Modular representation of the product in the knowledge base in the technological process formation

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Abstract. The article describes the stage of engineering preparation of production, where the knowledge base is offered in the form of a matrix, which will be an active information resource for a stage of technological pre-production.

1. Introduction
Modern technologies for polymeric products producing and processing include heat mass exchange Knowledge base provides a quantitative and qualitative analysis of the solution based on the internal algorithms and the aggregate of all the decisions taken once, forming the basis of precedents. In the database of precedents search, classification and analysis of the solutions storage is performed in a formalized manner [1-3,6,7].

2. Basic part
The system under consideration is used to support decision-making in a very complex area. Knowledge base containing a significant amount of decision rules is difficult for perception and use. It is therefore proposed to build the knowledge base in a modular fashion. Decomposition of knowledge bases is made in accordance with the hierarchical structure of the process. Advantages of modular knowledge bases are the following:
- modules provide tools and techniques to maintain knowledge bases stored in separate files and use these files by multiple applications;
- modularization is taken into account by the mechanism of output in the process of work, which improves its efficiency;
- modules can be selectively activated or deactivated, allowing you to exclude from consideration the rules of inactive modules.

Applying the above said to the problem statement, we decompose, with the purpose of identifying the relationship of generic "is a".

Any technical engineering product is a system described by a set of elements, the attitude to which depends on what angle the product is being viewed. Once the designer has designed a product, it must be produced, and since then it should be viewed as an object of production. If the technical system is viewed as an object of production, it is a set of assembly units and parts, impersonal in terms of their functionality. Designer in the preparation of technical documentation for a product gives the information on the item as an object of exploitation. For a technologist it is important at the stage of getting the task to produce new products quickly and accurately, to determine the expected complexity
of manufacturing the product, the need for technological facilities and the possibility of producing it under the operating conditions. However, the information that is presented in the design documentation is not sufficient to solve this problem. At present, this information is, to a great extent, in an \textit{implicit form}, and for obtaining it a highly skilled technologist and much time are required, which is unacceptable from the viewpoint of the product lifecycle, especially at the stage of design and production planning [4].

The task would be greatly simplified if the information was contained in the form of active information resources, that is represented an explicit table, containing the information on all the compounds, sets of main and additional bases with levels of accuracy and roughness of their surfaces, levels of precision of the parts.

To build up the production process of a part, a technologist needs to know not so much the brand of the material, but as the material processing characteristics and the recommended methods of the material processing. In this regard, there is a need to develop a method of describing a product as an object of manufacture. If we consider the product as a set of its constituent parts surfaces, then to evaluate the production of an item without developing the process is possible by using the complexity of technological transitions in manufacturing \textit{surfaces of parts} and the connection of the parts.

In this regard, a product design should be presented as a set of connections and surfaces of parts. To do this, the product is considered as a structured set of connections and surfaces of parts. The surfaces of parts are such elementary geometric surfaces as plane, cylinder, cone, etc. However, a part performs its functions, using a combination of surfaces. Then it is necessary to find in the design of a product such an element, the production technology of which was an element of the process to be included into it without significant changes. These elements are a combination of parts’ surfaces, due to which the part performs its functions called \textit{modules of surfaces}. Then, any part can be described by the modules of the surface [5].

Decomposition of classes and objects is brought to the level of elementary surfaces of parts, which are basic components of a complex system. Moreover, if we consider the levels of the hierarchy from top to bottom, the upper level is the class, such as a reducer. In relation to the upper level the following (sub) hierarchy level forms class objects, such as a framework, a shaft - gear, etc. The next lower level is an object for the higher level and the class level for a lower level, and so on up to the level of elementary surfaces.

When creating an intelligent system the fact, that there are much more objects in a complex system, than classes, is taken into account. Application of the hierarchical approach makes it unnecessary to repeat the same information for each example of an object, that is, with the introduction of the class structure it becomes possible to place in them the general properties of the examples. If this approach is used in the subject area, namely in engineering, all that engineers design, is designed to perform specific functions. The products of main and additional production, as well as related processes, have their functionality. Projects developed with the help of computer technology, are the objects that are seen by these resources. Then, during the production these projects are transformed into tangible objects that represent objects of production, which are perceived by human thinking.

Design and technological documentation consists of displaying the form of entities with certain content, which is the object [4]. All properties have some value that can be simple quantitative or qualitative (symbolic) characteristics, and may refer to another object. The sizes with deviations or maximum deviations; deviations of a form and a surface position; surface roughness values, etc. can be attributed to quantitative characteristics of products. Qualitative characteristics of products are the name and the brand of a material; fundamental size deviations, etc. Quantitative characteristics of technological operations include set-up time, the number of workers carrying out the operation, and qualitative characteristics – the code and the name of the operation, the code and the name of the equipment. To develop a product design or a process it is necessary to assign specific values to all the properties of the corresponding object and all the objects associated with the attitude "the whole – a part". In this way an example of an object is formed. A dynamic nature of the current properties of the
object's values is associated with the frequent need to make changes. Consequently, the behavior of the object is shown in the structural - parametric synthesis of design and technology.

In the model of a module CAD intelligent system of building up process, classes and objects are related to the hierarchical structure. In the process of structural synthesis in the method of the involved object - class a decision about choosing one of the objects - subclasses is taken and values of their own properties are defined. In the result of the parametric synthesis the selected object - subclass is activated, and it inherits the properties. In this process, technical documents are received, which reflect the state and behavior of the designed objects.

Intelligent system of building processes is a complex system, the implementation of which comes in the form of object interaction. The conceptual interaction of the objects occurs as the links between them. The links can be structural and parametric. Structural links are defined by the hierarchy of objects given in the Meta system, and parametric ones can be vertical and horizontal. Moreover, the vertical links inherit the properties by hierarchy and the horizontal ones transfer property values between the objects, not subordinate to each other [6, 9, 10].

Thus, the output stage of the design pre-production will be a knowledge base in the form of a matrix, which will be an active information resource for technological production preparation stage.

3. References

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