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CONDUCTING RESEARCH ON IDENTIFICATION AND ELIMINATION OF ERRORS ARISING WHEN PROCESSING COMPLEX SHAPED PARTS ON CNC MACHINES

Karimov Ravshan Khikmatulaevich
The Department of Descriptive Geometry and Engineering Graphics Fergana Polytechnic Institute, Republic of Uzbekistan

ABSTRACT

This paper analyzes the experimental determination of the radius of a circular arc in automatic mode on a CNC stand and its essence. The developed control programs for various parameters of the preliminary allowance, the radius of the tool sphere , and the radius of the machined surface were tested on a CNC machine.

Keywords: *determination, radius, CNC, machine, system, complex*

АННОТАЦИЯ

В статье анализируется экспериментальное определение радиуса дуги окружности в автоматическом режиме на стенде с ЧПУ и его сущность. Разработанные программы управления различными параметрами предварительного припуска, радиуса инструментальной сферы и радиуса обрабатываемой поверхности были испытаны на станке с ЧПУ.

Ключевые слова: *определение, радиус, ЧПУ, станок, система, комплекс.*

INTRODUCTION

Machining on wholesale modes may product without additional adaptive devices on CNC machines, if the control program is designed with varying na - parameters of the cutting speed and feed. But as modern CAM the system - we do not take into account changes in the geometric parameters of the cutting area, the development of UP with frame adjustment will be possible only "handed - hydrochloric," which is unacceptable when a large amount of control frames.

The second way to control cutting conditions is to regulate along a changing trajectory of the tool movement , which the machine control system converts into the corresponding parameters of cutting speed and feed.

To implement the method of regulating modes, the control system must solve the following tasks:

• determine the radius of the tool path,

• determine the moments when the tool approaches critical areas,

• set the spindle rotation frequency depending on the angle between the tool axis and the area to be processed,

• set the feed rate, depending on the changing geometry of the cutting zone.

In addition to establishing the optimal cutting conditions, at the stage of developing the cutting tool, it is necessary to take into account the effect of the cutting force on the pressing of the tool, setting the necessary correction for its geometric dimensions.

As parameters optimization process surround frezerova - Nia were chosen and form error performance surface finish.

In an experimental study of the volumetric milling process, it is necessary to consider the following technological parameters:

- cutting modes;
- geometric parameters of the chip formation zone;
- geometric parameters of the tool.

DISCUSSION AND RESULTS

Plan-matrix of a compositional plan on a cube of type B4

To ensure the highest forecast accuracy of the output characteristics, as factorial designs when constructing models, designs close to D - optimal [69] were used for three variable parameters, the design matrix of which is presented in Table 3.1.

Table 3.1.

Experience number	Coded parameter values		
	V	F	H
one	-one	-one	-one
2	+1	-one	-one
3	-one	+1	-one
four	+1	+1	-one
five	-one	-one	+1
6	+1	-one	+1
7	-one	+1	+1
eight	+1	+1	+1
nine	-one	-one	-one
10	+1	-one	-one
eleven	-one	+1	-one
12	+1	+1	-one

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At each point of the factor space, five experiments were carried out, the planning involved speed, feed, cutting depth, the range of factors is given in section 3.2. Defining display patterns change - teley process and the solution of optimization carried out with the use - vaniem algebraic polynomial of the second degree.

The processing of the experimental results was carried out according to the technique [69].

Technical characteristics of the machine 6B52F3.

Experimental studies were carried out on a 6B52F3 three-coordinate vertical milling machine with a SIEMENS 802 CNC system .

Table 3.2.

Spindle speed,	min^{-1}	1 - 6000
Spindle motor power, max,	W	7.5
Feed movement speed,	m / min	0 - 6000
Movement along the X Y Z axes , mm		1000X600X600
Table dimensions, mm		1100X400

Figure 2.28. Vertical milling machine with CNC 6B52F3.

Experiments to determine the geometric parameters of the cutting zone on CNC machines

Experimental determination of the radius of a circular arc in automatic mode on a CNC stand

In the second chapter of this dissertation, it was shown that the accuracy and productivity of finishing milling depends on the geometric parameters of the machining zone, which depend on the radius of the arc of the area to be machined (expressions 2.10, 2.11). From this parameter depends allowance in pa - it untreated zone (2.9) and the contact angle of the cutting edge with obrabaty - Vai surface (2.62, 2.67).

