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3D MAKING OF TEAM CUTTING TOOLS FOR HIGH-SPEED PROCESSING

S. PARTSIANKA, NIKOLAI POPOK
Polotsk State University, Belarus

The results of work on improving the constructions of block-modular face milling cutters, taking into account the analysis, the use of 3D modeling and rapid prototyping are presented.

Currently, more than 50% of cutting tools used in machine-building production are prefabricated, due to their well-known advantages compared to composite and solid [1]. However, due to the intensive development of high-speed machining, characterized by the rotational speed of the cutting tool from 10000 to 40000 min-1, the extensive use of prefabricated structures is constrained by their large size, inertia of the masses and, as a result, the cutting power [2].

Requires modern design and technological solutions to improve the aerodynamic parameters (properties) of cutting tools through the use of a rational form of buildings, balancing mechanisms, etc.

In the manufacture of modular cutting tools used various methods, such as pressure treatment and machining, powder metallurgy techniques and 3D printing. For each of these methods requires the construction of such a design of the cutting tool, which would take into account the functional purpose of the cutting tool, for example, for high-speed milling or boring, and features of its manufacturing technology (processing and assembly). The solution of this technologically complex tasks is possible with an integrated approach to design, involving mathematical modeling of a 3D design, prototyping (manufacturing) an experimental sample using three-dimensional technologies, physical modeling of cutting conditions of a material with a cutting tool model, and optimizing cutting tool parameters. cutting tool [1].

An analysis of the constructions of precast cutting tools shows that many foreign firms use a streamlined shape of cutters. And balancing mechanisms in the form of screws (Figure 1, a). In boring precast cutting tools, the body most often has a cylindrical shape and a balancing mechanism in the form of two rings. A 3D layout of the face milling cutter of a streamlined shape formed by two mating tori and balancing screws obtained on a 3D printer is proposed (Figure 1, b).

a) b)

Figure 1. - Flowing milling cutter (a), milling cutter with balancing screws (b)

In the model of the face milling cutter according to Figure 2, a balancing mechanism in the form of two rings with spiral grooves is proposed (Figure 2, b).

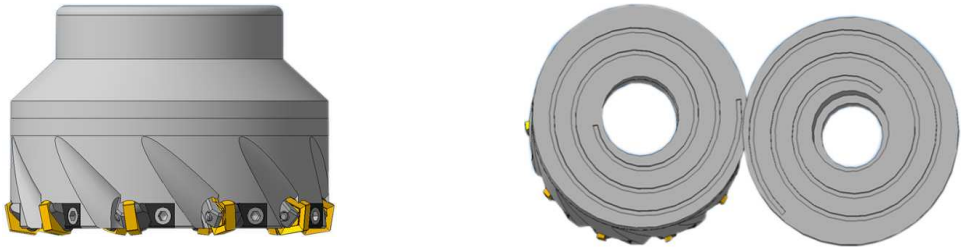

Figure 2. - 3D model of a face milling cutter of a streamlined shape formed by two mating tori and balancing screws (a)

The 3D layout of the boring tool has a cylindrical body and a balancing mechanism in the form of two rings, made in the shape of an Archimedes spiral (Figure 3).

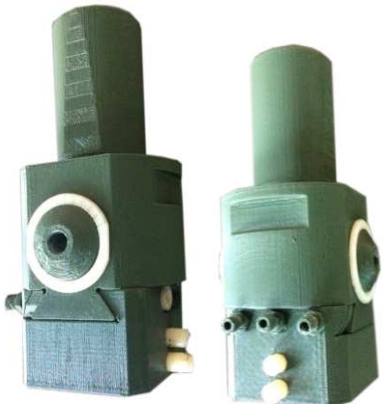

Figure 3. - Layout boring chuck with a balancing mechanism in the form of two rings

A feature of this construction of two balancing rings is the ability to change the corrective mass in anti-phase to the cutter imbalance added by moving a load (ball) of a certain mass in a groove in the spiral of Archimedes. Creation of a universal balancing mechanism to correct the imbalance in the different types of cutting tools involves the further development of 3D models, modeling prototypes and their testing.

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