



EXPERIMENTAL STUDIES OF THE TECHNOLOGICAL PROCESS OF PROCESSING CONCAVE SURFACES OF COMPLEX SHAPES

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KALIT SO'ZLAR

CAM, Developing,
SIEMENS 802

ANNOTATSIYA

The master's dissertation on the topic "Conducting research on identification and elimination of errors arising when processing complex shaped parts on cnc machines" contains 138 pages of a text document.

The aim of the dissertation was to improve the existing manufacturing technology. As a result of the research, the technological process of machining was improved for a body part of high complexity "Housing" in conditions of mass production using technological equipment with numerical control.

Developing an Experiment Plan

Machining on wholesale imalnyh modes may produ ditsya 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.

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

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).

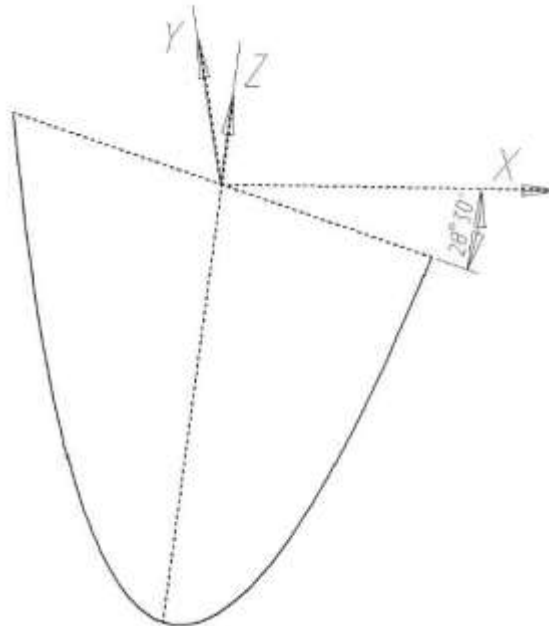


Figure 3.1. Parabolic trajectory

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			S I M E N S	
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.).

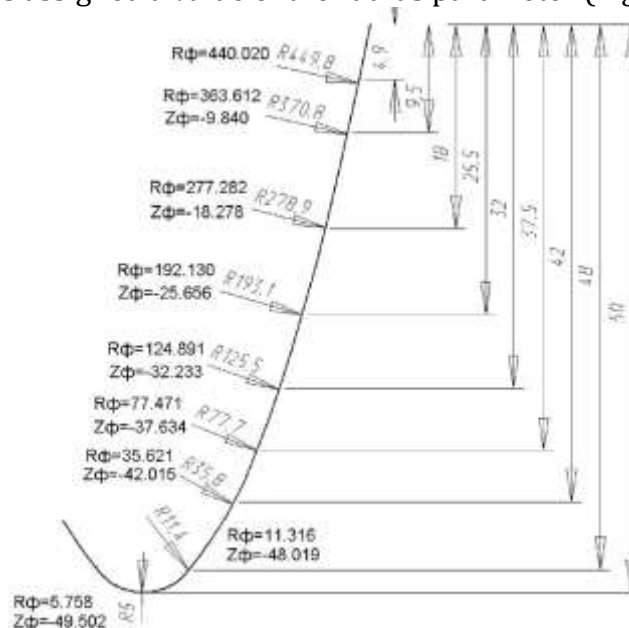


Figure 3.3. Geometric and actual parameters of circular arcs

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 .

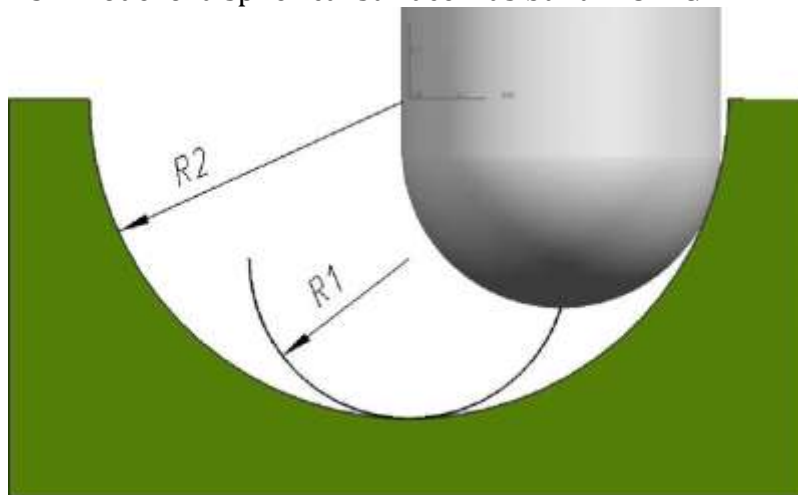


Figure 3.5. Spherical surface programming R 1- radius of the cutter trajectory, R 2- radius of the machined surface.