For the automatic control of the processing modes by frame-by-frame control, a method was developed for describing the translators of the tool path (postprocessor), which is presented in Appendix I.

According to the described technique, a postprocessor was written for the SIEMENS 802 (808, 810, 828, 840) CNC stand .

In order to check the correctness of the description of the software for determining the radius of the trajectory of the sections of the processed surface in the calculation block of the control program, expressions (2.10), (2.11) were written (Appendix I, Fig. 2.2 7, section - CALCULATION OF THE RADIUS OF TRA EKTORIA), and to visualize the parameters supplying at radius parameter - attribute to the value of the calculated radius.

The accuracy of the calculation of the radius of the trajectory arc was checked for the following trajectories:

- arc of a circle.
- ellipse, semi-major axis is parallel to the XY plane .
- ellipse, semi-major axis is parallel to the Z axis .
- parabola (Fig. 3.1).

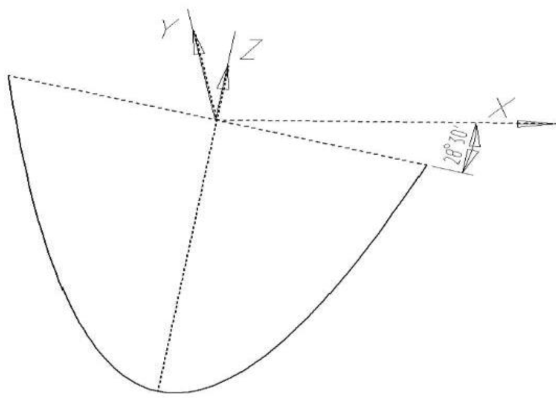

Figure 3.1. Parabolic trajectory

Below is a fragment of the control program for Z = -50 mm, as well as geometric and calculated values for a parabola (Figure 3.2), the branches of which are directed along the Z axis , and the plane is rotated from the XZ plane by 28.5 °.

PARABOLA.PTP				SIMENS
	Позиция	Остат. Траект.	T,F,S	
X	0.000	0.000 мм	T 11	
Y	-0.000	0.000 мм	5.758	100%
Z	-50.000	0.000 мм	F	
	0.000	0.000	5.758	мм/мин
	G54	G64		
№ кадра	Акт. программа	PARABOLA.PTP		
N490 R5=2.062 R6=14.035 R7=.5 R8=2.				
N500 R9=R3+R7 R10=R4+R8 R11=ATAN2(R10,R9) R12=90-R6-R11				
R14=R1/(2*R13)				
N510 X0.0 Y0.0 Z-50. F=ABS(R14)				
N520 R1=2.062 R2=14.035 R3=.5 R4=2.				

Figure 3.2. Parameters of the control program for Z = -50 mm

The rack display shows the following information:

- the actual value of XYZ, (position);
- section of the program, for the actual position of the tool;
- often the spindle rotation - S;
- feed F.

For visualization of the calculated values of radius of a circular arc, Pa - parameters of supply is assigned a value of the radius parameter (Figure 3.3.).

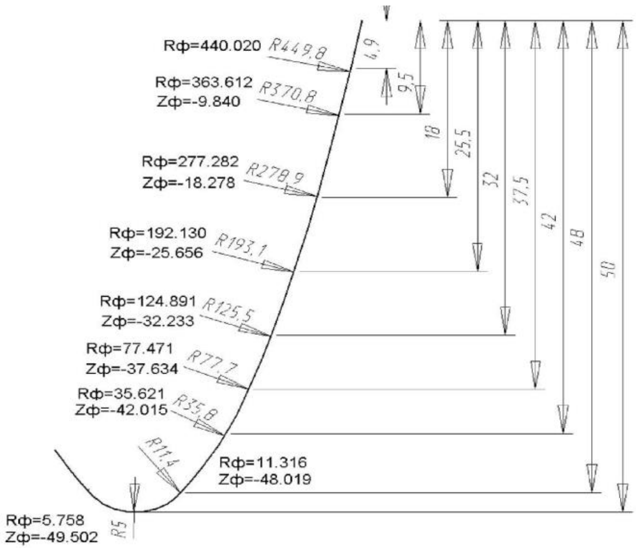

Figure 3.3. Geometric and actual parameters of circular arcs

The experiments carried out led to the following conclusion:

- the error of the calculated parameters does not exceed 10% of the geometric ones, and depends on the processing accuracy set in the operational editor.

