FUZZY EXTREME REGULATION OF PYROLYSIS REACTOR IN THE PRODUCTION OF ACETYLENE

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Annotatsiya. Ushbu maqola atrof-muhit omillarini hisobga olgan holda noaniq mantiqiy qurilmalar asosida asetilen ishlab chiqarish jarayonida intellektual boshqaruv tizimini ishlab chiqishga bag'ishlangan. Bugungi kunda obyektlarda texnik vositalarning mavjudligi murakkab avtomatlashtirish muammolarini hal qilish uchun ularning barcha resurslaridan foydalanishni kafolatlamaydi. Ekologiya va iqtisodiyot tutashgan joydagi kompleks mezonga yetarlicha e'tibor berilmayapti. Shuning uchun ishlab chiqarishni iqtisodiy va ekologik mezonlarga muvofiq optimal boshqarishni ta'minlaydigan tartibga solish tizimlarini yaratish muammosi juda keskin. Ushbu maqolaning maqsadi mahsulotning maksimal chiqishiga erishish va keraksiz ishlab chiqarish mahsulotlari miqdorini kamaytirish imkonini beruvchi asetilen ishlab chiqarishni boshqarish tizimini ishlab chiqishdan iborat.
Kalit so‘zlar: atsetilen ishlab chiqarish, noaniq mantiq, piroliz reaktori, intellektual boshqaruv, ekologik samaradorlik, avtomatlashtirish tizimi, optimal tartibga solish, qo‘shimcha mahsulotlarni minimallashtirish, iqtisodiy mezonlar, texnogen xavfsizlik

Аннотация. Статья посвящена разработке интеллектуальной системы управления процессом производства ацетилена на основе устройств нечеткой логики с учетом факторов окружающей среды. Сегодня наличие технических средств на объектах не гарантирует использования всех их ресурсов для решения сложных задач автоматизации. Недостаточно внимания уделяется комплексному критерию на стыке экологии и экономики. Поэтому проблема создания систем регулирования, обеспечивающих оптимальное управление производством в соответствии с экономическими и экологическими критериями, стоит весьма остро. Целью данной статьи является разработка системы управления производством ацетилена, позволяющей добиться максимального выхода продукта и сократить количество отходов.
Ключевые слова: производство ацетилена, нечеткая логика, реактор пиролиза, интеллектуальное управление, экологическая эффективность, система автоматизации, оптимальное регулирование, минимизация побочных продуктов, экономические критерии, техногенная безопасность

Abstract. This article is dedicated to the development of an intelligent control system in the process of acetylene production based on fuzzy logic devices, taking into account environmental factors. Today, the availability of technical tools in facilities does not guarantee the use of all their resources to solve complex automation problems. The complex criterion at the junction of ecology and economy is not given enough attention. Therefore, the problem of creating regulatory systems that ensure optimal management of production in accordance with economic and environmental criteria is very acute. The purpose of this article is to develop a management system for acetylene production, which allows to achieve the maximum output of the product and reduce the amount of unnecessary production products.
Keywords: acetylene production, fuzzy logic, pyrolysis reactor, intelligent control, ecological efficiency, automation system, optimal regulation, by-product minimization, economic criteria, technogenic safety

Introduction

A pyrolysis reactor is usually an extreme control object. Until recently, the main indicator of the acetylene production process was the maximum concentration of C_2N_2 in the obtained pyrolysis gases [1].
At the same time, taking into account the fact that soot is formed as a result of the reaction of such waste entering the environment in the form of dust and solid waste and in the form of contaminated water from industrial waste, the relationship of soot with the parameters of the pyrolysis process was checked. As a result, the relationship between the amount of acetylene and carbine formed was determined. Thus, the task was set to manage the pyrolysis process by environmental and economic criteria. To formulate this

management strategy, we will consider the pyrolysis reactor as a control object. As shown in the description of the pyrolysis reactor as an object of control, the main control effect affecting the amount of acetylene obtained is the ratio of natural gas and oxygen. Despite the fact that the static characteristic of the object is not stationary, one of the qualitative indicators in determining the regulator's working strategy is the time to look for an emergency. In this case, the static characteristic of CTO (Control of a technological object) should be considered semi-stationary [2].

