INTELLECTUAL DEVELOPMENT OF OPERATIONAL MANAGEMENT SYSTEM OF TRANSSHIPPING PROCESSES AT THE SEAPORT

РАЗРАБОТКА ИНТЕЛЕКТУАЛЬНОЙ СИСТЕМЫ ОПЕРАТИВНОГО УПРАВЛЕНИЯ ПЕРЕЗАГРУЗОЧНЫМИ ПРОЦЕССАМИ В МОРСКОМ ПОРТУ

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Abstract: *The paper describes the methods for the design of systems for implementing intelligent control of transshipping processes at the seaport. Movement of cargo flows requires a constant solution of singular case transportation problems of operational planning and management. The paper shows how the obtained mathematical models of management of cargo flow movement processes, allow for solving optimization problems of the divergent options of bulk cargo movement within the Functioning of infrastructures within a seaport, as well as their communication with suppliers and consumers of loads within the transshipping complex. Modeling of different options bulk cargo movement is needed for providing the given intensity of ship loading taking into account various factors, including weather. The designed model allows for solving the scheduling problems the execution of works on cargo handling in the seaport terminals.*

KEYWORDS: INFORMATION-MANAGEMENT SYSTEMS, INTELLECTUAL SYSTEMS, SIMULATION MODELING, TRANSSHIPPING.

1. *Introduction*

The analysis of the current state of management practice in technical systems shows the need to create automation tools allowing for providing optimal management of technological processes (TP) in real time. The implementation of such an approach is possible only in the presence of the integrated information-management systems (IMS) ensuring the solution of a wide range of problems in the automated control systems (ACS) of TP. In the existing control systems, there are no components ensuring the solution of analytical (not to mention intellectual ones) problems. This is due to the fact that the implementation, for example, of the functions of decision-making support by operational personnel of ACS TP, requires designers of these system to have knowledge not only in their own subject domain, but also the knowledge of specifics of technological processes and their management, that is the knowledge relating to other subject domain. For IMS designers, it is easier to confine themselves to the creation of the standardized information system of SCADA type (Supervisory Control and Data Acquisition System). When assessing the situations and decision-making, operational personnel, using information provided to it, will work the old-fashioned way, that is without intellectual support from such systems [1,2].

Creation of the new-generation intellectual systems (IS) for management the complex TP in different conditions of interaction with an external environment, is one of the urgent tasks of practical applications of methods of artificial intelligence and cognitive simulation in general [3]. The functional capabilities and the IC interface significantly depend on the possibilities of the formalized description and a completeness of the use of all diversity of mathematical methods of data processing. In this regard, of particular relevance is the problem developing special formal technique providing uniform representation of the models synthesized by means of different methods and means for the purpose of unification of operations of their processing in a computing environment[1,3].

2. *Preconditions and means for resolving the problem*

Complexity of management of cargo handling technological processing in terminals at the seaport is defined by a variety of works by their nature and labor intensity, the stochastic nature of the intensity of transshipping processes and the wait time spent of the delivery systems and cargo handling at the port, a continuity of transshipping works, and on the dependence of the activity of the cargo port on the cargo fleet movement. Competition between transshipment facilities for taking over cargo requires them to improve the quality of cargo handling, increase the intensity of performing cargo, warehouse and other works. Peculiarity of technological processes at the port consists in their continuous development conditioned by changing the needs for cargo handling, and by the constantly changing situation at the port and in the regions it serves. . The specified factors result in impossibility to describe analytically and design the formal models that considerably reduces the efficiency of management of similar low-formalized technological processes, and often even makes it impossible. As the tool for the analysis of the activity of the port, there has been chosen the simulation modeling. During the simulation modeling, the algorithm realizing the model reproduces the process of the functioning of the considered system in time, and there are simulated the elementary phenomena composing the process with the preservation of their logical structure and the sequence of the course of technological processes in time enabling, by initial data, to obtain information about conditions of the process at the certain points in time and allowing for assessing the system characteristics. The modelled system represents the service process of the requests flow for the execution of cargo-handling operations on ships and in wagons with goods.

At the same time, it is characterized by it is occasional emergence of the requests for services, and also by the completion of cargo-handling processes by cranes and loaders in irregular intervals. The considered process is of a continuous-stochastic and accidental nature. The block diagram of cargo handling

technological processes at the port is given in Fig. 1.

Meanwhile, baseline information has been used for correlation analysis carried out for the purpose of the solution of two tasks: definition of stochastic communication between parameters and assessment of strength of relationship of factors and the resulting indicator.

