

Methods of Computer Simulation Based on Shared Digital Platform

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Abstract

The model of the Shared Digital Platform is investigated, possessing the properties of the innovative control of kinds of activity of the organizational systems of using cognitive technologies for an integral informationally controlling medium. Analysis of those innovative methods of a support of activity that insure the given properties and consider the boundary conditions of stable functioning of the computational resources of the Shared Digital Platform is made. On the base of analysis results, the task of definition of the application domain of the given methods for the processes of the support of modeling of the objects of technogenic, natural and anthropogenic environment is solved. Practical significance of presented results consists in reduction of the time of conducting the scientific researches and introduction of their results to industrial environment.

Keywords: an organizational system, activity, the processes, the system of the control, the digital platform, making of a decision, innovations, cognitive technologies.

1 The Task Production

Informational infrastructure is defined as one of the basic directions of the development of digital economy [1, p. 12]. Within the framework of the given direction, the conceptual model of the Shared Digital Platform is built [2]. The innovative character of the control [3], revealed in a base of cognitive technologies [4], is the special property of this model. The given property provides the methodical basis for creation an integral informational control of medium, combining the resources of the organizational systems: over a territorial attribute; over belonging to a branch, the department; over execution of the state programs and the business projects; over other attributes [5].

The study of the boundary conditions of stable functioning of the Shared Digital Platform computational resources, built based on the conceptual model specified above, is carried out under support of the project #18-29-03091 of the Russian Foundation for the Basic Research. The applicability of the known support methods to organization of computer modeling of the objects of technogenic, natural and anthropogenic of a medium in the boundary conditions, stated above, is considered in the article.

The examples of the objects and results of their computer modeling are given in the Table 1.

Table 1: Computer simulation methods (examples).

	Method name	Objects and simulation results
1.	Virtual integrated modeling of the factors of influence between the physical processes [6].	<i>The objects:</i> relation between the electrical, thermal, mechanical, aerodynamic processes, providing simultaneous impact on industrial product or technological parameters. <i>Result:</i> the most critical from the standpoint of overload elements products.
2.	Imitative modeling of the factors of influence between the devices [7].	<i>The objects:</i> the description of interference of the occasional process. <i>The parameters:</i> the speed of movement of the devices

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	Method name	Objects and simulation results
		on heterogeneous wireless networks; the spatial density; the maximally permissible radius of interaction. <i>Result:</i> the probabilistic indexes of interaction between the devices: breakage of a connection; the duration of the presence of the connection; the duration of the absence of the connection.
3.	Modeling of the modular computational systems that function in a real scale of the time (less than 300 ms) [8].	<i>The objects:</i> The models of the computational systems. A checkup of the indexes of the time of data processing. <i>Result:</i> the model of a structure of the computational system, satisfying the given requirements.
4.	Modeling of charged particles of space beams and streams of protons [9].	<i>The objects:</i> the particle of the protons, being present in the galactic and solar space rays, in the streams. <i>Result:</i> the physical states of the particles, being present in the galactic and solar space rays, in the streams of the protons.
5.	Modeling of the seismic waves [10].	<i>The objects:</i> the processes of dissemination of the seismic waves. <i>Result:</i> the trajectories of seismograms as the diagrams and a report on testing of the indexes of the program code.
6.	Modeling of the special purpose indexes of economic security [11].	<i>The objects:</i> the event of counteraction to the different threats with economic security in strategic planning of the development of high technology branches. <i>Result:</i> rational distribution of the budget allotments over the articles of the plan.
7.	The modeling of the signals is in the systems of automated design [12].	<i>The objects:</i> The noise signals in the microchips, the factors of their influence on efficiency. <i>Result:</i> the report on the degree of correspondence to the normalized designed indexes.
8.	The modeling of the procedures is for the control of activity in the organizational systems [13].	<i>An object:</i> medium of the high technology informational, telecommunicative and engineering systems. <i>Result:</i> the procedures of the control that satisfy the given requirements.
9.	The modeling of bloodstream is in the vessels, feeding the brain [14].	<i>The objects:</i> the brachycephalic arteries, feeding the cerebrum. <i>Result:</i> tomograms and the angiograms of the vessels of the cerebrum and the indexes of their state.

