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Laboratory and simulation study of the effect of the parameters of the milling machine on the smoothness of the surface of alloy steel

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Abstract

With regard to the scope of application of VCN150 steel and the lack of a coherent research and laboratory work in relation to this type of alloy steel got a brief introduction to the way this type of alloy steel and its scope of operation to review the mentioned laboratory and simulation of it. Examples in the laboratory procedure in accordance with test method according to the number of nine pieces of Taguchi outlines prepared and with 3 Vf parameter (speed of progress), Vc (rotational speed), ap (the depth of the chip) to check the process of the various conditions of milling machine. Finally, the surface roughness test for portable devices by manufacturing parts model sutronic construction company taylor hobson and according to the output that the device was showcased, more progress in the speed and depth of the shear surface roughness has been more and more but in the method of simulation of the Abaqus software to review and analyze various conditions and laboratory results and spent milling machine simulations we compared the percentage error of the two methods . A three-dimensional finite element model for simulating a real process of milling machine was provided. The most important factors influencing the process of pellet woman numeric form and examine the laboratory assembled.

Keywords: Milling parameters, Roughness, Steel VCN150, Taguchi testing method, simulation.

Introduction

Machining of a manufacturing process for shaping metal parts by removal of excess material from them. Each piece in the machining process, on the one hand must quality parameters such as surface finish machining accuracy and dimensional tolerance and the minimum cost of machining, machining time and minimum or maximum profit taken into consideration. is required. The analytical models, due to limitations arising from quality parameters and machining conditions, to meet criteria such as minimum cost of machining, minimizing machining time has been developed.

To achieve maximum production capability and precise acquire the part geometry often used machining process. Machining of conversion processes that remove material from additional parts of the original piece, geometric shape that is created. So it is defined removal of material with a sharp machining such as turning, milling.

Various types of materials are machined shapes and geometric features such as slots screws, precision holes, edges and pages can be solved very polished and smooth. It also optimize parts for dimensional accuracy of casting, forming and shaping possible. The reasons for using machining can reduce thermal distortion and discoloration of payment methods, reducing production costs (usually in low numbers) and create features and surface textures to be named. More waste generated, time-consuming process, mass production more expensive and more energy is one of the limitations of machining process.

Each machining operations on two factors relative motion between tool and work piece and cutting tool geometry influence on the part geometry by the fruiting part geometry (feed) or a cutting tool or a combination of the two which determined.

In traditional machining techniques, the machining parameters by designers or manufacturers of machine tool and machining process based on the experience of this group of professionals and also took handbook tools. This is usually conservative parameters were used by ordinary people. Colding reported that 40 per cent greater than that of the optimal parameters used in the process [2].

Bozlix and partners to review their capacity and surface finish on the machined surfaces with different shapes. They tested different strategies and surface finish assessed in this case. Finally, the optimal mode for surface finish achieved [3].

Bojilin and colleagues to review the structure and surface finish their five-axis milling with changes in shear rate. They are different strategies for milling rough

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surfaces (Non Uniform Rational B-Spline) are presented and discussed their final surface finish. Finally, they state that it was the best surface finish, introduce and analyze parameters it. Figure: 1 magnification of 100 micrometers in milled surface topography shows for different speeds [4].