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.

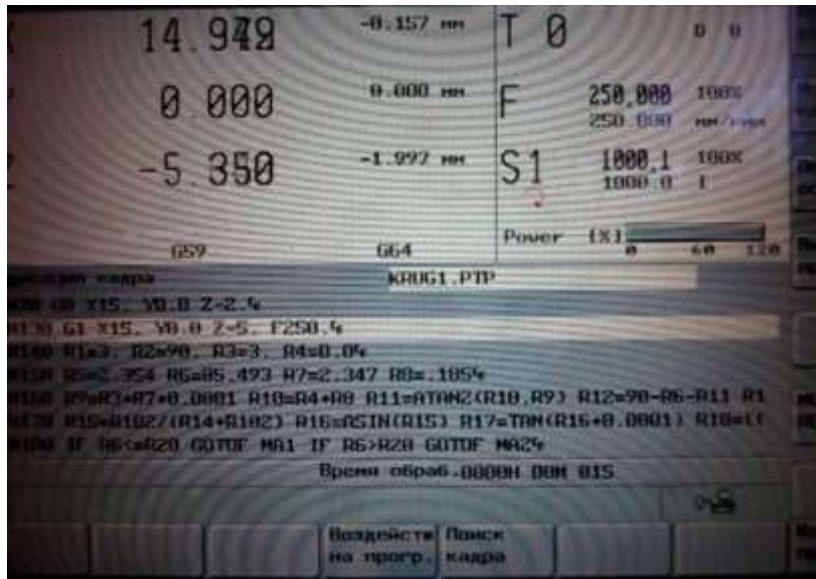


Figure 3.6. Fragment of the program when processing the "bottom"

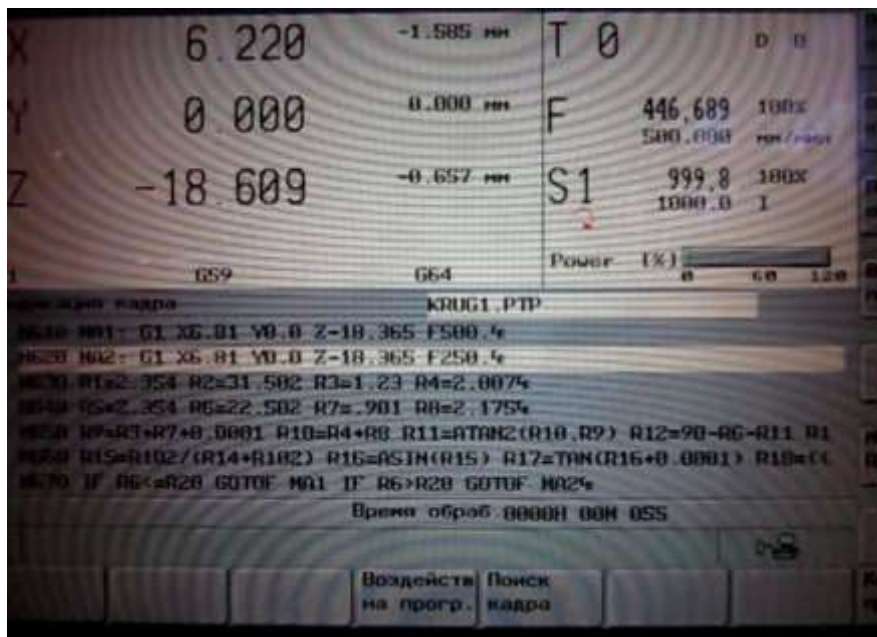


Figure 3.7. Fragment of the program when processing "walls"

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

Conclusions.

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 - transportation 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 instruments to compensate for the error parameter, which greatly increases the accuracy finishing processing volume of the concave spherical surfaces of complex shape cutters.