Methodology

The pyrolysis reactor is installed in the open area next to the heater for safety. Starting gases, mixed in a certain proportion. In the main flows of methane and oxygen raw material components, the consumption (FE 10-1 and FE 11-1) and the heating temperature are measured. The consumption of methane is stabilized by the PI regulator (FC 10-2) and determines the load of the reactor. The value of the methane flow is included in the contour of the ratio regulator (FFC 11-2), which regulates oxygen consumption in accordance with the PI law on the value introduced by the operator. The accuracy of maintaining the ratio calculated on the consumption of components is ± 0.001 at an absolute value of 0.480-0.520. The load of the methane reactor is usually from 3500 to 4500 m^3/hour. In the current automation and control systems of technological processes, the extreme regulator ratio is not implemented in the contour, which includes the acetylene concentration within the framework of the standard project. In this regard, the search and correction of contacts is carried out manually by the operator, which is aimed at the value of the acetylene concentration.

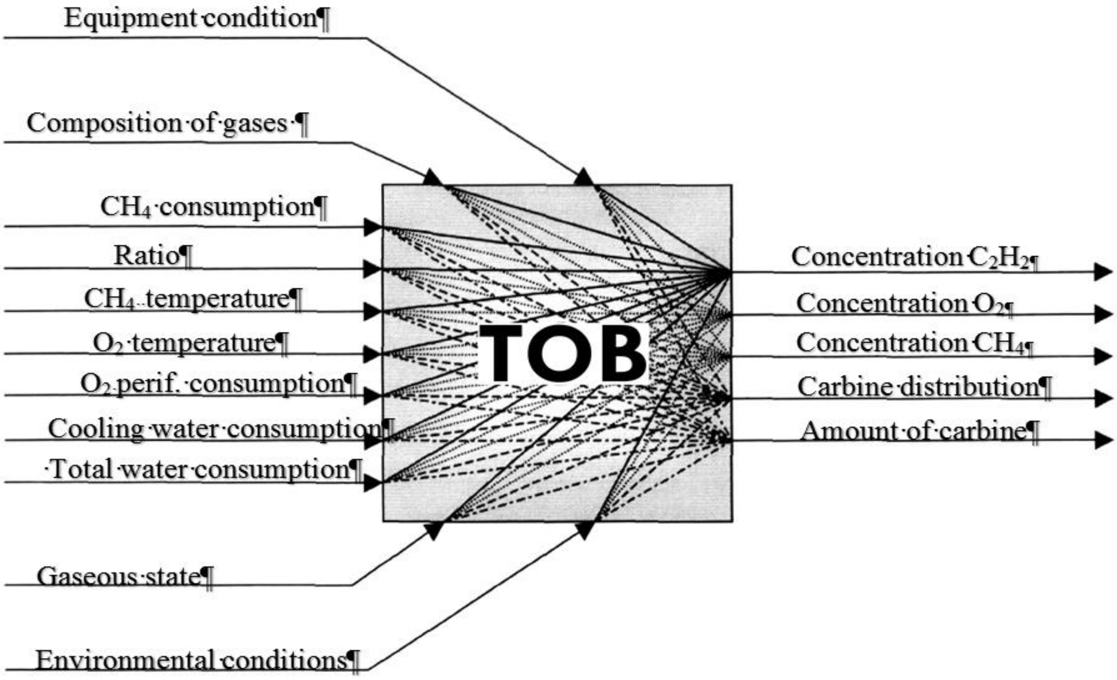

Fig.1. Scheme of interaction of technological facility management (TFM) parameters.

It takes from 30 to 50 days to repair the reactor, clean and check its mechanical properties. Nevertheless, such a small working time allows you to take the technological facility management to permanent types of objects (1-2 days), as well as the presence in the technological line of eight different reactors (due to small load capabilities). However,

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as a result of the assembly and assembly of the reactor, as well as the replacement of defective parts, its characteristics change. The turbulent flows of gases in the process and the synthesis reaction in the reactor are very sensitive to the accuracy of the production of mixing parts and combustion blocks, which leads to significant changes in the properties of control of a technological object [3,4].

