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ABOUT OPTIMIZATION TECHNOLOGICAL PROCESS OF PRIMARY COTTON RAW PROCESSING

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Abstract: *The methods of optimization of the class of separation processes on the example of the technological process of raw cotton ginning are given. Algorithms of multi-criteria optimization are presented. The problem is solved with the use of an automatic optimization system, which provides for the correction of the coefficients of the mathematical model of the process at certain intervals, and the solution of the problem of optimal control of the process of Ginning clap raw cotton.*

Key words: *multi-criteria optimization, perfor-mance criterion, optimal control, microprocessor system.*

I. Introduction

Questions of optimization of technological processes consider the example of the technological process of raw cotton ginning at the enterprises of the cotton-cleaning industry. The construction of mathematical models is associated with the development of an object management system, and the optimal management involves obtaining a given product according to a certain indicator - the criterion of efficiency. Obtaining a product of a given quality for a complex object can be achieved by changing the numerous characteristics of input variables or variables that fully characterize the internal state of the object, or both of these characteristics at the same time. The calculation of optimal characteristics provides for the establishment of such indicators of input variables and variables characterizing the internal state of the object, which would provide the required output quality in the best way, i.e. by a given criterion [1].

A common feature of all technological processes of primary processing of raw cotton, which belong to a wide class of separation, is the mass character: the number of elementary particles (volatiles, strands) to be processed is very large.

In most cases, the performance criteria are qualitative and technical-economic indicators of the technological process. These criteria include indicators of the quality of the output product, its cost, process performance, duration of the technological cycle, etc. Usually, many of the criteria are interrelatedly inversely related, and optimization based on such criteria gives conflicting results. For example, usually improving quality indicators leads to an increase in production costs, an increase in the duration of the production cycle, etc. The correct and objective assessment of the processes of primary processing of raw cotton is possible only when the processing indicator takes into account both the quantitative and qualitative side of the process. Therefore, the performance criterion must take into account the technical and economic indicators of the entire production [2,3].

The number of factors affecting a particular technical and economic indicator of the primary processing of raw cotton is large, therefore, the question of what the technical and economic indicators of the process should be in general, unfortunately, is currently for various production processes the ginning industry has not yet developed. Apparently, process indicators applied at various levels of the production hierarchy can be taken as the performance criterion. At the same time, indicators of individual production processes or workshops can be used to address the issue of optimal management of individual production processes or workshops, and enterprise indicators can be used to optimally manage the entire production. It should be noted that there is a definite connection between the indicators by which the work of an enterprise or a separate process is evaluated , and it must be taken into account when using these indicators as a criterion of efficiency.

II. Materials and methods.

The work refers to the automation of the process of primary processing of raw cotton and is dedicated to the synthesis of a system of automatic optimization of the example process Ginning clap raw cotton and raw[4].

Process requirements are dictated Ginning clap raw, firstly, the production conditions specified quality parameters of cotton fiber and cotton seeds, and, secondly, the need of the process most economic. The main requirements for the process are minimal Ginning clap raw cotton fibers and debris, reducing damage and lowered cotton seed, as the values of these parameters depend on the possibility of further processing.

Selected optimality criterion process Ginning clap raw subject to positional constraints on the input parameters of the process and the resulting mathematical model of the process made it possible to solve the problem of the optimization process.

The compromise problem under consideration cannot be solved completely by the usual stabilization of the most important parameters of the process being studied, since in real conditions of primary cotton processing it is usually not possible to avoid the influence of a number of uncontrolled disturbing influences. The solution of the problem can be solved using the system, we automatically optimize providing adjustment coefficients of a mathematical model of the process at regular intervals, and the solution of the problem of optimal control of process Ginning clap raw.

Periodic adjustment of the mathematical model of the process requires the use of reliable information about the state of the control object [5]. The lack of continuous information included in the mathematical model parameters such as the performance of the fiber y, the damage of cotton seeds, fiber debris and residual dropping of cotton seeds, forcing the model to be adjusted at a certain time interval (after receiving the results of laboratory tests) .

The basis of the construction of automatic process control system Ginning clap raw cotton and lies the choice of such structural interrelationships of individual units that would ensure the complexity of processing primary data and the issuance of effective information by management bodies at all levels of the object under control. The operation of the control system is associated with the implementation of methods for optimizing managed processes. The structure of the control system should be based on the principles of minimizing the number of stages and taking into account the simplest links between the subsystems and the elements of the general scheme.

III. Results.

For solutions this problem has developed a system of automatic optimization process Ginning clap raw cotton and raw (Figure 1) .

The optimization system works as follows [6].

The operating memory of the control computer using the device for communication with the object is entered information that comes from the control system of technological equipment, manual input data, representing the results of laboratory tests, as well as regulatory information. Poll values of parameters such as the fiber performance, damage of the cotton seed fiber clogging spine and lowered cotton seeds produced after a certain time.

During the processing of the information received, the values of the indicated coordinates are averaged over the time interval between two polling cycles according to a recurrent expression:

$$\bar{V}^{n} = \bar{V}^{n-1} + \frac{1}{n}\left(V^{n} - \bar{V}^{n-1} \right),$$

where $\bar{V}^{n}$, $\bar{V}^{n-1}$ - the values of the measured coordinates, averaged, respectively "n" and "$n-1$" polls;

V^{n} - instantaneous value of coordinates in n- th poll [7].

