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INFORMATION-ALGORITHM SYSTEM OF TECHNOLOGICAL MONITORING BY THE PARAMETERS OF CONTINUOUS PRODUCTIONS

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Abstract: Modern industrial enterprises are characterized by large volumes, complexity and interconnectedness of streams of operational and static information about the technological process. The process of its accumulation and processing is one of the most important in accounting, control of functioning and production management, which leads to the creation of an integrated information database to automate the solution of management problems. To solve this problem, it is proposed to create an information-algorithmic system for technological monitoring of production processes. In the conditions of complexity, dynamism and indistinctness of the characteristics of production processes in industrial enterprises, the development and accumulation of knowledge about the models of the object, methods of solving automation problems, as well as the corresponding tools that allow to effectively maintain and develop, the information management environment are becoming more and more in demand.

Keywords: technological monitoring, information flow, situational model, algorithm, production situation.

Introduction

Large volumes, complexity and interconnectedness of streams of operational and static information in accounting, control of the functioning and control of processes of dynamic objects leads to the creation of an integrated information database for automating the solution of control problems in industry.

To solve these problems, both completeness and reliability, and complex processing of all accumulated technical and technological information about the processing of raw materials are required. This information usually accurately characterizes the structure, properties and processes in industrial plants. In the integration of these data, in their complex processing with the help of adequate models and tools for collecting, processing and storing data, there are significant reserves for increasing the efficiency of operation of technological equipment and production. In this regard, it seems very important to create an information-algorithmic system of technological monitoring in the tasks of operational control of the processing of raw materials [1-3].

The activity of modern industrial enterprises (IE) is associated with the movement of interrelated and volumetric flows of material and information resources, characterized by partial uncontrollability and stochasticity. The management of such resources in a dynamically changing environment requires prompt decision-making in a short time. The solution of this problem in modern conditions is impossible without the use of the achievements of modern information technology [4-6].

The main drawback of the existing production management system is the discrepancy between the rate of production and the receipt of information, about its indicators, that is, the receipt of information to the management about the main indicators of the production and economic activities of the enterprise for an operational analysis of its work significantly lags behind the progress of production. Such a delay, inconsistencies in time lead to a depreciation of information about the operation of technological units, does not make it possible to timely determine deviations from operational plans in the process of their implementation, to identify the reasons that caused these deviations, to reveal internal production reserves,
to take effective measures for their rational use. Obviously, all this will lead to a significant decrease in the efficiency and effectiveness of production management [8, 12-13].

The above factors and analysis, existing systems indicate that improving the control systems for the production processes of raw materials processing is not possible without creating an information and algorithmic control system for technological production processes, the main task of which is technological monitoring of enterprises and obtaining operational information about the current state, as technological units, and the whole complex in the development of management decisions [10-14].

Solving problems
To solve this problem, the process of processing raw materials is functionally decomposed into sub-processes, the structures of which change over time depending on factors such as changes in the requirements for the quality of the finished product and the raw material of raw materials, as well as on the operating modes of the units, changes in the technological regulations and production situation [5, 8, 12, 14].

With this approach, for the formal description of technological processes in dynamic objects, it is proposed to single out the variables characterizing the controlled and controlled information parameters of the process of processing raw materials and their set of values and \( x_1, \ldots, x_n \) and \( y_1, \ldots, y_m \) and many of their values \( X_1, \ldots, X_n \) и \( Y_1, \ldots, Y_m \). On these sets, the relationship is defined \( Q_i (i \in I) \), forming joint relationships of variables \( X_1, \ldots, X_n \) and \( Y_1, \ldots, Y_m \). Function \( f_j (j \in J) \), matches variables \( x_1, \ldots, x_n \) with variables \( y_1, \ldots, y_m \), with

\[
X = \bigcup_{i=1}^{n} X_i, \quad Y = \bigcup_{j=1}^{m} Y_j.
\]

Then the relationship from \( Q_i (i \in I) \) will be defined on sets \( X \) and \( Y \), a functions \( f_j (j \in J) \) in General, they will be multi-valued functions from \( X \) and \( Y \). For this object, the system \( Q \) it turns out to be a family of shared connections \( Q_i (i \in I) \) between variables \( x_1, \ldots, x_n \) and \( y_1, \ldots, y_m \) together with the specified family of functions \( f_j (j \in J) \), matching variables \( y_1, \ldots, y_m \) in a place with variables \( x_1, \ldots, x_n \) according to multiple goals

\[
V : Q = (X, Y; Q_i; f_j; V).
\]

In this case, the operation of the system at each moment of time is characterized as the \( r \)-and phase \( s \)-as to regime \( j \)-as on the process of functioning on \( \lambda \)-the hierarchy level. Dividing the process of functioning of a complex system into phases, modes, and hierarchy levels allows you to get more reliable information about the process and significantly simplify its description.

To connect the information flows received from various technological units, we fix and mark the set of input \( X \) and output \( Y \) information flows of each unit of the system \( Q \).

