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Automation of Synthesis of Structures, Systems Engineering Strategies for Production

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Abstract

The article describes an automated system of support of decision-making structures in the synthesis strategies of industrial engineering systems, based on the method of structural and technological complexity of produced parts. This paper critically evaluates various tool management approaches, identifying the operational tradeoffs and analyzing the models developed to address management decisions involving tooling. The evidence is clear that a lack of attention to structured tool management has resulted in the poor performance of many manufacturing systems. Plant tooling systems affect product design options, machine loading, job batching, capacity scheduling, and real-time part routing decisions. With increasing automation in manufacturing systems, there is a growing need to integrate tool management more thoroughly into system design, planning and control.

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Keywords: Automated system; *the structure-strategy option*; *manufacturing system.*

1. Introduction

Based on the analysis [1-4] we define the production system.

Definition 1. Production System (PS) - a set of processes that occur in the process, information and organizational structure of the enterprise, in the manufacture of required properties. Let us more detail on these three structural components. In this paper, technology, information and organizational structure are considered together. We introduce the following concept, which will more accurately describe the substation engineering.

Definition 2. The structure of the strategy of PS Engineering is understood a certain set of its elements and options ordered technologies: manufacturing of products, transfer of information, the organization of management, implementing product lifecycle.

The central idea of the method of synthesis of effective approaches and options for the structure of the production system is the construction of matrices performance combination of processes and structures, followed by a choice of rational variants depending on certain selection criteria

2. Structure of the strategy of Engineering

Note 1. Elements and technology mutually adapted with products specific structural and technological complexity.

Figure 1 qualitatively shows how to interact with each other technological, information and organizational components of structures strategies.

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The structure of the strategy can be represented as a tuple:

$$F = < T; I; \hat{I} > \quad (1)$$

Where: T - technological structure; I - information structure; Î - organizational structure.
Then F is nothing but as the ratio of these sets and is defined by the Cartesian product of the sets T, I, O.

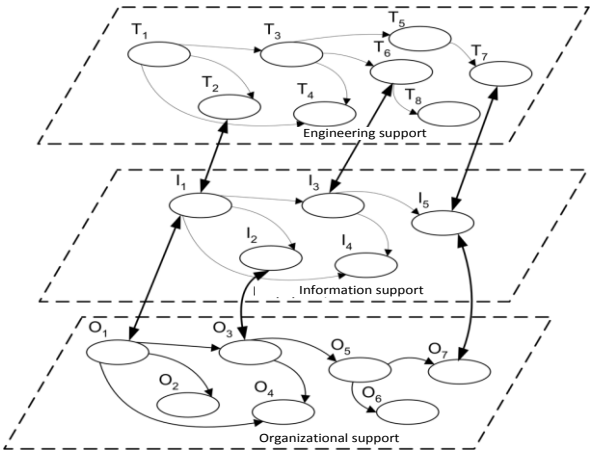

Fig. 1. Structure of the strategy of engineering PS.
T - technological structure; I - information structure; A - the organizational structure.

As can be seen from the definitions of the essence of the process is necessary to develop automated synthesis systems, structures, strategies of industrial engineering systems.

Currently, considerable attention is paid to automated systems support the adoption of technical, organizational and other solutions for the modernization of production of mechanical engineering systems. Their use increases productivity, automates manual tasks of gathering information and documentation.

Decision support systems there are so many, but in the field of mechanical engineering, used to select the technology and information systems, based on the index of structural and technological complexity (STC), does not occur. This system allows you to select the most favorable set of technology and information systems, based on a synthesis of options strategies, industrial structures, engineering systems [1].

The central idea of the method of synthesis of effective approaches and options for the structure of the production system is the construction of matrices performance combination of processes and structures, followed by a choice of rational variants depending on certain selection criteria [2].

Operation of the system begins with the user input is constructive-technological parameters of details on the production and synthesis given criteria. The criteria for the synthesis of structures, strategies may include the cost of equipment, batch production, etc. After entering the data, the system analyzes the structural and technological elements (STE) parts with reference to the database and produces a synthesis of the structures, strategies, manufacturing systems engineering, depending on the set at the stage of entering parameters and synthesis criteria.

The main objective of the module is a decision support subsystem synthesis options strategies structures manufacturing systems engineering. It is this subsystem on the basis of data obtained as a result of the subsystem selection process and information management, provides a synthesis of options strategies, industrial structures, engineering systems.

The algorithm of the module support decision-making in carrying out the synthesis of the structures, strategies, production engineering systems (PES) is shown below (Figure 2) [3]. The operation of this module begins with a connection to the directory design and technological elements, directory, process equipment and information systems, customization and creation of the basic structures, data and objects used in carrying out the synthesis of structures, systems engineering production strategies. Our next step is the preparation and formalization of requests required for the operation of an automated decision support system. After performing the two previous steps going directly to the process selection process and provide information structures and synthesis strategies production systems engineering, with shaped elements structures upgrade options strategies, depending on

the set of input parameters at step synthesis criteria. At the final stage embodiments previously formed into reports are sorted and presented to the user for further use.

Decision Support System is divided into four groups [4]: Information Support; technological support; STE; Detail.

Entities belonging to the group "Information Security", designed to store information about the information element of the structure of the PES engineering strategies [5].

