METHODOLOGY FOR CONTROLLING DIMENSIONAL TOOL WEAR

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Annotation: *Determining errors that occur during the cutting of surfaces of parts in mechanical engineering remains the most important task. Before cutting the surfaces of the workpieces, it is necessary to study the working surfaces of the dies. This article provides information on methods for determining the geometric parameters of the surface when cutting with stamps on shaped surfaces, in particular on the structure of the cutting zone of shaped surfaces, the penetration of the cutter into the cutting zone and control conditions in the cutting zone.*

Keywords: *strength parameters, diagnostics, models, cutting area, strength, durability, stamping, stamping form, cutting parameters.*

INTRODUCTION

CNC B workbenches are carrying out extensive scientific and research work on studying the effect of the forces acting on the cutting tools on the quality of the details, accuracy and the wear resistance of the cutting tools through diagnostic systems during the mechanical processing of the complex-shaped details. In this direction, among other things, research on increasing the service life of cutters on the basis of reducing the amount of cuttings during the processing of complex-shaped details, on the basis of reducing the effect of radial forces affecting the processing surface is considered a priority. At the same time, the development of adaptive software for automatic selection of force diagnostic features and calculation of their limit values, taking into account the reliability of the state of the cutting tool, remains one of the urgent tasks of today.

Materials and Methods.

When processing modern materials, tool life is one of the main indicators of its performance. As the tool wears, cutting forces increase and the geometry of the tool changes.

To determine durability, it is necessary to know the dullness criterion tool, which depends on the requirements for the workpiece being processed. In production, the main criterion for dullness is the width of the wear chamfer along the back surface of the tool.

The wear characteristic is usually relative linear wear, which is usually determined by the formula:

$$h = \frac{100 \cdot h_3}{l}$$

where h_3 is experimentally frozen wear on the rear surface, mm;

l is the length of the path traveled, mm.

Relationship between the values of radial dimensional wear and tool wear along the flank surface with the flank angle of the cutter.

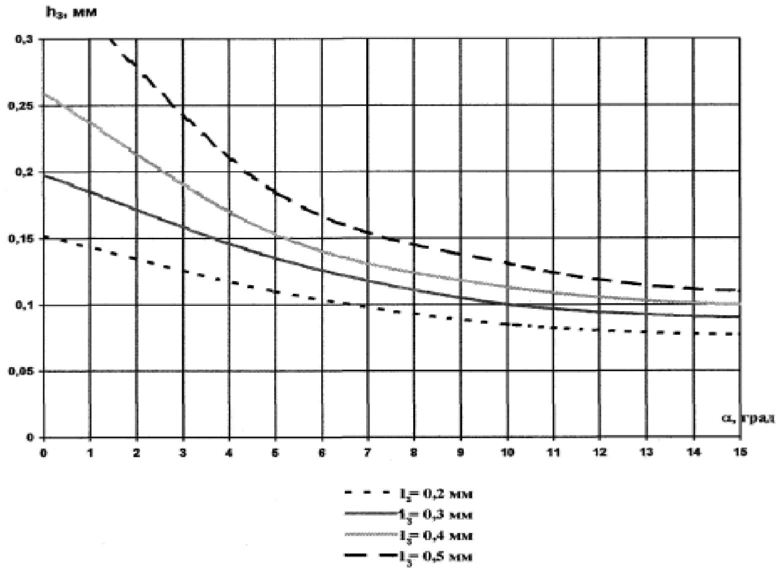

Figure. 1

Relationship between the values of radial dimensional wear and tool wear along the flank surface with the rake angle of the cutter.

