ANALYSIS OF IMPORTANT FACTORS IN CHECKING THE OPTIMALITY OF AN INDETERMINATE ADJUSTER IN A CLOSED SYSTEM

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ABSTRACT. The article deals with the identification of factors that increase the quality of the system in which the inaccurate corrector is applied. The factors related to the uncertain alignment block were studied and the dependence of the system reaction on them was analyzed. The problem was solved on the basis of isolated factors, using statistical data related to the implemented system, using the method of experimental-statistical modeling, and the results were analyzed.
Keywords: solid system, intelligent system, fuzzy logic, fuzzy straightener, system error, experimental-statistical modeling method..

1. Introduction

The use of intelligent control systems in the automatic control of complex chemical-technological processes or, in general, a wide class of dynamic systems, determines the current trend of system development. This is due to the fact that intelligent control systems are used to manage complex, ie deterministic and stochastic controllers that do not support technical systems.

It is known that intelligent systems of automatic control are adaptive systems that study the flow of information that characterizes the nature of the object of control, the storage of related information between the elements of the system, its analysis [3].

Typically, the application of a digital rectifier to a continuous system leads to a digital system, and the evaluation of system behavior is based on the laws of digital control. Based on this analogy, the application of fuzzy rectifiers (HR) to systems allows us to talk about intelligent control systems. We explain the transition from a continuous system to a digital system and the organization of the reverse process in two terms: analog-to-digital converter (ARD) and digital-to-analog converter (DAC). In such an intellectual system, the concepts of "Fascification" and "Defasification" establish a boundary. These concepts are described in terms of "inaccurate" and "exact" input and output sizes.

The quality indicators of a system (closed system) are determined by evaluating its errors. In this sense, this is the primary aspect of improving the management system. In this case, any method or means of achieving system error reduction can be considered as a device for the development of automatic control systems. Intellectual systems, in turn, have the potential to achieve this. This possibility is the possibility of optimal adjustment on the basis of broad meaningful thinking.

Increasing the number of input errors received by the feedback system rectifier, increasing the number of comparison options to ensure the optimal quality of the classical control system is not studied as an important function, because the higher the value, the higher the value. In a rigid system with an indefinite rectifier, however, this factor has no meaning at all, that is, there is no concept of the rectifier function of the rectifier. In this case, other factors related to the uncertainty corrector may be the main influences on the quality of the system.

2. Problem statement.

It is very common in scientific research to compare the concepts of classical control of technological systems and intelligent control. The main research area is the construction of two types of rectifiers in a given system and the analysis of the results obtained from their optimization. The main purpose of this research is to improve the usual straightening system, which can be achieved by applying an inaccurate straightener to the system and creating an intelligent control system. In summary, it is recognized that the system is an intelligent management system when further improvement (enhancement) of the quality indicator is carried out. If this claim is accepted as a valid confirmation, another aspect of the above purpose will become apparent. This is not a step in the transition to an intelligent control system, but in ensuring the quality of the system at this stage. This raises a number of issues. In particular, HP is a matter of determining the factors that increase the quality of the applied system.

The fuzzy rectifier of asystem controlled by fuzzy logic has the following functional diagram (Figure 1).

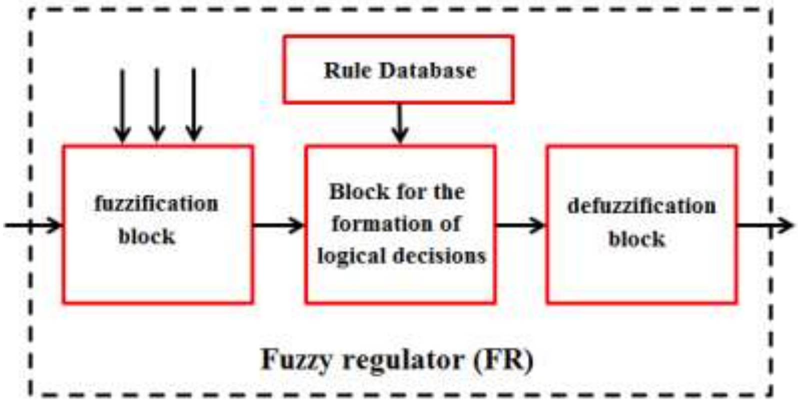

Figure 1.