FOYDALANILGAN ADABIYOTLAR:

1. ГОСТ 1 4.004-83. Technological preparation of production. Terms and definitions of basic concepts. - Introduction. 1983-01-07. - М.: USSR State Committee for Standards, 1983. - 8 p.
2. ГОСТ 14.205-83. Manufacturability of product design. Terms and definitions. - Introduction. 1983-01-07. - М.: USSR State Committee for Standards, 1983. - 4 p.
3. Axmadbek Maxmudbek o'g'li Turg'unbekov, & Abdumajidxon Murodxon o'g'li Muxtorov (2021). Theoretical Studies Of The Technological Process Of Machining Parts With Concave Surfaces Of Complex Forms On Cnc Milling Machines. Journal of Innovations in Social Sciences 1(1), 90-97.
4. Ахмадбек Махмудбек Ўғли Турғунбеков (2021). НОТЕХНОЛОГИК ЮЗАНИНГ ТЕШИКЛАРИГА ИШЛОВ БЕРИШДА ДОРНАЛАШ УСУЛИНИ ТАДБИҚ ЭТИШ. Scientific progress, 2 (1), 4-10.
5. Abdumajidxon Murodxon O'G'Li Muxtorov, & Axmadbek Maxmudbek O'G'Li Turg'unbekov (2021). VAKUUM XALQALARI UCHUN SILIKON MATERIALLARNI TURLARI VA ULARNING TAHLILI. Scientific progress, 2 (6), 1503-1508.
6. Rustam Karimov (2021). PLANNING OF BELT BRIDGE FOR UNSYMMETRICAL PROGRESSIVE STAMPING. Scientific progress, 2 (2), 616-623.
7. Karimov, R. (2021). PLANNING OF BELT BRIDGE FOR UNSYMMETRICAL PROGRESSIVE STAMPING. Scientific progress, 2(2), 616-623.
8. Karimov, R. J. O. G. L., & Toxtasinov, R. D. O. (2021). FEATURES OF CHIP FORMATION DURING PROCESSING OF POLYMER COMPOSITE MATERIALS. Scientific progress, 2(6), 1481-1487.
9. Karimov, R. J. O. G. L., O'G'Li, S. S. D., & Oxunjonov, Z. N. (2021). CUTTING HARD POLYMER COMPOSITE MATERIALS. Scientific progress, 2(6), 1488-1493.
10. Jaxongir o'g'li, R. K., & Sobirovna, N. S. IMPROVING THE QUALITY OF LASER CUTTING OF METALS BY OPTIMIZING THE TECHNOLOGICAL PARAMETERS OF THE PROCESS.
11. Dostonbek, V., Nizomiddin, J., & Jurabek, S. (2021). EXPERIMENTAL AND THEORETICAL STUDIES OF THE PROCESS OF CUTTING POLYMER MATERIALS. Academicia Globe: Inderscience Research, 2(05), 485-490.
12. Ravshan, K., & Nizomiddin, J. (2020). Increasing efficiency of production of machine parts using a combined blade tool. ACADEMICIA: An International Multidisciplinary Research Journal, 10(5), 445-448.