In this regard, after starting the "new" reactor, the optimal parameter values will be different. 1 diagram of the interaction of reactor parameters for output of products according to the figure is shown. The control object is multi-dimensional and multi-contact. Part of the parameters cannot be measured directly. Therefore, it is possible to discard insignificant or weak impact parameters and distinguish pyrolysis reaction, taking into account unstable impact parameters. Studies in several reactors have shown that the ratio of natural gas and oxygen has the greatest effect on the concentration of acetylene. Peripheral O_2 consumption affects the change in ratio by entering the total amount of oxygen in the reaction, but its consumption is not taken into account because it is constant throughout the operation of the reactor. The remaining parameters are also constant in the pyrolysis process (temperature of gases and water consumption). Atmospheric conditions, in particular ambient temperature and secondary air pressure, change the degree of oxidation of the gas for heating, affect the temperature of methane and oxygen gases, but can only be measured indirectly. Parameters such as dispersion and coal content in pyrolysis gas cannot be measured in real time. Therefore, it is possible to control the pyrolysis process based on waste reduction criteria, using the Binding of the amount of coal to the ratio of methane and oxygen.

The dynamic characteristic of the reactor is shown above. If you delay it with first-class aperiodic element and calculate the transfer coefficient of technological facility management:

$$w'(p) = k_{ob} \cdot \frac{1}{1.2p+1} \cdot e^{-1.5p} \quad (1)$$

$$k_{ob} = f(s) \quad (2)$$

When removing the change - ratio-dynamic characteristic of the control effect, the following is significant: Δs=0,505-0,495=-0,010.

Structural scheme for the implementation of a linear offset.

Static properties of technological facility management

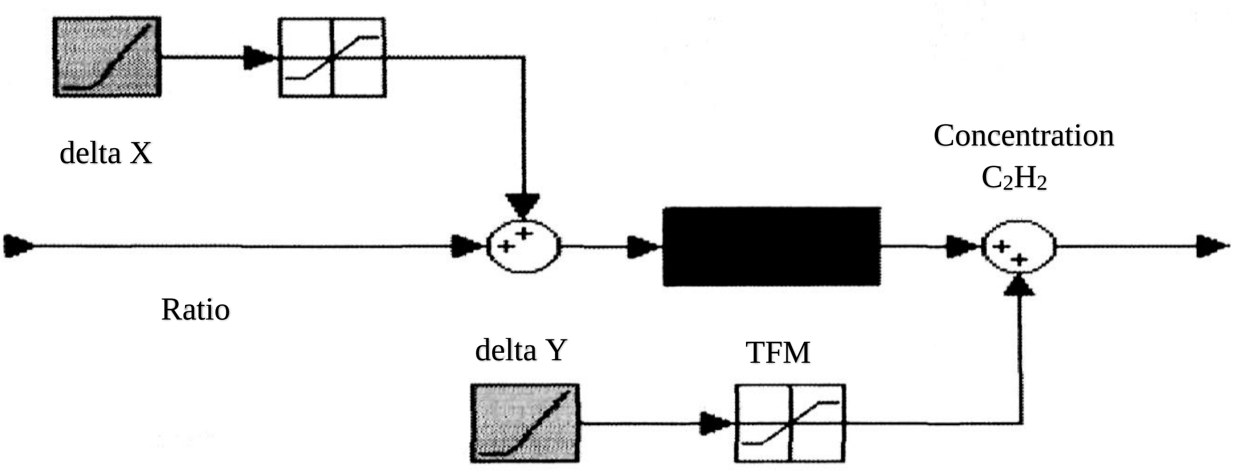

Fig.2. Implementation of linear static properties of technological facility management.

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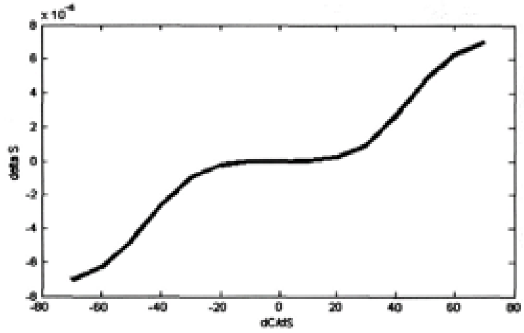
The described methods of modeling the imbalance of an object cannot actually change the shape of its static properties, which is due to the desire to slightly simplify the model. System model exhibits a static behavior with a plateau region, as illustrated in figure 3.



