DEVELOPMENT OF THE SPECIALIZED SOFTWARE MODULE FOR DESIGN OF WORKING SURFACE GRINDING MODES

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Problem setting. Recently, developers of software products related to computer-aided design (CAD) tend to expand capabilities and functionality of their products, thereby giving them more universal look. However, despite this the technical departments of enterprises still have to implement some software products related to the only area of concern of operators of automated workplaces in order to be able to solve certain classes of problems. The result of the automation process design is a set of design documentation sufficient for making and subsequent operation of the product. Not all the software products allow to solve the problems of product development and all design-related aspects.

In this case, we deal with the problems related to grinding of industrial products. In order to solve the problem of grinding mode design, grinding tool design, regulation of labour time for a grinding process, it is necessary to use, as a minimum, a system of computer-aided design (CAD) and computer-aided manufacturing system (CAM).

The purpose of this work is to develop a specialized software module for design of working surface grinding modes.

Basic research. Taking into account the cost of additional software and time required to design grinding tools we can conclude that one of the problems can be solved by specialized software, while the other one can be resolved due to a high-level programming language. These tools allow to develop own design and information system for specific issues and simplify the process of automated design using an application programming interface (API). The functional model is presented in Figure 1.

Problems like grinding mode design and regulation of the labour time of the grinding process are resolved through the creation of software products which are able to operate with databases and have a visual and intuitive user interface. Using database management systems one can make an information-computing system that consists not only of state standards, but also from individual enterprise solutions. Built-in mathematical modules in high-level programming languages allow to carry out complex calculations of incoming data.

Grinding tool design is directly connected to the CAD-system. To solve this problem it is expedient to use an application programming interface. Currently the majority of the most common CAD-systems have application programming interfaces that consist of finished classes, procedures, structures, functions, constants that are provided the software product for their use in external software applications.
Figure 1 – The functional model of the software module.

An API provides software functionality that can be used by a software developer to solve required problems. For development of applications for the relevant CAD-system modules for various programming languages are used. These modules describe the interfaces according to the syntax of a language. In API components interact with each other hierarchically. Each interface is a class with properties and methods. Each interface is a class with its properties and methods. For example, a class that describes a CAD-system is the key interface of the system, and other interfaces can be obtained from it. To get this interface one can use a function described in the relevant modules.

API-technologies of several CAD-systems allow to develop complete design documentation for a particular product and to simplify the process for a workstation operator. The bottom line is that the design process, which is usually performed manually, can be simplified by the already given program code with constructing commands, for example, a 3D-model is ready-made, and the operator must just set its necessary geometrical parameters. As an outcome he will get a 3D-model of the right size. This method simplifies the design of similar models (particular class products) which are frequently used and have different geometrical parameters. By the same principle one can create a library of standard products. The use case diagram of the development process is shown in Figure 2.
There are at least two ways to implement the documentation design using API-technologies:

1) Document creation (2D-drawing or 3D-models) from scratch. This method involves entering the parameters of the document via the code. For example, you need to design a 3D-model which consists of a certain number of sketches that are composed of geometric primitives and operations. You need to choose a coordinate system in which sketches will be built then you build sketches and perform necessary operations.

2) Method of parameterization. This method is in the following: the interaction of software application will not be carried out not with geometric design classes, but with classes which interact with variables.

For realization of this method we do not need to design a model via software code, we need to design it manually. Then, for necessary sketches and operations their own variables should be set, which make them parameterized.

These variables include geometric parameters that can be read from the model (assemblies, drawings) and changed. This method should be used when designing simple products, assemblies, drawings and solving simple problems. For objects of a complex geometric shape, parameterization is difficult process.

In fact, a specialized computer-aided design (CAD) based on other CAD-system is created, thereby avoiding any purchase costs of additional software modules.

**Conclusion.** Having considered the problems of work and solution methods, we can conclude that the use of high-level languages, database management systems, and application programming interfaces of CAD-systems, let you get individual software modules with the possibility of further improvement.

**References**
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Анотация. Статья присвячена проблеме разработки программного обеспечения, которое комплексно решает задачи, связанные со шлифованием промышленных изделий, а именно: расчет режимов шлифования, проектирование шлифовальных инструментов, нормирование рабочего времени на шлифовальную обработку.

Ключевые слова: шлифование, шлифовальные инструменты, система автоматизированного проектирования, автоматизация виробничих процесів.

Summary. The paper deals with the problem of creating software that comprehensively solves the tasks associated with grinding of industrial products, namely: design of grinding, grinding tools design, and regulation of labour time for the grinding process.

Key words: grinding, grinding tools, computer-aided design, computer-aided manufacturing system.