Sets of input \( X^{(j,k)} \) and output \( Y^{(j,k)} \) information \( Q_j \), flows that are interconnected in terms of information are determined by relations.

\[
X^{(j,k)} = G_{bj}^{-1} ([Y_t^{(j,k)}) \cap G_k ([X_t^{(j,)})]), \quad Y^{(j,k)} = [Y_t^{(j,)}] \cap G_k ([X_t^{(j,)}]).
\]

Here, the operator \( G_{bj}^{-1} \) defines the relationship between the input and output parameters \( J \)-of the aggregate. Sets of input \( X_t^{(j,)} \) and output \( Y_t^{(j,)} \) information of all aggregates of the system are determined by the following relations:

\[
[X_t^{(j,)}] = \bigcup_j [X^{(j,0)}] \quad \text{and} \quad [Y_t^{(j,)}] = \bigcup_k [Y^{(k,0)}].
\]
In accordance with this scheme for interfacing information flows, the analysis of the functioning of each technological unit and the process as a whole is carried out.

Information about various production situations (emergency, normal, pre-emergency, etc.) arising during the operation of the facility, a lot of heterogeneous information about the process of processing raw materials, uncertainty in assessing its condition and ambiguity in the choice of decision-making methods that are characteristic of process control, cause the need to build situational models that allow quantizing information flows in time [5-8]. The situational model of the process, processing of raw materials as a control object is presented in terms of the accepted signature

\[ M_{OV} = \{O, \Omega, \Omega_{\delta}, P_3(\Omega), P_i(\Omega_{\delta})\}, \]

Where \( O = O_{ov} \cap O_{ov} \) — a lot of information about the parameters of raw material processing processes (drying, cleaning, evaporation, etc.)

\( O_{ov} \) — a set of parameters that characterize the control object

\( O_{ov} \) — a set of elementary operations;

\( \Omega = \{O_1 \times O_2 \times O_3 \times ... \times O_n\} \) - state space of the control system, \( n \) - the amount of information on processing of raw materials;

\( \Omega_{\delta} \) - many technological regulations for processing raw materials \( \Omega_{\delta} \supseteq \Omega; \)

\( P_3(\Omega) \) — the restrictions in the technical regulations, \( P_3(\Omega) \rightarrow \Omega_{\delta}; \)

\( P_i(\Omega_{\delta}) \) — rules for switching modes of operation of aggregates in the state space (choosing the trajectory of movement); rules for switching modes of operation of aggregates in the state space (choosing the trajectory of movement): \( \Omega_{\delta}^1 = P_i(\Omega_{\delta}^2), \quad \gamma(\Omega_{\delta}^1, \Omega_{\delta}^2) \) - the state of the control Object in the process of transition Production \( i \)-situation \( S_j \) it is possible to represent a control Object on a set of States in accordance with the accepted concept designations as

\[ S_j = \{\Omega_{\delta}^i, P_{ij}(\Omega_{\delta}), U_K(t), \Omega_{\delta}^K, \varphi(\Omega_{\delta}^T, U_K(t))\}, \]

where \( \Omega_{\delta}^S_i \) - the set of Control Object States that make up the situation \( S_j \); \( \Omega_{\delta}^T \) - current state of the control Object; \( P_{ij}(\Omega_{\delta}) \) - the rules of forming the state \( \Omega_{\delta}^S_i \); \( P_{ij}(\Omega_{\delta}) \rightarrow \Omega_{\delta}^S_i \) for the control Object during the transition from \( j \)-th to \( i \)-th situation; \( U_K(t) \) - control actions aimed at the final state of the control Object in accordance with the control goal; \( \Omega_{\delta}^K \) - control actions for the transition of the control Object from the current to the new \( \Omega_{\delta}^H \) state, \( \Omega_{\delta}^H = \varphi(\Omega_{\delta}^T, U_K(t)) \).

A set of interconnected functional blocks based on information flows of input and output values of parameters and execution mechanisms determine the organizational structure of the information organizational system for technological monitoring of the raw material processing process.

Thus, at any arbitrary time, the state of the enterprise aggregates \( S \) is characterized by the aggregate

\[ P_3 = \{X(t), Z(t)\}, \quad \gamma(\Omega_{\delta}) \] - a set of generally related parameters, and both the values of these parameters and their composition depend on time, \( Z(t) \) - multiple values of these parameters. Change \( Z(t) \) и \( X(t) \) happens situationally, e.t.c

\[ (X(t_{i+1}), Z(t_{i+1})) = F(X(t_i), Z(t_i), A(t_{i+1})), \]
where $X(t_{i+1}), Z(t_{i+1})$ - values $X(t_i), X(t_i)$ after completion $(i+1)$- situations; $t_i, t_{i+1}$ - time of completion of two consecutive $(i$- and $(i+1)$- situations; $A(t_{i+1})$ - paraphernalia $(i+1)$- events; $F$ - functional dependence of input and output variables arising from current production situations.

**Conclusion**

The effective implementation of an information-algorithmic decision support system in the tasks of technological monitoring and control of the raw material processing process allows analyzing various production situations, predicting possible emergency situations and choosing the best mode of operation of technological units. It also allows you to increase productivity and meet the requirements for production with a focus on solving the tasks.

1. The information flows of the raw material processing process are structured to ensure the interconnection of information in the organization of a unified information base of the technological monitoring and control system of the raw material processing process

2. Situational models of technological processes of raw materials processing have been obtained, allowing determining various production situations in the process of functioning of objects.

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