

Міністерство освіти і науки України
Національний університет харчових технологій

**80 МІЖНАРОДНА НАУКОВА
КОНФЕРЕНЦІЯ
МОЛОДИХ УЧЕНИХ,
АСПІРАНТІВ І СТУДЕНТІВ**

*“Наукові здобутки молоді –
вирішенню проблем харчування людства
у ХХІ столітті”*

Частина 4

10–11 квітня 2014 р.

Київ НУХТ 2014

6. Intellectual technology in modern control systems

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Introduction: Problem of construction of real mathematical models of the objects, systems or processes has always been highly problematic, because you can not always get clear information about the object and describe its future behavior. Modern technological systems of food production is exactly such complex technological objects of control with the characteristic features of complex systems: multifactorial, the presence of processes with different nature of physical and chemical phenomena, high levels of interference and noise, significant nonlinearities, nonstationarity, uncertainty in the evaluation of technological factors and situational behavior. The decision-making in control in such conditions is an extremely complicated problem. Therefore, to improve the efficiency of modern control systems is applied intellectual technologies that help carry out an operational collection and analysis of information received in the process of functionality of control system and helps in decision-making in control.

To the intellectual methods of control related methods fuzzy logic and linguistic approximation. They are used in the structural and parametric identification, as a result of which we need to get a real object model.

Resources and methods: The methods used in the given work to solve the problems use intellectual (language) data processing methods, fuzzy sets, neural networks theory, the theory of complex systems, chaos theory, time series analysis and methods of system analysis.

Methods of linguistic approximation and fuzzy sets are used in many modern decision making support subsystems such as analytical information system (AIS), technological monitoring subsystem and others. Exactly in this composition of subsystems we are consider intellectual technology.

Results: The control system is, for example, a distillation unit (DU), which is a unified system of closely interrelated parameters, precisely because the violation of sustainable operating mode on any one part of it leads to negative consequences in the DU overall.

However, continuous monitoring of the parameters of the distiller is a very difficult task for the decision maker operator (DMO), diverting him from other important duties. Performing the main technological operations also requires the analysis of large amounts of information. Running DU needs continuous monitoring of indicators of operating mode of columns.

In such typical situations the great help for DMO provides an additional subsystem that operates in the real time and prevents the dispatcher about the deviations from the optimal modes of work of DU and gives some recommendations. Using such system greatly reduces the chance of human error, which helps to reduce downtime, and in certain situations to prevent such a serious situation as an emergency.

In the modern theory of identification the methods of fuzzy logic is main in the construction of models for which it is possible to use Expert linguistic expressions like "If ... and ... then ...". Using linguistic rules "IF-THEN" can significantly reduce the amount of experimental data required for quality identification.

The method of identification of nonlinear dependences using fuzzy knowledge bases typically consists of two stages. The first phase is structural identification. It is a formation of fuzzy knowledge base, that crudely displays the relationship between input and output using linguistic rules «IF-THEN». Linguistic rules are generated by the expert. The second phase is the parametric identification, which is a research of the preliminary dependence by

finding such of the parameters of the fuzzy knowledge base that minimize the deviation of the model and experimental results.

In the course of solving the task of structural identification by using fuzzy logic we use two types of fuzzy models: a Mamdani type of fuzzy model and a Sugeno type of fuzzy model.

Conclusions

Thus, the task of developing and implementing intellectual technologies in modern control objects activity is very actual and requires further development, as a number of issues still remain unresolved.

Identification with fuzzy logic conclusion is one of the most effective methods for constructing models of nonlinear dependencies. Fuzzy models and algorithms for processing information allow to structure the data and to forecast the behaviour of the object in the future (for a certain period of time).

As the result of research we found that the use of linguistic information in the form of expert rules "IF-THEN" can significantly reduce an amount of required training set for fuzzy identification. The identification with Sugeno type of model usually provides high precision for large size of sample of the experimental data. However, there are difficulties in the interpretation of the content of parameters of fuzzy model and in explanation of inference. There is no such difficulty with the Mamdani model type. Its options after training are easily interpretable and intuitive for customers of fuzzy model (DM).

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