The task of optimizing management of transshipping processes is as follows: in the transport hub, there is some number of loading and unloading points, the number of identical vehicles and the number of the flows of cargo passing through the transport hub. It is necessary to arrange a route of movement of each flow of cargo and of vehicle within the transport hub to provide a minimum of costs of transportation of goods and reduction of time for processing of vehicles.

For imitation of the obtained model it is offered to use a Matlab software Simulink package. Simulink is an interactive environment for modeling and the analysis of a wide class of dynamic systems by means of the block-diagrams, which may be combined in the component blocks that allows for using hierarchical representation of the structure of model, thereby providing the simplified view of components and subsystems [3].

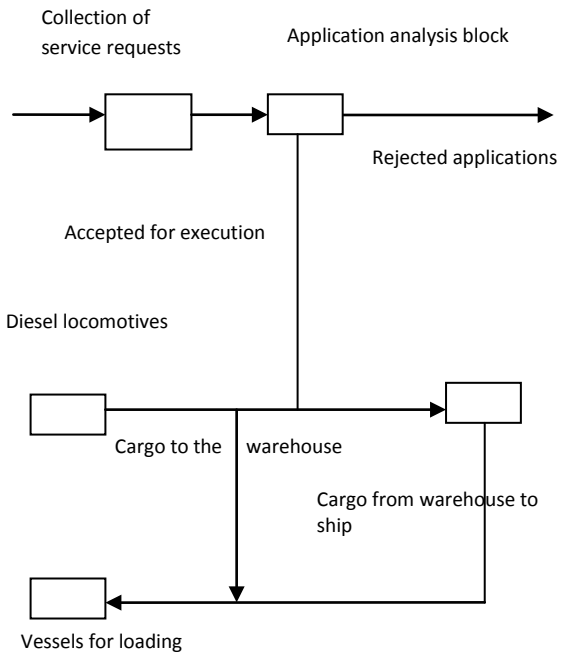

Fig. 1. The block diagram of cargo handling technological processes at the port

Figure 2 illustrates the model of transshipping processes of the transport hub. The model presented in Fig. 2 is composed of three sub-models implemented as the separate blocks - way 1, way 2 and way 3 blocks (Subsystem components). By means of keys, it is possible to choose a necessary way of transshipping processes. The addition blocks summarize expenses on transshipping processes taking into account transit factor.

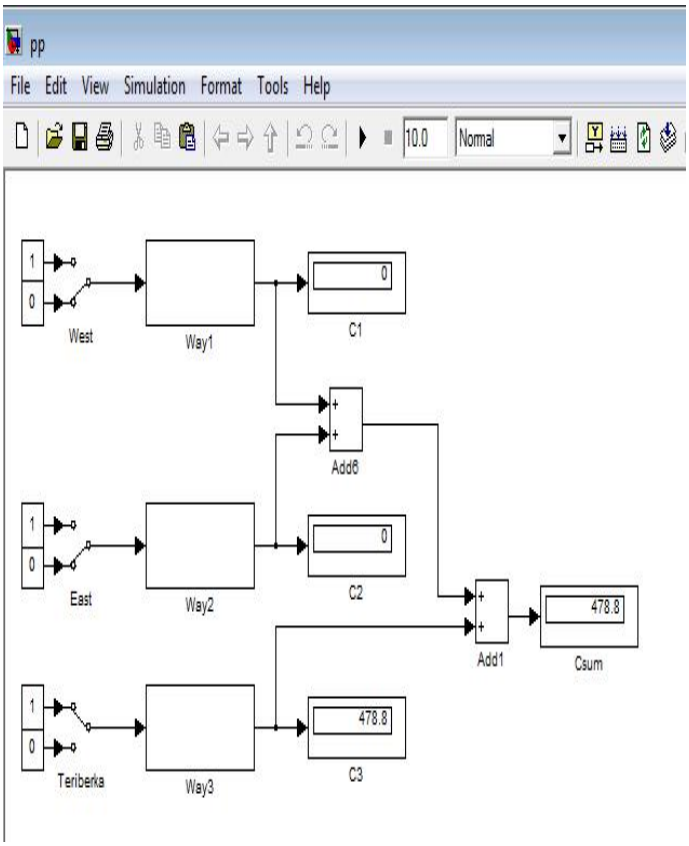

Fig2. A graph-model of transshipping processes

3. Conclusion

Thus, using the model developed in a Simulink package, it is possible to estimate costs of transshipping processes by various vehicles and methods. From this point of view, it ispossible to optimize process of cargo transshipping byeconomic criterion, such as a total complex expense of movement of cargo flow.

4. References

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