TECHNOLOGY, MACHINE-BUILDING

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AUTOMATION OF PRODUCTION PREPARATION BASED ON 3D LAYOUT OF TECHNOLOGICAL EQUIPMENT

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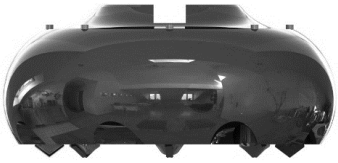
Introduction. The automation of production based on the prototyping of technological equipment based on the results of 3D modeling when creating block-modular face mills are presented.

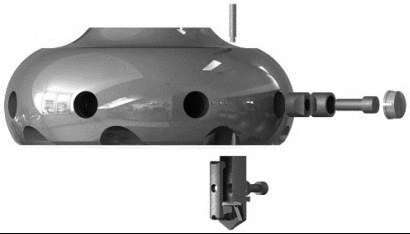
Research results. The results of work on the automation of production based on the prototyping of technological equipment based on the results of 3D modeling when creating block-modular face mills are presented.

Basic. Preparation of machine-building production, as known, includes the development of product designs and manufacturing techniques. Automation of procedures and development of the proposed designs and technologies on mock-ups obtained using layer-by-layer synthesis contribute to reducing time costs at this stage of production.

A technique that has been developed for 3D designing and printing on 3D printers of technological equipment models, in particular block-modular cutting tools (BMRI) [1-3]. The methodology includes the calculation and design of 3D structures using the software such as Ansys, Compass Vertical, Solid Works and the technologies for their machining on turning and milling three-axis machines of the Emko and Robodrill model, printing on a 3D printer type "Mojo" and "hybrid" method, combining traditional and additive technologies (table 1).

Table 1 – The Method of manufacturing a block-modular cutting tool

Tradicional

Metal tool construction
Additive

Plastic tool construction
"Hybrid" (unconventional)

Metal cutting units and assembly elements + plastic case

Distinctive features of the obtained BMRI mock-ups are the "streamlining" of the shell shapes and efficient of structural elements from the point of view of the laws of hydro and aerodynamics or chip and heat removal, as well as the use of special balancing devices (elements).

Mathematical and physical modeling of various options for shapes (cylindrical, spherical, torus) and the location of structural elements (orthogonal and at an angle) during the flow around liquids and air flows of BMRI has been conducted.

The optimal design options have been established. It is provide minimal energy consumption, losses, matching chip, and heat-conducting flows from the working area at the static and dynamic BMRI positions.

Rationing of work and cost estimation were carried out during the implementation of various production technologies of BMRI (Ficture 1).

Method for manufacturing block-modular cutting tool:

Tradicional	Additive	«Hybrid»
≈1000 bel. rubles	≈ 350 bel. rubles	≈ 720 bel. rubles

Figure 1. – Estimation of manufacturing costs

As can be seen from Figure 1, even the use of the "hybrid" method of producing a BMRI prototype from polymeric materials allows one to save money in comparison with the development of BMRI designs on experimental metal samples.

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