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AUTOMATED SYSTEM OF THE PROCESS OF ACCOUNTING AND CONTROL OF DIVICES OF THE RAILWAY AUTOMATION AND TELEMECHANICS

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Abstract:

Transport processes, especially from the point of view of the analysis of functioning of the automated technological complexes, including management and control of systems and devices of railway automation and telemechanics, are naturally formalized with application of schemes of mass service. the methodology of description of electronic document flow of technical documentation (EDMTD) in automation and telemechanics economy is based on allocation of the following components: control levels, technological chains according to the selected levels of hierarchy and algorithms of technological processes (TP) of the studied EDMTD.

The formalized EDMTD scheme is synthesized on the basis of the generalized formalized scheme (GFS) of complex Queuing systems proposed by the authors in [4,5]. The content of the conceptual model (model description) is formed in accordance with the selected components based on the results of the survey of real processes of EDMTD. This allows us to move from a description model to a formalized scheme [6], which serves as the basis for the development of automated technology and simulation model (SM) of EDMTD, designed to assess the effectiveness of the system engineering decisions. A formal model is defined by a pair of disordered sets: a) a set of variables-parameters; b) a set of relations linking the values of these variables.

Keywords: Railway automation and telemechanics, electronic document management of technical documentation, graph theory, model of electronic document management, formal presentation of technical documentation

The transition to new technologies of automated control necessitates the development of electronic document management systems that provide effective support for decision-making at all stages of development, implementation and operation of systems and train traffic control. When creating systems of railway automation and telemechanics, modern design methods are not always used, the organization of interaction of the involved organizations, quality control of work performance, automation of input and receipt of information. As a result, the terms of design, construction and commissioning of systems increase, unproductive time expenditures, it is more difficult to plan the timing of the completion of work, it is impossible to make corrective management decisions in a timely manner and, as a result, the cost of work is significantly increased.

Today, in the world practice in the field of automation, the leading place is occupied by the creation of highly efficient control systems for technological processes with the involvement of intelligent technologies. Further development of intelligent control technologies in railway transport makes it possible to implement perfect technical systems with high performance characteristics and advanced functionality.

In this regard, the creation of an integrated monitoring and management system for design, construction, commissioning, supplies of devices, materials and equipment, as well as analysis of the quality of work performed on the basis of electronic document management of technical documentation (EDTD) is relevant.

The use of electronic document management is due to the increasing complexity of systems and, as a consequence, the huge volumes of transmitted and processed information. For example, a visual check of a project for electrical interlocking of a station without the

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use of technical means in time can be comparable to the design time of a system. Thus, without the use of means of complex automation of the processes of obtaining information and information exchange, it is impossible to reduce the time and increase the efficiency of work.

graph was practically implemented in a software package and is the basis for storing data on the architecture of the simulated document management system.

Consider the logic diagram of the algorithms of the process of maintaining custom specifications of the algorithm A11.

$$A11 = b_{111}\downarrow^{111} b_{112}\alpha_{111}\uparrow^{111}\downarrow^{117} d_{111}\alpha_{112}\uparrow^{112}\alpha_{113}\uparrow^{113}\upsilon_{119}b_{113}\omega\uparrow^{116}\downarrow^{113}\upsilon_{111}\downarrow^{116}\upsilon_{112}\upsilon_{113}\times$$
$$\times\upsilon_{114}\upsilon_{115}\upsilon_{116}\upsilon_{117}\upsilon_{118}\alpha_{114}\uparrow^{114}\downarrow^{114} b_{115}b_{116}b_{117}\upsilon_{111}\upsilon_{1112}\downarrow^{112}\upsilon_{1110}b_{114}\alpha_{115}\uparrow^{115}\upsilon_{+}\omega\uparrow^{117}\downarrow^{115}\upsilon_{J}$$

To display the transient process, in the algorithmic description using graph theory, we construct a transition graph (fig. 1).