It is how visible from the examples (the table 1), the complicated procedures, the structures, the elements (the particles), technical, natural and the anthropogenic processes be the objects of modeling. The given complexity is conditioned by the operations for treatment and for comparative analysis of large factual and retrospective data in the conditions of the real time that are inherent in the simulated processes. For example, similar business transactions realize themselves in the seconds [15]. Results are reached with the help of complex approach, by combination of analytical, imitative models and the computer algorithms. The made description is inherent in many simulated processes in the different domains of science, spheres of the control and branches of economy.

In connection with it, generalization, it is assumed that, the factor of real scale of the time with large data processing imposes a restriction for the time of treatment. The normalized indexes of the time of data processing in one cycle of modeling and the probability of his non-exceeding in such a case are the boundary conditions of stably functioning of the computational resources of the Shared Digital Platform.

Review and analysis of the known innovative methods and the models that are protected with the patents for inventions and the useful models are brought. Their appointment is for a support of activity, in participated by the organizational systems. On the base of given analysis the domain of their application for the Shared Digital Platform that are used in modeling of the objects, relating to the technogenic, natural and anthropogenic media, was defined.

2 The Support Methods of Kinds of Activity of the Organizational Systems

Table 2 represents the patented (innovative) methods of a support of kinds of activity (the processes) of the organizational systems and the models of the technical solutions, built considering critical technologies of informational infrastructure [16]:

- technologies are for data factual acquisition of essences, influencing components and states of kinds of activity, their treatment and structuring, accumulation and systematization of retrospective data;
- technology is for creation of integral informational-controlling medium intended for a union with the computational resources that are located in the different organizational systems, and that differ in the systems for addressing and the program codes;

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- technologies are for analysis of normalized, factual and retrospective given;
- technologies are for the development of the scripts for the solutions of the one that considers obtained results of activity analysis and considering the given boundary conditions of a support of activity;
- technologies are for definition of the objects for the innovations, that is conditioned by an increase of the number of new automated processes and, as consequence, the production of projects for creation of the new applied informational systems in the organizational systems.

Table 2: Review of the innovative methods and the models of a support of activity

	Method (model)	Characteristic
1.	Method of supporting operation of organizational system [17].	<i>Result:</i> automatic execution of estimation of activity effectiveness and the automatic control of the objects of a support of the one that considers executed estimation and the normalized boundary conditions of stability. <i>Effect:</i> reduction of the time of making and execution of the decisions.
2.	Organizational systems management system [18].	<i>Result:</i> the automatic checkup of relevance of data on reformation of these data of the considering executed checkup, chosen for execution, the scripts of the control, are in case of necessity. <i>Effect:</i> an increase of the degree of certainty of the made and executed decision.
3.	Management Center of Organizational system [19].	<i>Result:</i> the technical solution is over a realization of a method of a support of activity of the organizational system [17] with a centralized system of the control.
4.	System of situationally analytical centers of organizational system [20].	<i>Result:</i> the technical solution is over a realization of a method of a support of activity of the organizational system [17] with a distributed system of the control.
5.	Monitoring Center for sustainability information systems [21].	<i>Result:</i> formation, conservation, allocation of data on factual stability of the informational systems. <i>Effect:</i> reduction of the time of the exposure of defects of technical means, the mistakes of the programs, the wrong actions of the personnel.
6.	Stability of information systems support center [22].	<i>Result:</i> execution with a view on a support of given boundary conditions of stability (stability) is automation of the functions of analysis of data on stability of the informational systems, making on this basis of the decisions and them. <i>Effect:</i> reduction of the time of elimination of defects of technical means and the mistakes of the programs.
7.	Method to pass information [23].	<i>Result:</i> reduction of electric power, necessary for a transfer of information into the robotic objects, realizing a support of activity of the organizational systems. <i>Effect:</i> an increase of reticence of the fact of a transfer of the teams of an administration.
8.	Robotic control objects [24].	<i>Result:</i> the technical decision on a realization of a method of a transfer of information [23].
9.	Method to pass information [25].	<i>Result:</i> the package of information furnished about with their transformation into information, furnished about an appointment of this; also reverse the transformation on reception. <i>Effect:</i> the support of inter-operability of the systems of the control, differing in the modes of identification and the systems of the internal addressing of one's objects.
10.	Complex of information interaction [26].	<i>Result:</i> the technical decision on a realization of a method of a transfer of information [25].
11.	Method of Transmission of Control Commands [27].	<i>Result:</i> the transfer of data on a team with their transformation into the commands, given about a function of this, and a reverse transformation on reception. <i>Effect:</i> the support of inter-operability of the systems of the control, differing in the program codes.
12.	Integrated control system [28].	<i>Result:</i> the technical decision on a realization of a method of a transfer of the teams of an administration [27].