a) having a "plateau" area
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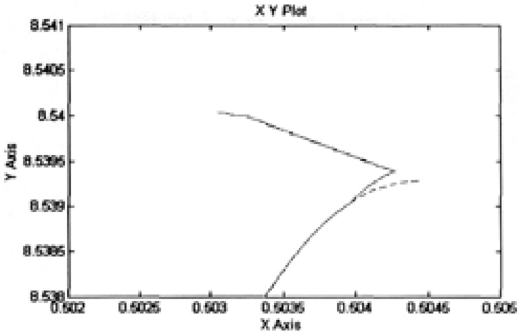

b) Having the territory of the "plateau"
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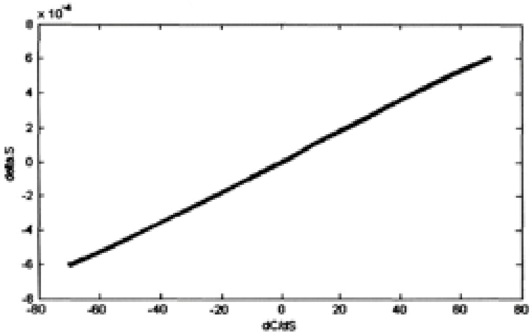

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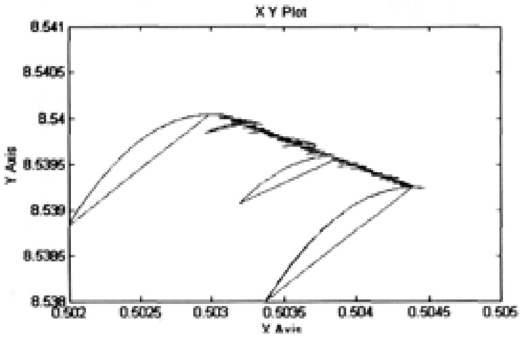

g) Having the territory of the "plateau"
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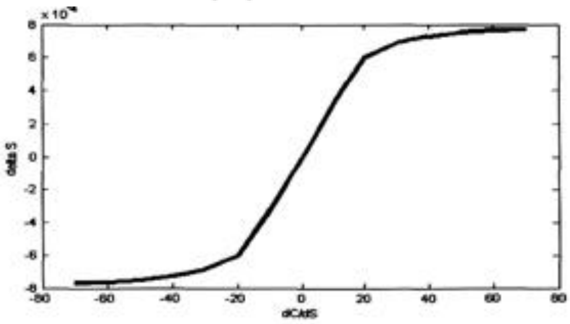

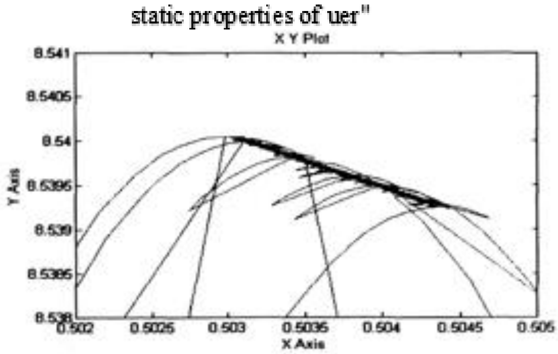

h) Having the territory of the "plateau"
static properties of uer"

j) Having the territory of the "plateau"
static properties of uer"

Fig.3. Fer extremum search graphs with different static properties when replacing an extremum under linear law.

Transitional tables are shown next to the corresponding static characteristic of the indefinite regulator. The misalignment of the static characteristic obtained experimentally at the time when the extremum was already found was simulated [5].
Thus, modeling showed the performance of the system. It is recommended to consider the plateau region as the main static property, as shown in the figure 4.