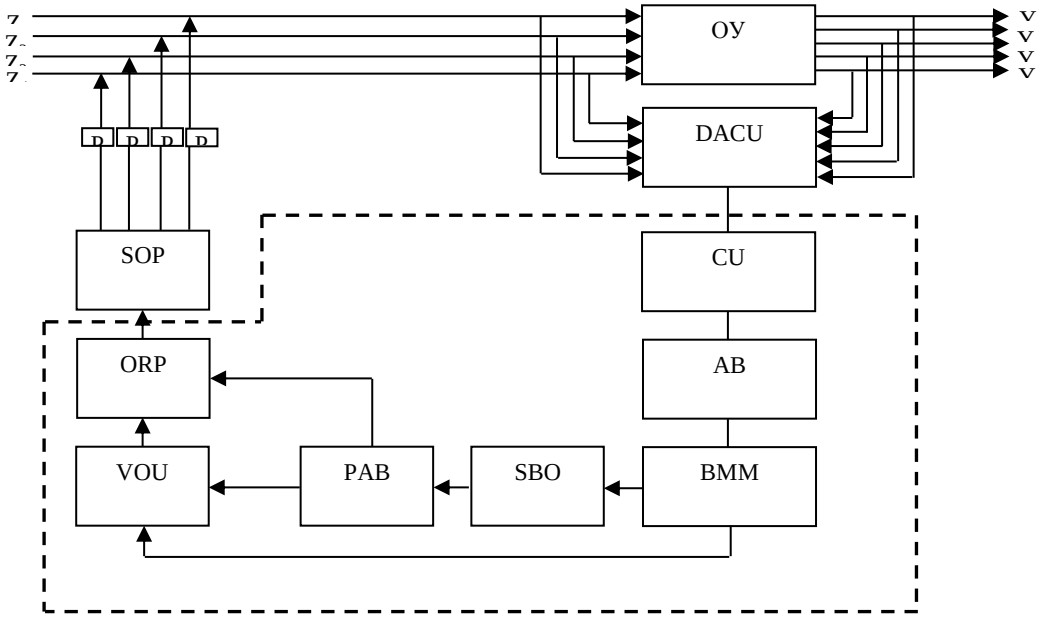

Figure 1**. Functional-structural diagram of the automatic system process optimization Ginning clap raw cotton**

Next, the averaged information from the data analysis and conversion unit (DACU) enters the comparison units (CU) and adjustments (AB), where refined model coefficients. In the block of the mathematical model (BMM) Calculate th tsya mathematical model of the process. The results obtained are compared by the corresponding output values of the object stored in the memory of the machines. In accordance with the specified optimization criteria in the scalar block optimization (SBO) searches for a set of optimal values of input process parameters. The optimal values of the process parameters are received in the process analysis block (PAB), where they are checked for accuracy. When the number of criteria is more than one, PAB sends information to the vector optimization unit (VOU). If the number of criteria is one, then the PAB transmits the information to the optimal Regulator Parameters (ORP). The results of the calculations are transmitted to the block for setting the optimal parameters (SOP), which sets the optimal parameters of the regulator and maintains these values until the next information is received. Regulators (PO_1, PO_2, PO_3,PO_4) affect the input parameters of the object according to the signals from the SOP.

Thus, the control and management stabilizes the process parameters, allows you to accurately and quickly adjust the technological modes of operation of the unit when conditions change, as well as to obtain the necessary technical and economic information for a complete and timely analysis of the process and making appropriate decisions [8].

From the analysis of aggregation, and also from the operating experience of the system determined that the most acceptable in the system of automatic control process Ginning clap raw cotton and is the use of a microprocessor device. As expected microprocessor device using e industrial controller. The microprocessor system consists of: an

adjustable electric drive feed rollers, made on the basis of an asynchronous AC motor with a gear motor and a frequency conversion device; devices for measuring power consumption (energy consumption) by the engine of the gin saw cylinder ; block microprocessor information processing and generation of control signals; actuator.

The basis of the microcomputer system is put the fact that to the amount of raw cotton and fed to the work at optimum gin corresponding to certain Single consume power (power consumption) of the saw cylinder engine it linters. If this value is exceeded (in case of excessive energy consumption), it is necessary to reduce the supply of raw cotton to gin through the control unit and vice versa. Information about the state of the engine load (power consumption) of the saw cylinder gin and is obtained from the sensor and power.

Based on the above reasoning, the main components and mechanisms of the automatic control system were selected.

Developed and manufactured by the control system automatically process Ginning clap raw cotton and introduced at the Buka Experimental Cotton Ginnery and obtained positive results.

IV. Conclusion

The introduction of the automatic control system of technological process Ginning clap raw cotton and raw It leads to: gin increase performance at the expense of fiber uniformly supplying a raw cotton; the exclusion of the formation of faces; reduce downtime; energy savings; ensuring the conditions of safety and labor protection. The expected annual economic effect from the introduction is 150.5 million sums per system.

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