3.2.2. An experiment to identify previously unprocessed areas in automatic mode on a CNC stand .

Once in software is required baking was introduced by definition block division arc radius circumference surface treated in councils - a block (. Figure 3.4), by definition, previously has been inserted optionally-governing program - CLOSED plots (2.19).

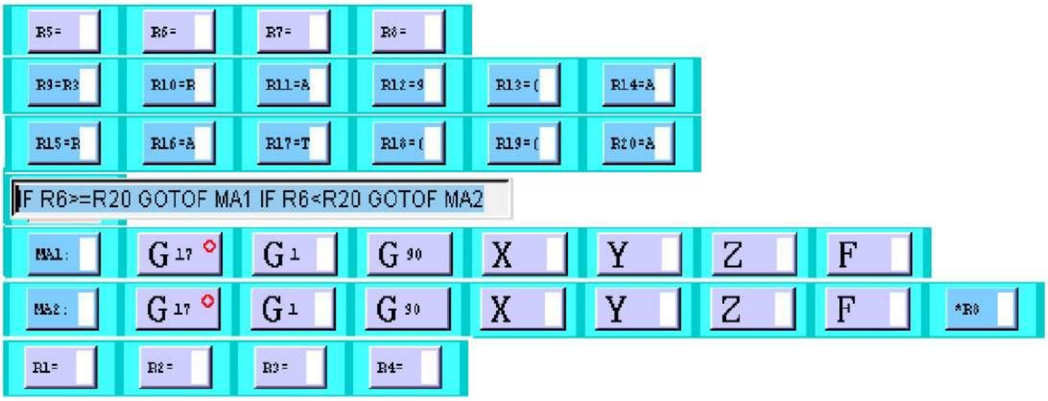

Figure 3.4. Calculation unit for determining untreated zones In order to check the condition of expression (2.19), the following experiment was performed.

A 3D model of a spherical surface was built in UNIGRAPHICS CAD .

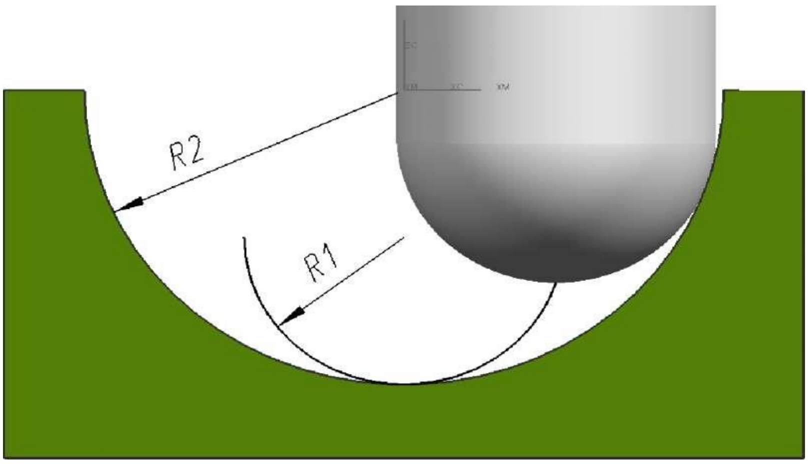

Figure 3.5. Spherical surface programming R 1- radius of the cutter trajectory, R 2- radius of the machined surface.

The developed control programs for various parameters of the preliminary allowance, the radius of the tool sphere , and the radius of the machined surface were tested on a CNC machine.

At sites "wall" machine practiced by moving the feed frame MA1 S = 500 mm / min, when approaching a previously unprocessed area ne remescheniya perfected on frame MA2 feed S = 250 mm / min.

The experiments revealed , and the possibility that the systems councils Lenia CNC machines allow to define portions approximation instru - ment to previously untreated zone, and the feed switch in the "bottom" mode is made at a height of 0.1-0.3% of the diameter of the milling cutter that enables predot - repair the breakage of the tool.