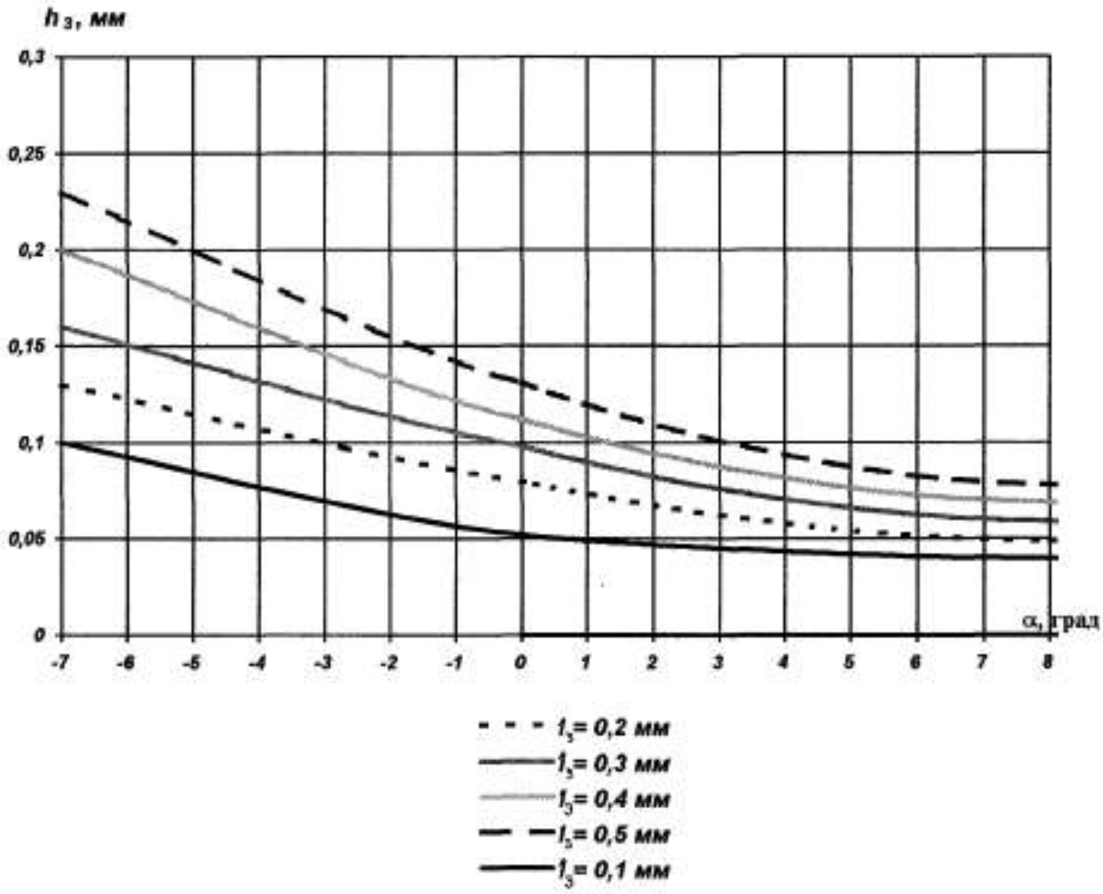

Figure. 2

To calculate the value of relative linear wear for carbide tools, we use the formulas obtained in [1,2].

When working at speeds less than or equal to optimal:

$$h = 0.095 \cdot m_1^7 \cdot \alpha^{0,4} \cdot \left(\frac{б_0}{1+\delta}\right)^{10} \cdot E^{0.037} \cdot \left(\frac{Q_u}{Q_0}\right)^6,$$

when working at speeds greater than optimal:

$$h = 0.095 \cdot m_1^7 \cdot \alpha^{0,4} \cdot \left(\frac{б_0}{1+\delta}\right)^{10} \cdot E^{0.037 \cdot \left(\frac{Q_u}{Q_0}\right)^6} \cdot \left(\frac{V}{V_0}\right)^{0.011 \cdot \left(\frac{Q_u}{Q_0}\right)^9},$$

Where $б_0$ - a dimensionless criterion that reflects the influence of the physical and mechanical characteristics of the material being processed on the wear process;

$m = \frac{\tau_p}{\sigma_B}$ - ratio of plastic shear strength to tensile strength, $н/м^2$;

E - similarity criterion characterizing the influence of the thickness of the cut layer on the cutting process;

δ- relative elongation of the processed material;

$Q_и$- melting point of tool material, degrees.;

Q_o - optimal temperature in the cutting zone, hail.;

V_o - optimal cutting speed, m/min.

The processing error caused by dimensional wear of the tool can be determined by the following formula: [50,51]

$$\Delta_и = h_{о.л.} \cdot V \cdot T,$$

Where $\Delta_и$- processing error caused by dimensional wear of the tool, мм;

T - tool operating time, min;

$h_{о.л.}$- relative linear wear value;

V- cutting speed, m/min.

Of the processing modes, the magnitude of the dimensional wear error is mainly influenced by the cutting speed. Makarov A.D. [50] proved the presence of a clearly defined minimum relative wear in the zone of optimal cutting temperatures. Moving away from the minimum to the right or left entails an increase in the relative wear of the tool. Depth of cut and feed have little effect on the change in wear rate.

Therefore, to control accuracy in finishing and finishing conditions, it is necessary to assign a speed that would ensure minimal relative wear. Calculation of speed is possible based on known empirical dependencies [16].

Conclusion.

1. It has been established that the following factors have the greatest influence on the number of transitions: the rigidity of the technological system, the mechanical properties of the material being processed and the durability of the tool.

2. Based on the research, guidelines on cutting modes for CNC milling machines have been developed and implemented at a number of factories. A new edition of general machine-building standards for cutting modes for face milling operations on CNC machines has been prepared, supplemented for the first time with maps for selecting the number of transitions (processing stages) with the influence of various technological factors.

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