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OPTIMIZATION OF SMART SYSTEMS IN CONDITIONS OF COMBINED UNEMPLOYMENT UNDER THE CRITERION OF ENERGY EXPENDITURE

Smart-control systems (SCS) - a wide class of systems in which the adoption of management decisions is based on incomplete, qualitative orcertified data using intelligent technologies. Preferably, such technologies use fuzzy logic. However, in many cases, the source data for decision-making are the results of measurements, which are characterized by random errors. Thus, Smart-systems present both stochastic and fuzzy models, which leads to a combination of uncertainty. When optimizing for the criterion of energy expenditure, the task is complicated, since energy costs for management are predominantly determined indirectly.

Questions of the influence of various sources of uncertainty on the management process are discussed in [1]. The application of fuzzy logic to making optimal solutions in various fields is considered in many articles of the collection [2], in particular [4] the relationship between statistical and fuzzy approaches is considered. An article [3] is devoted to the optimization of the energy management process.

In existing works, the problem of fuzzy optimization of stochastic systems remains open. Therefore, the task of developing optimization methods according to the criterion of energy consumption of the SMART-systems under the conditions of combined uncertainty is urgent.

Statement of the problem. It is necessary to investigate the effect of the use of fuzzy logic on the results of decision-making on controlling the minimum energy criterion based on statistical data.

To **solve the problem**, let's consider the criterion for the average energy loss on the control:

$$\overline{E} = \int_0^T \left[\int_{\Delta_X} P\, f\left(P / \Delta_X\right) dP \right] dt$$

where P - the power of control, $f\left(P / \Delta_X\right)$ - the distribution of the probability of power with the error of estimating the vector parameters of the system Δ_X. The power of control is found in the form

$$P = U \cdot \dot{X}$$

where U - control, $\dot{X}$ derivative of the vector of the parameters of the state of the system.

Let the control law be implemented by the controller on the basis of the rules base and the fuzzy conclusion of Mamdani. Modeling has shown that the asymmetry of membership functions at the edges of the range leads to a change in the distribution of probability (Example on Fig.1) and, accordingly, the optimization criterion. To correct the criterion, an additional non-linear transformation of the argument is required.

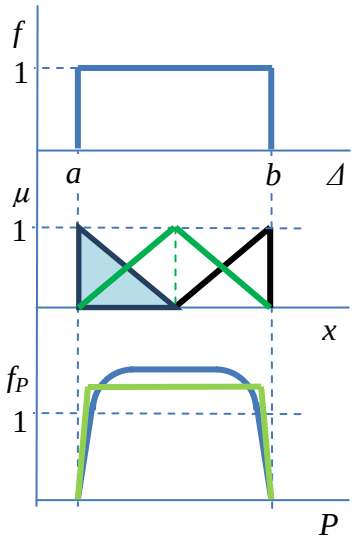

Fig. 1 – Fuzzy evolution of statistical distribution

Conclusions. The results of the study showed that the optimization of the fuzzy control system by the criterion of minimum average energy losses requires a nonlinear correction of the probability distribution function of losses.

Literature:

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