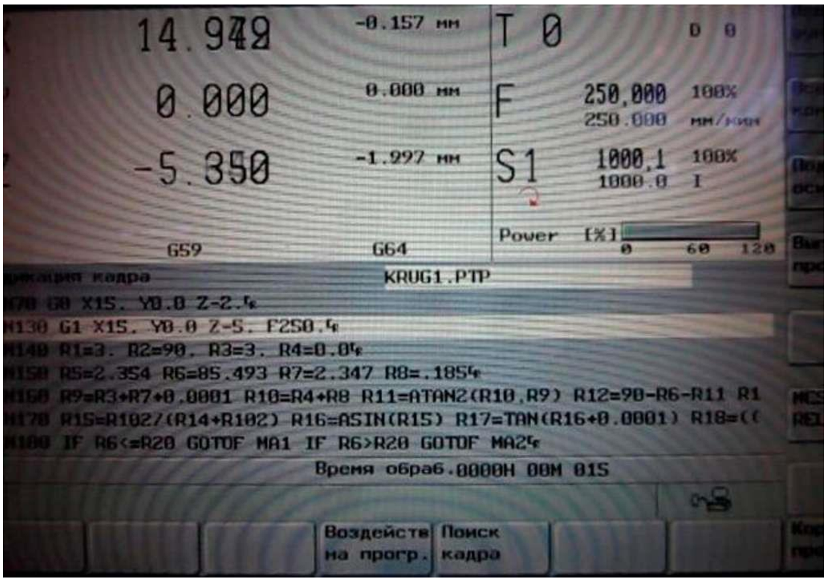

Figure 3.6. Fragment of the program when processing the "bottom"

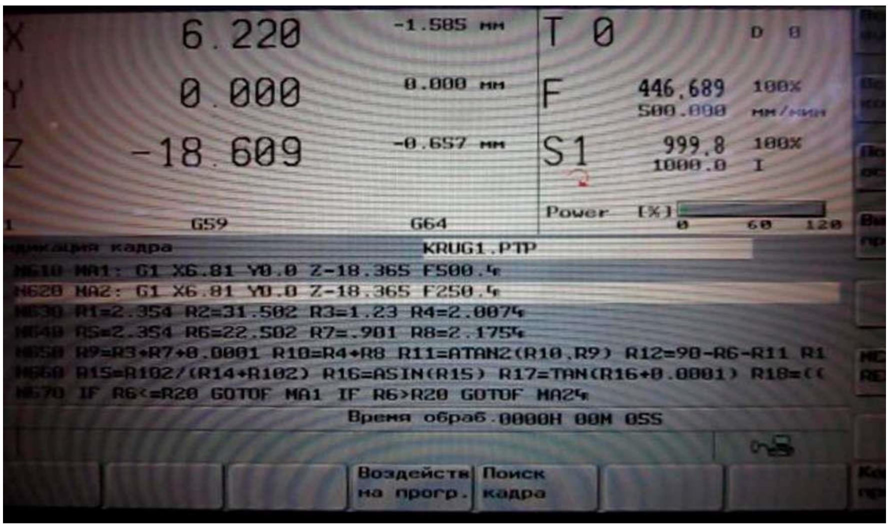

Figure 3.7. Fragment of the program when processing "walls"

In Figure 3.6 shows a program fragment when passing optionally previously - CLOSED zone ("bottom") in Figure 3.7 fragment at passage portion "wall."

CONCLUSION

The experiments carried out by the automatic determination of the geometry - - empirical treatment zone parameters and previously untreated areas of the ICU - the theme of the NC confirm the theoretical expression developed in the WTO - Roy chapter.

Changing the tool path when the finishing mill volume - tion concave surfaces leads to a change in the geometry parameters - Ria cutting zone, which in turn leads to variation in magnitude of squeezing the cutter from the treatment surface and therefore to variability parameter processing accuracy.

Change tracking trajectory automatic reception CNC machine, without the use of additional devices, allows error processing result value to constant values-compensation - tran sportation cutting modes, as confirmed by experiments carried out - Tammy.

Allowance for error processing allows to influence the geometric parameters of the formed linear dimensions and change the trajectory inst - ments to compensate for the error parameter, which greatly increases the accuracy finishing processing volume of the concave spherical surfaces of complex shape cutters.

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