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Creating a rigid model of solid end radius cutter in NX

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Abstract. The article describes the sequence of actions in a module NX-CAD to get solid model of the instrument in accordance with GOST 16231-81 "End radius cutter with a tapered shank for processing of light alloys"

Today there are many companies producing tools such as Sandvik, Iscar, DIXI, YUMT, Hofman and etc. Each of these companies produces the directory in which under any specific conditions on the basis of the classifier, you can pick up a tool and recommend treatment regimens, this is true also for the end radius cutter. However, part of the cutting tool at domestic enterprises is often made according to National Standard, as they are given all the design parameters, but they do not give any recommended operating conditions. In view of the relatively high cost of such a tool, the error in the selected cutting conditions can lead to high cost of the final product. To avoid such errors, it is possible to simulate load on the finite element model of a cutter [1] and on the analysis of the data to make recommendations on the use of various cutting conditions.

Solid model of cutter is necessary for the finite element analysis, resulting in CAD systems [2]. Solid modeling in the system Siemens NX is performed in the corresponding module. We create a model of the cutter with diameter d = 12 mm in accordance to National Standard 16231-81 "End radius cutter with a tapered shank for processing of light alloys" [3].

First we construct a sketch in the plane XY (Figure 1), all sizes of face sections according to National Standard [4]:

1) The circumference of the core d=4.8
2) The line of vertical axis and we made it auxiliary
3) circumference d = 4, which applies geometric constraints "point on the curve," is connected to the tip of the tooth, and the "Ref" with a circumference of the core.

4) The line which forms a clearance angle of 20 degrees and a length in the direction X 1.2mm.
5) The circle d = 12, which applies geometric constraints "point on the curve," is connected to the end point of the tooth neck, and regarding the core of the circle
6) Create an array relative to the center
7) fast cutting takes away extra line

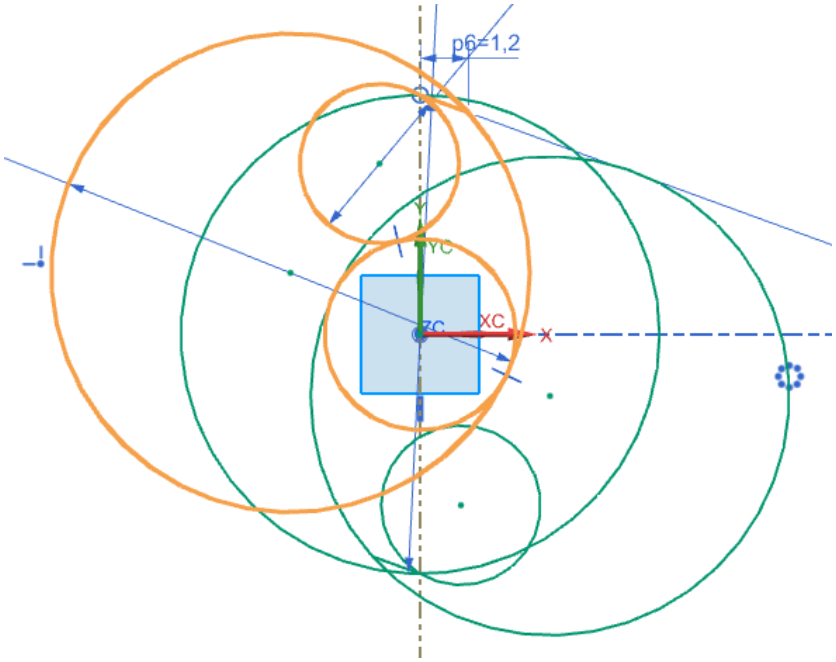

Figure 1. Sketch of the cutter in the face section to trim auxiliary lines.

We create guides on the ZY plane: one as the original tool surface for future spiral, the second line as a core to impart thickening GOST, as well as the centerline of the tool. We define a "Spiral" along the guide axis with the specified size parameter "On the curve of the law," where the curve of the law is the image of the original surface of the tool, the baseline is the tool axis with a pitch P = 65.3 mm. This spiral is the future cutting edge [5]. (Fig. 2).

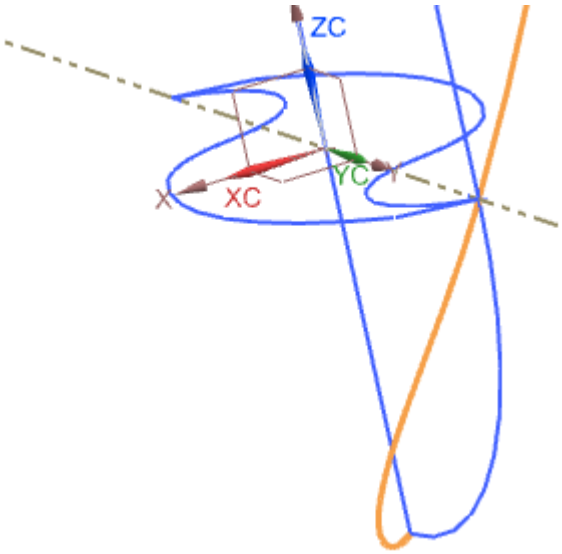

Figure 2. The guide spiral of cutting edge.

To simulate the output of the tool it is necessary to provide radius output in guide for the helix

With the command "sweeping" we build the body of the milling cutter. As the section we select the thumbnail of the end section. We choose two sets of rails, in the first it will be a spiral, in the second it will be an axis section, that is the way section will move along the spiral. However, the cross section will tend to go to the normal to vectors of the guide, in order to avoid this we will define the axis of the reference curve, it will provide a condition under which the section plane at each point of the trajectory will be normal to the axis.

At the end of the cutting part circumference sketch d = 12 mm is created. With boolean operations we will find the intersection of the final approximated profile of the cutting part. With further indentation sketch of a circle with offset and slope we will create the neck of cutters and Morse taper. At the end of the Morse taper we create a sketch rectangle and squeeze the foot. We add "rounding" at the transition elements[6].

The resulting model (Fig. 3) is nearly the same geometry of the actual milling [7] except for the exit site of the second order instrument, but this place is rarely a stress concentrator and almost does not give an error by further engineering calculations.

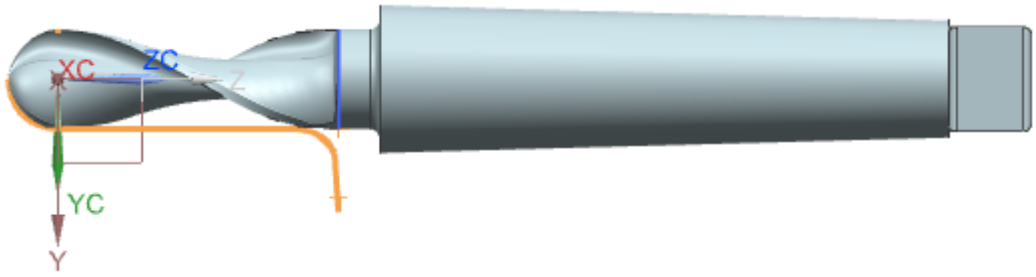

Figure 3. The finished solid model with a dedicated cutter curve-guide spiral. This model is applicable to further finite element analysis.

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