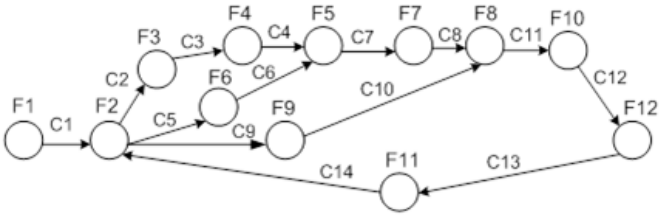

Fig. 1. Graph model of algorithmic description A11

The graph model uses the following conventions:

- documents changed in the state used in the modeled process – F1,…, F12.
- algorithms to change states – C1 ,…, C14.

Possible chains (S) of Algorithm A11 in the graph model:

S1=F1C1-F2C2-F3C3-F4C4-F5C7-F7C8-F8C11-F10C12-F12

S2=F1C1-F2C5-F6C6-F5C7-F7C8-F8C11-F10C12-F12

S3=F1C1-F2C9-F9C10- F8C11-F10C12-F12

S4=S1-S2-S3-C13F11C14-S1-S2-S3

Formally, the EDTD process is represented in the form of three finite sets and connections of the elements of these sets with each other. The mathematical notation of this process is presented as a triplet

$$D_T = \{U, P, F\}$$

where D_T is a formal model of electronic document management of technical documentation; U - many participants; P - many processes; F is a set of states of technical documentation (TD) with admissible ranges of values.

The set of participants is defined as a finite set of actual participants in the workflow, P – as a finite set of processes that are performed within the considered document flow system by participants from the set U. F is a finite set of states that the TD can take after the processes from the set P are executed by participants from the set of participants.

The logical level of the formal model of the TD workflow is implemented using the graph theory apparatus. When building a graph model of the TD document flow, it is proposed to use the following method of displaying the TD document flow in graphs. To specify the set of vertices of the graph, we will use the set of possible states F. The edges of the graph are specified using the set of processes P. We establish this correspondence in such a way that the following rules are fulfilled:

- one vertex of the graph corresponds to one and only one element of the set F;
- one element of the set F corresponds to one and only one vertex of the graph;
- one element of the set P corresponds to one and only one edge of the graph.

As a basis, we will consider the general technological process of maintaining custom specifications (MCS) of railway automation and telemechanics (Fig. 2), presented in the article [2].

The process consists of the following steps:

1) The design organization draws up custom specifications (CS) on the basis of the completed project for objects under construction or reconstructed.

2) Compiled CSs are approved by the Automation and Telemechanics Service.

3) After that, the CSs go to the capital construction department. Based on these data, it is determined which equipment needs to be ordered by manufacturers. Since there are several hundred items of equipment and instruments in the ZS, the probability that only one plant produces them is very small. Capital construction department shares the equipment specified in the CS between suppliers.

4) Suppliers, in turn, give an order to the plant to fulfill the order.

5) Upon completion of the work, the plant sends the equipment to the distance warehouse.

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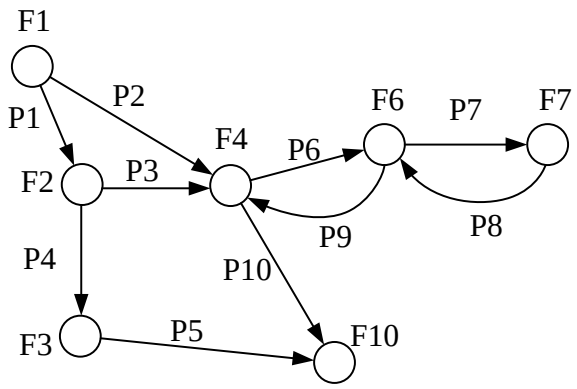

Fig.2. Graph of the technological process for maintaining custom specifications of railway automation and telemechanics

The demand for high-speed rail transport is increasing, which reveals the need to update and modernize the systems and devices of railways, to develop modern information technologies for electronic document management.

Based on the methodology for constructing a conceptual model of document flow systems for technical documentation and a composite document flow model, this article presents a graph and automaton model of electronic document flow of technical documentation, and their implementation in a software module.

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