13. Усманов, Д. А., Умарова, М. О., & Жумаев, Н. К. У. (2019). Построение графика проекций поверхности отклика для типа барабана и формы сороудаляющей сетки очистителя хлопка-сырца. *Проблемы современной науки и образования*, (11-1 (144)).
14. Eraliyevna, T. Z. (2020). Development trends in the building complex in Uzbekistan. *ACADEMICIA: An International Multidisciplinary Research Journal*, 10(6), 1702-1705.
15. Turg'unbekov Axmadbek Maxmudbek o'g'li (2021). THEORETICAL STUDIES OF THE TECHNOLOGICAL PROCESS OF MACHINING PARTS WITH CONCAVE SURFACES OF COMPLEX FORMS ON CNC MILLING MACHINES. 1(8), 122-128.
16. Eraliyevna, T. Z., & Shavkatbekovna, G. E. (2021). History, concept and origin of architectural art. *ACADEMICIA: An International Multidisciplinary Research Journal*, 11(6), 714-716
17. Eraliyevna, T. Z. (2021). History of architecture city and ferghana cities in the region. *CENTRAL ASIAN JOURNAL OF SOCIAL SCIENCES AND HISTORY*, 2(2), 11-15
18. Усманов, Д. А. (1981). Исследование эффективности очистки хлопка-сырца от сорных примесей. Дисс. канд. техн. наук. Ташкент.
19. Kholmurzaev, A. A., & Polotov, K. K. (2020). METHODS OF USING MEDIA EDUCATION IN THE LEARNING PROCESS. *Theoretical & Applied Science*, (5), 205-208.
20. Ahmadbek Mahmudbek o'g'li Turg'unbekov(2021). ARRALI JIN MASHINASIDAGI KOLOSNIK PANJARASI BO'YICHA OLIV BORILGAN ILMIY TADQIQOTLAR TAHLILI. *Scientific progress*, 2 (7), 78-82.
21. Достонбек Азим Ўғли Валихонов, Алишер Ахмаджон Ўғли Ботиров, Зухриддин Носиржонович Охунжонов, & Равшан Хикматуллаевич Каримов (2021). ЭСКИ АСФАЛЬТО БЕТОННИ КАЙТА ИШЛАШ. *Scientific progress*, 2 (1), 367-373.
22. Omonbekovna, U. M., Siddikovich, S. P., Uli, A. K. K., & Bakhtiyarovna, Y. N. (2021). Structure of national avry hair tissue and specificity of its production. *ACADEMICIA: AN INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL*, 11(2), 1132-1138.
23. Omonbekovna, U. M., & Siddiqovich, S. P. (2021). Optimization of the parameters of the aurband process in the manufacture of warp threads for national aurb fabrics. *ACADEMICIA: An International Multidisciplinary Research Journal*, 11(4), 396-400.
24. Холмурзаев, А. А., Алижонов, О. И., Мадаминов, Ж. З., & Каримов, Р. Х. (2019). Эффективные средства создания обучающих программ по предмету «Начертательная геометрия». *Проблемы современной науки и образования*, (12-1 (145)).
25. Абдуллаева, Д. Т., Каримов, Р. Х., & Умарова, М. О. (2021). МАКТАБ ТАЪЛИМ ТИЗИМИДА ЧИЗМАЧИЛИК ФАНИНИ РИВОЖЛАНТИРИШ ВА БИЛИМ БЕРИШ ЖАРАЁНИНИ ТАКОМИЛЛАШТИРИШ. *Scientific progress*, 2(1), 323-327.
26. Abdumajidxon Murodixon O'G'Li Muxtorov, & Axmadbek Maxmudbek O'G'Li Turg'Unbekov (2021). VAKUUM XALQALARI UCHUN SILIKON MATERIALLARNI TURLARI VA ULARNING TAHLILI. *Scientific progress*, 2 (6), 1503-1508.
27. Усманов Джасур Аминович, Умарова Мунаввар Омонбековна, Абдуллаева Доно Тошматовна, & Ботиров Алишер Ахмаджон Угли (2019). Исследование эффективности очистки хлопка-сырца от мелких сорных примесей. *Проблемы современной науки и образования*, (11-1 (144)), 48-51.



28. Хусанбоев Абдулкосим Мамажонович, Ботиров Алишер Ахмаджон Угли, & Абдуллаева Доно Тошматовна (2019). Развертка призматического колена. Проблемы современной науки и образования, (11-2 (144)), 21-23.
29. Fayzimatov, Sh N., Y. Y. Xusanov, and D. A. Valixonov. "Optimization Conditions Of Drilling Polymeric Composite Materials." *The American Journal of Engineering and Technology* 3.02 (2021): 22-30.
30. Yunusali Yuldashalievich Xusanov, and Dostonbek Azim O'G'Li Valixonov. "POLIMER KOMPOZITSION MATERIALLARDAN TAYYORLANGAN DETALLARNI PARMALASHNI ASOSIY KO'RINISHLARI" *Scientific progress*, vol. 1, no. 6, 2021, pp. 1169-1174.
31. Dostonbek, V., & Saydullo, A. (2020). Using gaming technologies in engineering graphics lessons.
32. *ACADEMICIA: An International Multidisciplinary Research Journal*, 10(5), 95-99.
33. Valixonov Dostonbek, Jumaev Nizomiddin, & Srojidinov Jurabek. (2021). EXPERIMENTAL AND THEORETICAL STUDIES OF THE PROCESS OF CUTTING POLYMER MATERIALS. *Academicia Globe: Inderscience Research*, 2(05), 485-490. <https://doi.org/10.17605/OSF.IO/U8XN3>
34. Достонбек Азим Ўғли Валихонов, Алишер Ахмаджон Ўғли Ботиров, Зухриддин Носиржонович Охунжонов, & Равшан Хикматуллаевич Каримов (2021). ЭСКИ АСФАЛЬТО БЕТОННИ КАЙТА ИШЛАШ. *Scientific progress*, 2 (1), 367-373.
35. Усманов Джасур Аминджанович, Холмурзаев Абдирасул Абдулахатович, Умарова Мунаввар Омонбековна, and Валихонов Достонбек Аъзим Угли. "Исследование формы сороудалительной сетки колково-барабанного очистителя хлопка-сырца" *Проблемы современной науки и образования*, no. 12-1 (145), 2019, pp. 35-37.
36. Dostonbek, V., & Salimaxon, N. (2021). The effect of scraping and surface cleaning on the scraping of scraping to be dressing in the cutting of polymer materials. *ACADEMICIA: An International Multidisciplinary Research Journal*, 11(6), 717-721.