Now we can briefly clarify the parameters of the components of the indeterminate rectifier, the magnitude of the input and output.

Fascification of blocks. Converting the current value of the input variables of an indeterminate constraint to the linguistic magnitude of the reality is called the act of phasing [3]. In the phase of classification, the error of the system ε, the rate of change of the error $\dot{\varepsilon}$, the acceleration of the error $\ddot{\varepsilon}$ are qualitatively described in terms of expressions of the input linguistic variables.

Let's say the system has input $u(t)$ and output $x(t)$.In this case, the continuous error of the system $\varepsilon(t)=u(t)-x(t)$ is expressed as equality. The continuous error of the system is quantized step by step by the ARI device and $\varepsilon[k]$ produces a quantization error. The error formulas for the first and second order errors are as follows:

$$\dot{\varepsilon}[k]=(\varepsilon[k]-\varepsilon[k-1])/h;\ \ddot{\varepsilon}[k]=(\varepsilon[k]-2\varepsilon[k-1]+\varepsilon[k-2])/h^2 \quad (1)$$

Preliminary separation: as input factors (initial effect) on the inaccurate correction results, we define the input magnitudes - discrete error and its subsequent order.

Block for forming logical solutions.In this case, the working rules are written on the basis of the knowledge matrix, and the working rules are

$$AGAR < boshlang'ich vaziyat > -UNDA < javob reaksiyasi >$$

understood as the linguistic rules in appearance.It represents the knowledge of the interaction of HP with the object of control (OO).

IF – THEN The effect between the inputs and outputs is related to the concept of implication (activation), which in turn represents the process of finding the degree of authenticity of each of the logical rules of this type(Figure 2).

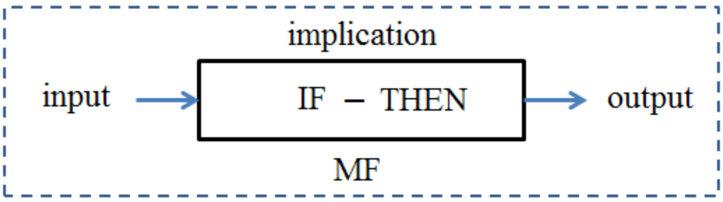

Figure 2.

The range of ε change of a variable is divided into subgroups, each of which has a TF relative to this variable

$NB, NM, NS, NZ, Z, PZ, PS, PM, PB$. The state of continuous connection with the basic concepts of an indefinite set can be seen in the diagram below (Figure 3).

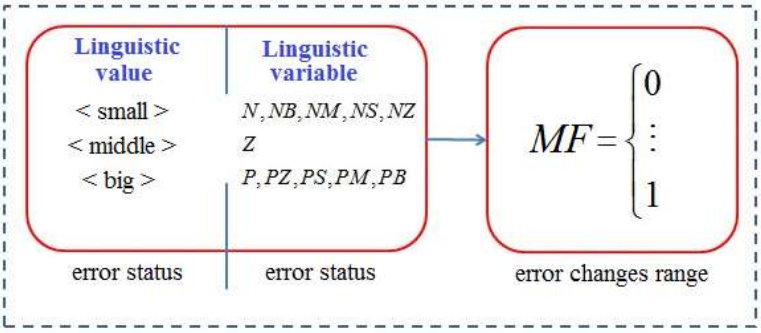

Figure 3.

Suppose that the inaccurate rectifier output variables are equal to m the number of sizes, that can be accepted and we write them m as terms:

$$A = \left(A_0 = 0, A_1 = 1, ..., A_{m-1} = m-1\right).$$

Indefinite term - we define the number of sets with the number of related functions, conditionally denote it and consider the state of its relationship.

The importance of s, m pairing quantities in the formulation of management rules is that they determine the number of all possible combinations that can lead to inaccurate considerations. However, another aspect remains open, namely the existence of the law of interdependence of these couples.

Indeed, we have the following table (Table 1).