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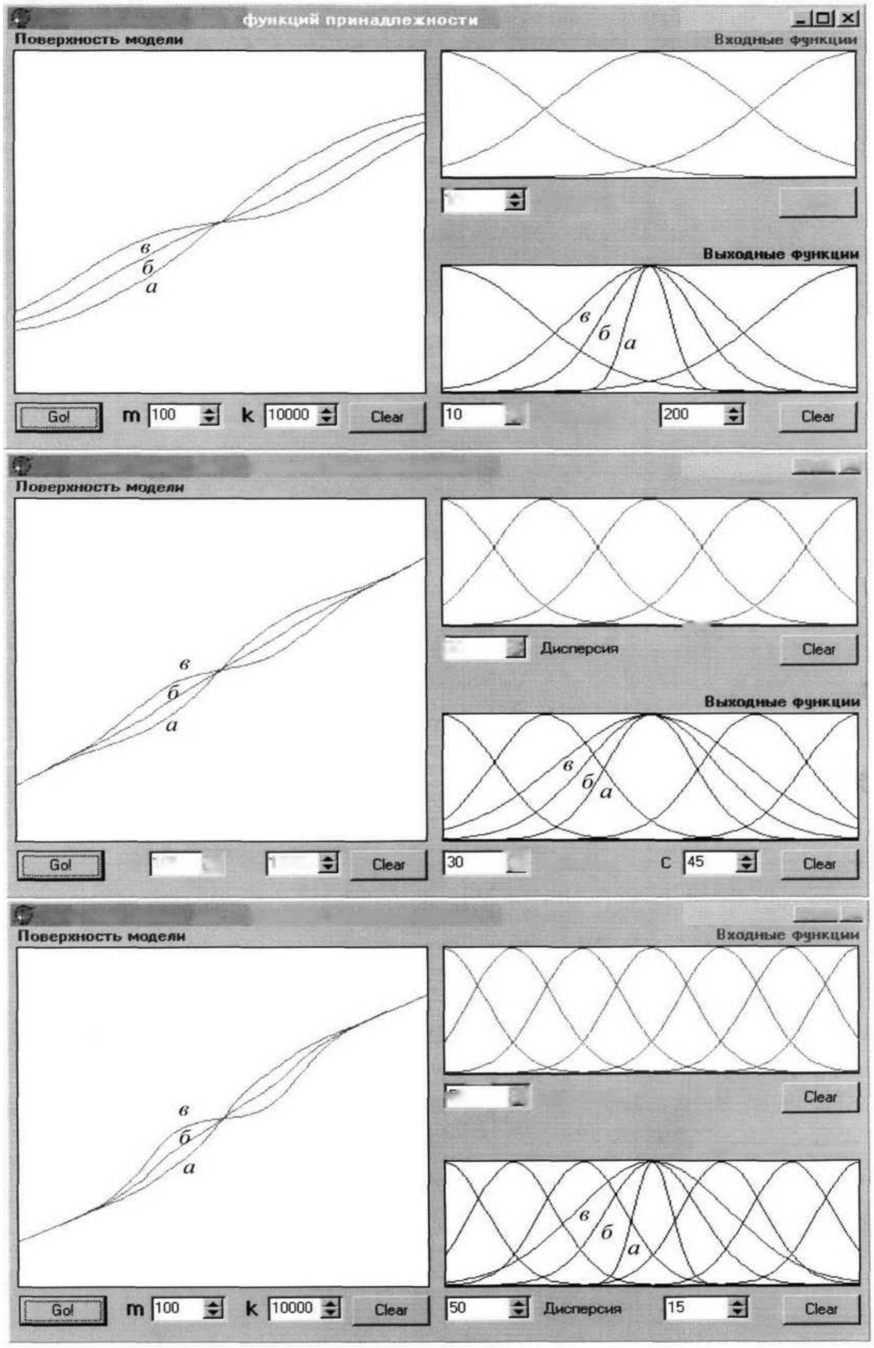

Fig.4. The dependence of the shape of the static characteristic of the unclear regulator on the number of TFs and their parameters.

Conclusion

The acetylene pyrolysis production department was analyzed to determine the technological parameters that have the greatest impact on the ecology of production. The relationship between the amount of acetylene obtained and carbine dispersion is shown. A strategy for conducting a technological process by environmental and economic criteria is proposed, which consists in automatically maintaining the operating point of a pyrolysis reactor at a distance from the extremum. In the strategy for controlling the pyrolysis reactor, determined by determining the type of static characteristic of the regulator, a method for synthesizing the fuzzy extreme regulator is proposed. Criteria for choosing the type of characteristic are the minimum time of extreme search time and the accuracy

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of storage in statics. A method has been developed that allows you to synthesize a fuzzy extreme regulator that supports the Working point of the object at a certain distance from the extremum, which provides the necessary value of the control effect, which leads to the minimization of production unnecessary products.

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