	Method (model)	Characteristic
13.	Device management [29].	<i>Result:</i> component in composition of the technical solution [28].
14.	Data transmitter [30].	<i>Result:</i> component in composition of the technical solution [29].
15.	Data receiver. [31].	<i>Result:</i> component in composition of the technical solution [29].
16.	Method of Determination of the Objects of Innovation in Information Systems [32].	<i>Result:</i> automatic definition of the objects of innovations of the one that considers the boundary conditions of stability over the time of data processing and the probability of non-exceeding of it. <i>Effect:</i> reduction of the terms of execution of the innovative projects of automation of the new processes.
17.	Identifier of Innovation Objects in Information Systems [33].	<i>Result:</i> the technical decision on a realization of a method of definition of the objects of innovations in the informational systems [32].

On the base of the analysis that is made with respect to the innovative methods and models, listed in the Table 2, the domain of their application for a medium of the processes, is defined which are used for a support of computer modeling on the Shared Digital Platform:

- the processes of collection, treatment and configuring of data on essences, influencing state of the simulated objects;
- the processes of creation and actualization of integral informationally-controlling of a medium of the organizational systems independently of an identity of the systems of addressing and the program codes;
- the processes of accumulation and configuring of retrospective data are in an integral informationally-controlling medium;
- the processes of analysis of normalized, factual and retrospective data, definition of the indexes of stability of medium of modeling of the Shared Digital Platform;
- the processes of development are on the basis of results of analysis of the scripts of a support of stability of the objects of medium of modeling in the given boundary conditions of stability;
- the processes of definition of the objects (technical means, the programs, the informational systems, the informational high roads, et al) in informational infrastructure of the Shared Digital Platform, which it is required to modernize, replace or develop in connection with an increase of the number of simulated processes.

Practical significance of application of the represented as higher innovative methods consists in reduction of the time of computer modeling of the objects with observance of the boundary conditions for stability of means of the support.

3 The Boundary Conditions of Stability of the Informational High Roads

It is defined that recommendation of the given processes is a support of given boundary conditions about stability (stability) of the objects that realize a support of modeling. Information on the presence of the universal method for definition of such indexes as applied to both technical means and the programs, and the high roads in informational infrastructure of the Shared Digital Platform is not detected. In the same time, in a solution of the similar tasks is possible to be guided the known methods in definition of effectiveness of activity of the organizational system based on standard, normalized and factual of the indexes of activity it. At it:

- the standard indexes are defined by the reached levels of engineering, technology, the administrations and formations are in the subject domain of activity of the organizational system in the absence of the restrictions on the cost of the project, the normalized indexes are defined by the designed solutions of a version of the Shared Digital Platform, selected among the considered versions in the index of the degree of effectiveness of activity and given cost [34];
- the factual indexes are defined with the help of an analytics-methodical apparatus and technological information on the indexes of objects of observation - the material and immaterial objects of the organizational systems and the external medium, having influence on results of activity [35];
- the calculation of the values of the indexes is produced provided a period of acquiring of statistical samplings of information is common to calculation of the values of all indexes [36].