Entities belonging to the group "Enabling Technologies", designed to store information about the technological elements of the structures, strategies Substation Engineering.

Entities belonging to the group "STE", designed to store information about the attributes, geometry and process parameters, as well as the typical technological processes, ensuring shaping of design and technological elements.

Entities belonging to the group "Detail", designed to store information about the range of products to be manufactured in the framework of the synthesized structure strategy of the production system.

The main functions in the formation of a finite set of substation engineering:

- formed a set containing a set of process equipment parameters;
- formed by a plurality of parameters of manufactured parts;
- formed a plurality of STE generators item;
- formed set of equipment, each element of which contains the parameters of the technological equipment necessary for the production of specific details;
- formed by a plurality of information elements of the structures of production strategies of engineering systems (including options CAD/CAM/CAE systems that can be used to design and manufacture specific details);
- formed many options structures, strategies of production engineering systems;
- clipping options that do not meet the financial and economic needs of the enterprise, based on the theory of fuzzy sets;
- clipping a variety of options, the implementation of which cannot be implemented for financial reasons;
- the conclusion of the final set.

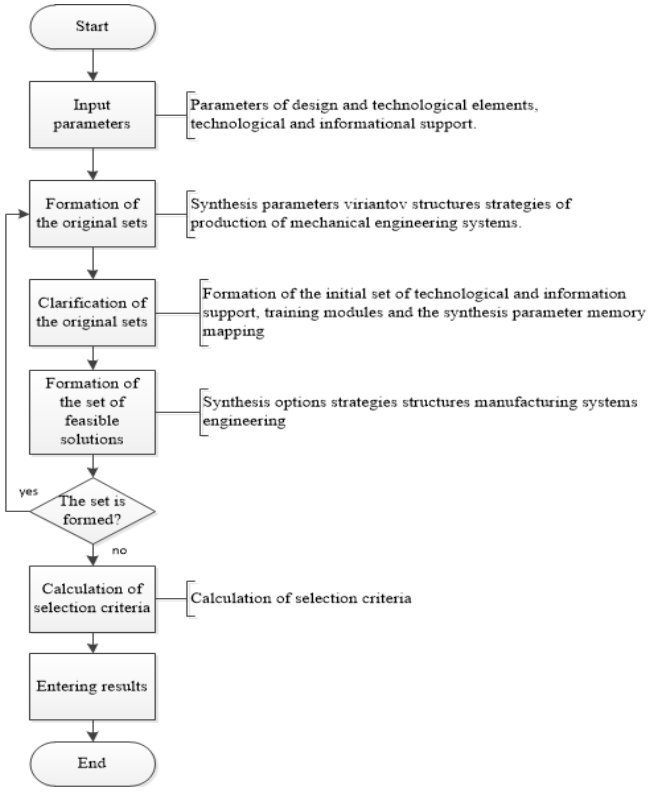

Fig. 2. The general algorithm of the automated decision support system.

Figure 3 shows the architectural model of the complex software, which presents the core technology in the writing system. Client Layer is responsible for displaying information to the user using the browser, providing the customer with the results of the program. Logic layer controls the operation of the program, performs computations and calculations. Data layer stores information that is sent to the logical layer for processing and receives modified or added data.

The server part of the system consists of the application server and database management system (DB). As the database has been selected PostgreSQL.

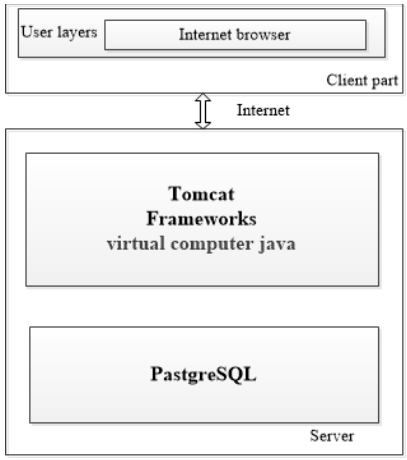

Fig. 3. Architectural model of software system.

The developed automated system will function as a site / web application, where all data is stored on a remote server, and the user will be able to log in via the Internet. This decision will allow the user to log in without having to install the application on a local computer and to log in from any workstation that has access to the Web application.

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References

[1] Kuznetsov A. Common definitions and understanding of the problem of choosing the strategies of production structures engineering systems. Automation and modern technologies, №4, Machinery Publisher. 2007. p. 40-42.

[2] Zamyatin K, Kuznetsov A. Choice of technological elements of structures-systems engineering strategies for production. Bulletin of Samara Scientific Center of the Russian Academy of Sciences. Special Issue: Actual problems of mechanical engineering, 2009. p. 292-296.

[3]Zavertyaeva O, Kuznetsov A. Approach to automations an analysis efficiency of technological equipment in a structure-strategy. Pollack Periodika, International Journal for Engineering and Information Sciences, Pollack 2007.1.7 Vol.2, No. 1. p.79-88.

[4] Pokorný P, Peterka J, Václav Š. The task of 5-axis milling. Tehnički Vjesnik - Technical Gazette. Vol. 19, No. 1, 2012. p. 147-150.

[5] Anutov R, Kuznetsov A, Yakimovich B. Rational choice for high-tech engineering industries. Computer-engineering. No4. 1997. p.2-4.