ε	$\dot{\varepsilon}$	T_1	T_2	$\cdots$	T_s
P	PB	A_2	A_3		A
	PS	A_2	A_2		A
	Z	A_0	A_{m-1}		A
	NS	A_1	A_1		A
	NB	A_{m-1}	A_1		A
Z	PB	A_2	A_3		A
	PS	A_2	A_3		A
	Z	A_{m-1}	A_0	$\cdots$	A
	NS	A_{m-1}	A_0		A
	NB	A_{m-n}	A_1		A
N	PB	A_3	A_4		A
	PS	A_4	A_4		A
	Z	A_{m-1}	A_{m-1}		A
	NS	A_5	A_5		A
	NB	A_5	A_{m-n}		A

Here, for example, we consider the table to be completed on the basis of the following rule:

$$Агар < \varepsilon = P > ва < \dot{\varepsilon} = PB > ва < \ddot{\varepsilon} = T_1 > бўлса, унда < A = A_2 >$$

Final decomposition: a factor for optimizing the algorithm for synthesizing an inaccurate rectifier. Therefore, we take the issue of determining the level of significance of the identified factors in terms of the impact of HP on the output.

3. Problem solving method.

In solving this problem, we use the methods of inference and experimental-statistical modeling with the help of feedback analysis. We accept isolated factors as input factors. Conditional notation is performed as follows:

1 – system error $\varepsilon[k] = u[k] - x[k]$ is determined by the formula;

2 - the first-order error is determined by formula (1);

3 - the second-order error is determined by formula (1);

4 - first round TF;

5 - second round TF;

6 - the number of indefinite term sets;

7 - number of rules;

8 - output size (response function). Let the experimental values be given in the table below in accordance with the notation (Table 2).

Table 2

№	1	2	3	4	5	6	7	8
1	0,2	0,04	0,48	0	0,449329	1	15	0,6
2	0,12	0,008	0,016	0	0,527292	2	30	0,52
3	0,104	0,0112	0,0016	0	0,599296	3	45	0,408
4	0,0816	0,008	0,0016	0,0816	0,663916	4	60	0,328
5	0,0656	0,006592	0,000704	0,0656	0,720594	5	75	0,26208
6	0,052416	0,0052352	0,0006784	0,052416	0,7694	6	90	0,209728
7	0,0419456	0,00419584	0,00051968	0,041946	0,810815	7	105	0,16777
8	0,03355392	0,003355136	0,000420352	0,033554	0,845546	8	120	0,134218
9	0,026843648	0,002684416	0,00033536	0,026844	0,8744	9	135	0,107374

To estimate the magnitude of the output for each factor (8), we perform a regression analysis and calculate the key indicators. The results of the analysis are presented in the table below (Table 3).

3-жадвал.

	Coefficients		R^2	R_{ix}	Standard error	t - statistics		F - statistics
1	0,0571	3,0625	0,930	0,96	0,050	1,846	9,48	89,893
2	0,1890	11,6033	0,597	0,77	0,118	3,557	3,22	10,380
3	0,2641	0,7173	0,430	0,66	0,141	5,289	2,30	5,286
4	0,4090	-3,1265	0,290	0,54	0,157	5,041	-1,69	2,856
5	1,1255	-1,1808	0,996	0,99	0,012	53,462	-39,78	1582,734
6	0,6147	-0,0621	0,955	0,98	0,039	21,444	-12,19	148,672
7	0,6147	-0,0041	0,955	0,98	0,039	21,443	-12,19	148,672

Here in the first column there is a sequence of seven factors, in the second and third columns the coefficients of the linear regression function for each factor, in the fourth and fifth columns the coefficients of determination and correlation, in the sixth column the standard coefficient, in the sixth column the standard coefficient. The t-statistics are used to check their significance, and the F-statistics are used to check the model for similarity at the end. Based on the results of the analysis, the following comments can be made.