For example, object "the informational high road" it is possible to use a method of analysis of productivity of high road, including homonymous technique and the models of a high road [37].

On drawing (Fig. 1) the example of use of technique for calculation is given the maximum number G_{val} . of data packets in the queue at which indicators are met: the maximum waiting time T_{val} . in queue и the minimum probability P_{val} measure T_{val} . Based on the maximum number G_{val} . of data packets, necessary productivity of high road is defined.

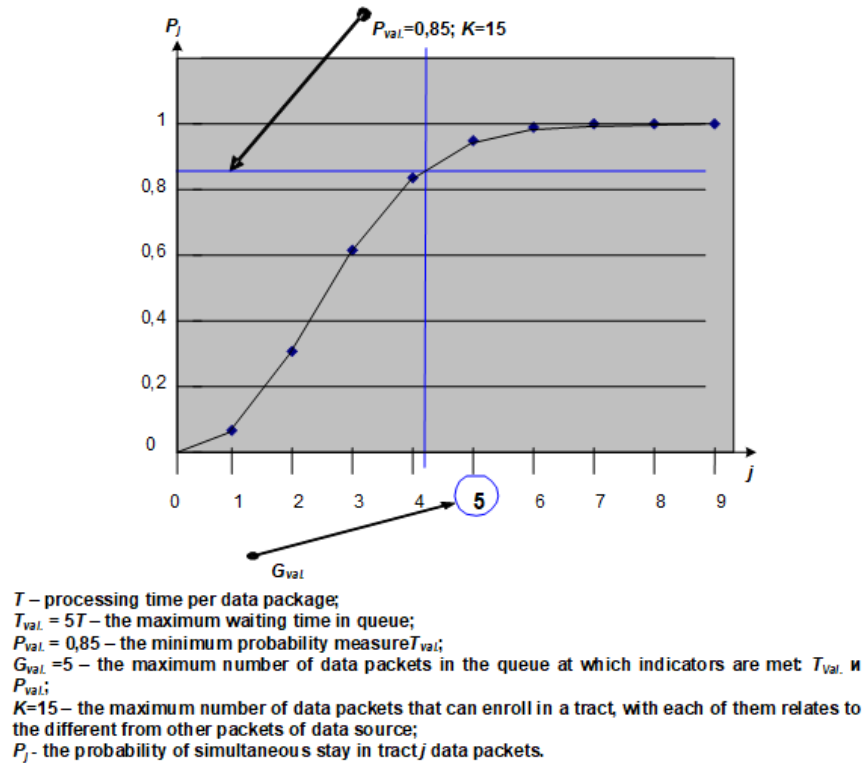


Figure 1: The boundary values of stability of informational high road

4 Conclusion

The article is dedicated to investigation into the questions about an application of a digital platform for modeling of the objects, relating to the technogenic, natural and anthropogenic media. The methods, insuring an informational support of activity, realized in the organizational systems, provide the basis of such a platform.

The innovative methods and the models, which are protected with the patents for inventions, and the useful models are presented. The given solutions are intended for automation of the processes, realizing an informational support in modeling of the articles and the processes. The calculation of the indexes is produced in the boundary conditions of stably functioning of the computational resources.

Effectiveness of the Shared Digital Platform consists to the unions with the computational resources of the organizational systems, located and consolidated in a base of the digital platform. The time led away for modeling of the promising industrial technological articles, the social and natural processes, is reduces. Including the time of conducting of scientific researches, introduction of their results to industrial Wednesday.

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