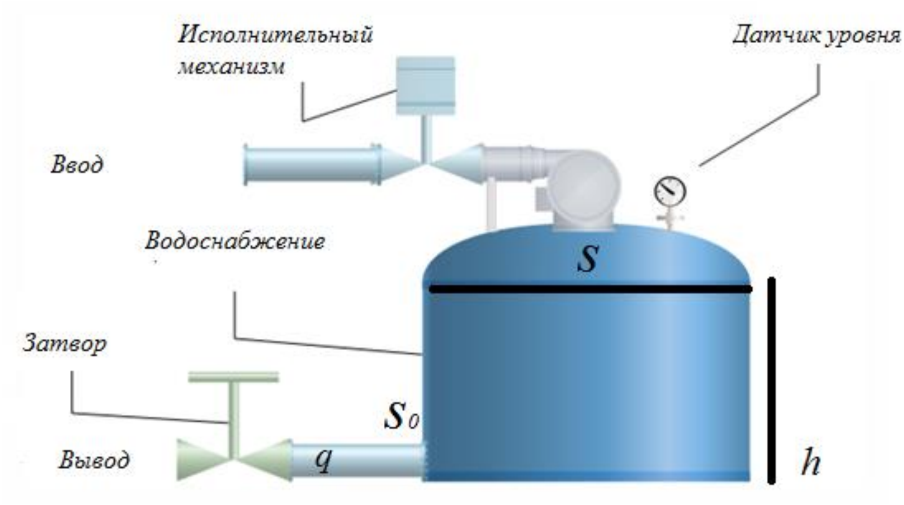

Figure 1.1. Automatic adjustment of the tank level with inflow and outflow of liquid: 1 - level sensor; 2 - actuator; 3 - capacity; 4 - shutter.

To influence output signals, input signals, called control parameters, are changed in a directional manner, and their target change is called control effect. The fluid level is called the performance control parameter, and the fluid flow rate is called the control. In STOST, the most common control parameters are the consumption of substances (liquids, vapors, slurries, deposits) and energy (heat, electricity, etc.).

Other ACS perform the same five functions, for example, a digester has a temperature control system. From the examples given, it is clear that in order to manage any STOCT, it is necessary to obtain information about its specified and actual state, determine the difference between the actual state and this state, and on this basis develop and implement a targeted impact on the object.

As already mentioned, any control process consists of five main actions performed by technical devices in the automated control system. The device that receives information about the state of the controlled object is called a counter or parameter value sensor. The device that determines the difference between the measured value of a parameter and the specified value is called an adder. It performs algebraic addition - subtracts a measured value from a given value. A device that influences an object is called a regulator. It is the body that regulates the transfer of this effect to the object, and a special device is used to move it - an actuator. All these devices, as well as the control object, will be elements of the ACS (in some systems, some of the devices can be used together, for example, the adder can be part of the controller, and the actuator can be combined with the controller). For example, in this example, the tank with inflow and outflow of liquid is the object of level control, the foam is the measuring device, the lever acts as an adder and regulator, and the valve acts as the regulator.

Now consider a mathematical model of the process in which we take the following as an important parameter

Mathematical equation:

based on Bernoulli's law 1)$pgh = \frac{pv^2}{2}$
v - flow 2)$V = \sqrt{2gh}$speed

g -9.81 [m / c^2] gravitational acceleration
R - liquid density
q- _ flow 3)$q = s_0 \times h$rates

Using these basic parameters, a mathematical model of the process can be obtained; water consumption varies depending on the stage, while external influences are not taken into account.
We assume that our process is linear; usually processes in nature are nonlinear .
Linear function: 4)$y = kx + b$
hence the water consumption: 5)$q = kh + b$
we can obtain a mathematical model of the process if we obtain the differential function from the resulting formula. It can be concluded that the mathematical model of the process is very important to determine the stability of the process.

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