1) The primary error in the input of the system is the input effect for HP, the reaction of the system to it is strong, there is a linear empirical relationship (regression equation) between them, and the obtained model is reliable. The significance of this factor is high;

2) the rate of the fixed system error (first order product) of the input effect and the system response to it are moderate (not strong), there is a linear empirical relationship (regression equation) between them and the obtained

model is reliable. The significance of this factor is not high;

3) the acceleration of the fixed system error (secondary product) is the input effect and the system response to it is low (weak), there is a linear empirical relationship (regression equation) between them and the obtained model is close to the confidence limit. The significance of this factor is not high;

4) The reaction of the system to the function of type 1 belonging is low (weak), there is a linear empirical relationship between them (regression equation) and the obtained model is unreliable. The significance of this factor is low;

5) The reaction of the system to the function of type 2 belonging is very high, there is a linear empirical relationship (regression equation) between them, and the obtained model is very reliable. The significance of this factor is very high;

6) Term **-** the reaction of the system to the number of sets is very high, there is a linear empirical relationship (regression equation) between them, and the obtained model is very reliable. The significance of this factor is high;

7) The reaction of the system to the number of rules is very high, there is a linear empirical relationship (regression equation) between them, and the obtained model is strictly reliable. The significance of this factor is high.

Хулоса. It should be noted that on the basis of intelligent systems lies the concept of vague logic, which has a base of ambiguous sets. Also, the conditions for the implementation of the system will be worked out with expert information values. The conclusions obtained on the basis of the obtained expert information values (observational results) allow us to reflect on the following.

The dependence of the effect of a fixed system output with an inaccurate rectifier on system errors indicates that the knowledge base of the system is provided with certain categories of information due to the increase in the order of errors. However, the quality of this system is not significantly affected by the main input error.

It can be seen that the functions of relativity are important in the synthesis of the indeterminate rectifier that provides the system quality indicator. This is one of the important aspects of having the expected control process, that is, the problem of changing or synthesizing the functions of belonging during the model (expected) process.

Optimizing the inaccurate rectifier solves the problem of setting terms to change it, synthesizing the rule base. This is because, as noted above, these factors have a strong effect on the system response and are important for achieving the expected (exemplary) process.

We know from the results of scientific research [14] that the algorithm for achieving the expected control process includes the steps of selecting the structure of the inaccurate controller, modeling the object of inaccurate control. Without excluding them, the part algorithm for synthesizing an inaccurate rectifier can be given as follows(Figure 4).

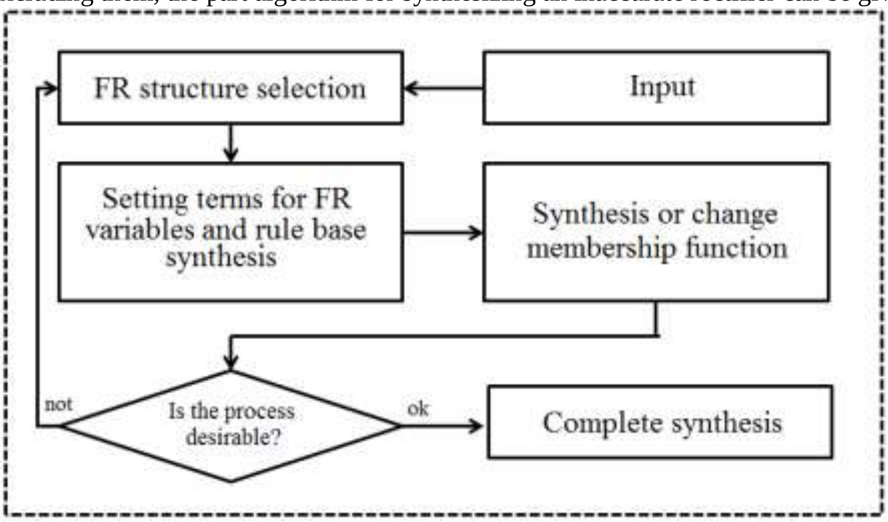

Figure 4.

The synthesis of an indeterminate straightener represents the process between the blocks "problem statement" and "modeling of an uncertain straightener". Here you can get the system error for the "input" block and its first and second order derivatives. We also assume that the choice of the structure of an indeterminate rectifier depends on the number of its input parameters. Typically, the construction of an indeterminate rectifier is the same as in the model (inaccurate perception, formation of logical solutions, transition to the exact value). Thus, in the study of the alignment system, which is considered as an integral part of the intelligent control system, it can be emphasized that determining the exact parameters of its optimal control is another important aspect of achieving efficiency.

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