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ScienceDirect

Procedia Manufacturing 22 (2018) 160–165

Procedia MANUFACTURING

www.elsevier.com/locate/procedia

11th International Conference Interdisciplinarity in Engineering, INTER-ENG 2017, 5-6 October 2017, Tirgu-Mures, Romania

Using CAD CAM system for manufacturing of innovative cutting tool

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Abstract

Development of machining process depends of cutting tools and machine tools. Various new tools are being developed and tested. For example single edge tools, especially for oblique cutting. Oblique cutting process using special tools with continued cutting edge make new possibilities to research. This tools are very useful especially for surface finishing. Single edge tools exist with straight and circular edge. In paper was presented CAD (*Autodesk PowerShape*) model of new solution innovative tool curvilinear cutting edge. Using CAD model was elaborated in CAM system (*Autodesk PowerMill*) program for machining this tool using 5-axis DMG MORI DMU 50 milling machine. The tool was made for research with possibility of change value of main cutting edge angle - λ_s.

Peer-review under responsibility of the scientific committee of the 11th International Conference Interdisciplinarity in Engineering.

Keywords: turning; innovative tools; oblique cutting; curvilinear cutting edge; round insert; CAD-CAM.

1. Introduction

Progress in machining are made both in cutting edge materials and in the development of cutting tools [1-4]. An example of the use of new kind of tools can be cutting with single-edge tools [2-5]. One single edge tools can be

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2351-9789
Peer-review under responsibility of the scientific committee of the 11th International Conference Interdisciplinarity in Engineering.
10.1016/j.promfg.2018.03.025

divided into two groups: with straight edge and circular edge cutting tools. The second solution is particularly interesting, giving the possibility to shorten the cutting edge length for large diameters of workpiece.

The tools with single straight edge [2-5] was used to longitudinal turning – see Fig. 1. It is also possible using of this tools crosswise. The advantage of such single-edged tools is that the cutting edge is straight and the edge surfaces forming both the rake and the back are planes.

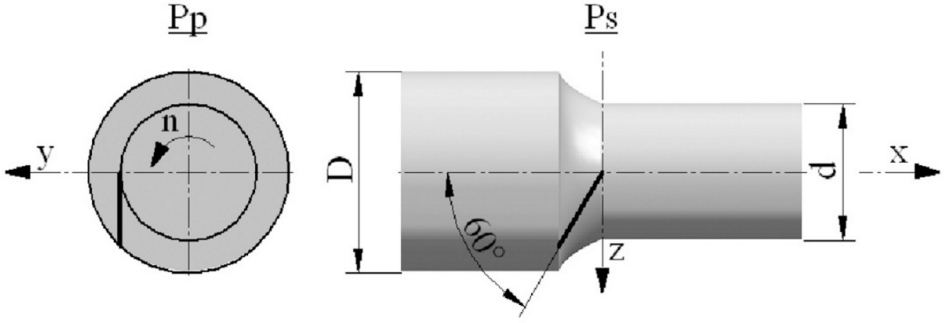

Fig. 1. The principle of longitudinal turning using single - edge tool with straight cutting edge for λs = 60°.

Single cutting edge makes it possible to get *Ra* at a range of 0.32 to 1.25 μm at feeds from 0.2 to 0.4 mm/rev [6]. The disadvantage of using these tools is to limit their use to machining of free surfaces.

As single-edged tools are also used too cutting edges in the form of a circular arc. They are used both in orthogonal and oblique cutting [7-10]. The use of single-edged tools in oblique cutting provides a favorable characteristic of the top layer [6,11].

Single-edged tools have sometimes an unpronounced name, since they cannot distinguish the corner of the edge. The ”corner” is the current point of contact between the continuous cutting edge and the machined surface. Eliminating the corner from conventional lathe tool construction increases the active cutting edge length, which results in a reduction in its individual power and thermal load [3], and thus results in reduced edge wear [3]. It is possible to increase the duration of the tools by periodically moving the worn cutting edge by a fraction of the active cutting edge length [4,12-14].

In the case of oblique turning with a single-edged tool, the cutting edge occupies a twisted position relative to the axis of rotation. In the straight edge machining, the cut surface created is a single-pore rotary hyperboloid [3] whose parameters depend on the diameter of the machined surface and the angle λ_s of the cutting edge. The curvature of the vertex of the hyperbola approximates a strictly tangent circle whose radius is significant. Hence, the surface roughness of the surface is reduced using this kind of tool [6]. In the field of cutting with circular arc edges this problem is not developed.

It is convenient to use the technical programs commonly used to prepare the production: CAD (Computer Aided Manufacturing) - CAM (Computer Aided Manufacturing). Today's CAD programs offer a wide range of design possibilities for different types of components, and functionality speeds up the design phase. For construction, attention should be paid to the technology of the construction, which is one of the conditions for obtaining a perfect product.

The paper presents an example of using the CAD-CAM system (*Autocad PowerShape-PowerMill*) to produce an innovative tool for turning with circular arc edges in orthogonal and oblique conditions of cutting.

Nomenclature

λ_s	main cutting edge angle [°]
γ_n	normal rake angle [°]
α_n	normal back angle [°]
R*zt*	surface roughness [μm]
f	feed [mm/rev]