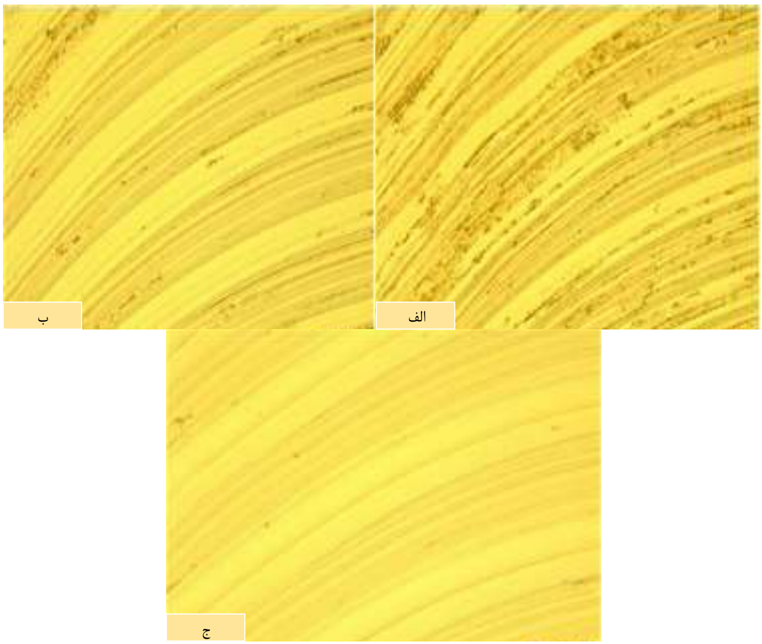
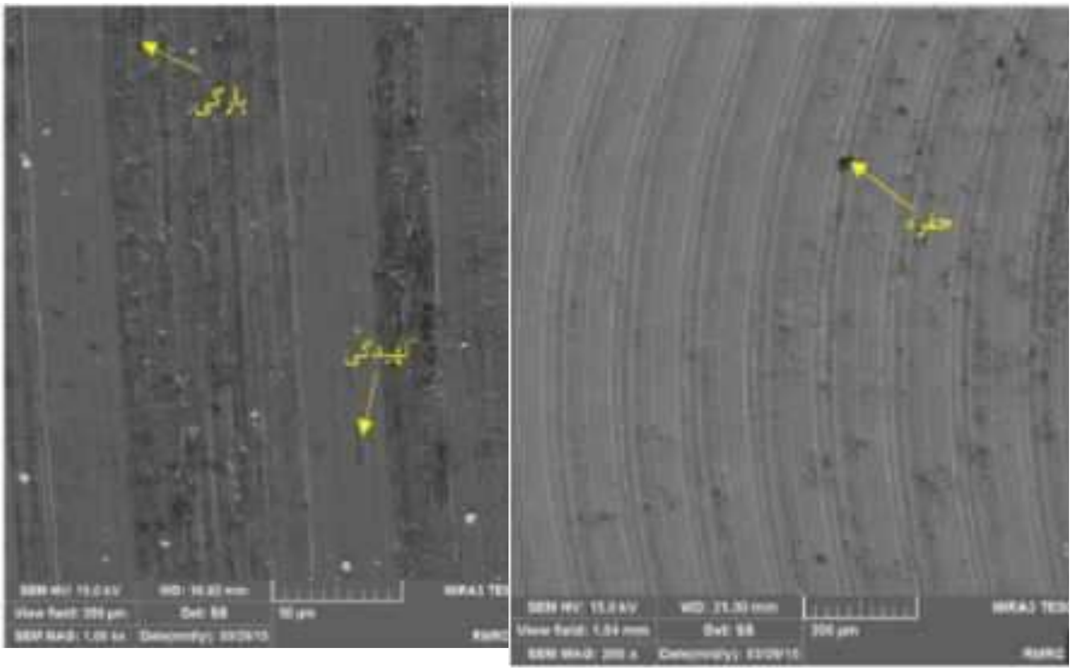


Figure 1: the shape of the topography of the surface milling machine for the shear rate a) 150 m/min) 300 m/min c) 450 m/min.

Willey et al. in 2008 to extract the move tool in complex curves. It was initially a series of circular and linear lines to curves of nares. Then it curves smoothly and in the end move tool to navigate the curves were extracted. The results showed that this method of progress and momentum swings in this case have dramatically reduced compared to normal mode [5]. Murugan and associates to review changes to the roughness of the surface by changing the parameters of machining. With Taguchi method tested and designed with the most optimal mode of genetic algorithm for surface roughness philanthropists. The shape of the typical level of car pictures 2 2 work with shear speed 150 m/min and the rate of the advance of 04.0 mm on a dent in two Zoom 200 and 1000 times the show [6].

Hassanpour and partners to examine different strategies of arbitrary shape along with levels of milling machine by changing the parameters of the machines tested. The final results indicate that it is working on the machine strategies the final workpiece properties such as hardness and surface smoothness is important [7].



(ب) (الف)

Figure 2: images taken by the electron microscope, for example a: zoom magnification 200 times 1000 times

The surface roughness levels DAS and colleagues in the process of turning hard working hard alloy steel, coated by tool were examined. In the test the impact of three rate parameters, shear velocity and depth of progress cutting the check and it became clear that the rate of progress and the shear velocity were the most influence on the surface roughness. Figure 2 3 average roughness surface roughness profiles and equal to the central line between it and the integral of absolute roughness profile or during the measurement [8].

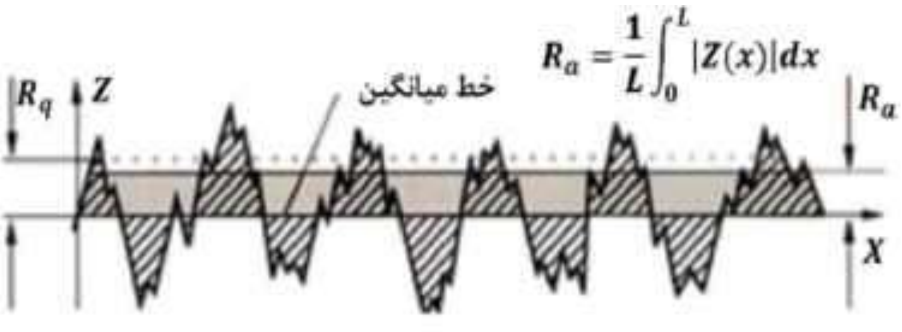


Figure 3: schematic form and how to determine the mean roughness surface roughness

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Moisan studies on the effects of shear rate and the rate of progress, click on the tool wear in turning on the hard level health gears hardened steel Mn5Cr27 topical. The results suggest that the rate of progress was the main parameter on surface roughness affects [9]. Lubrication using the minimum shear as the process fluid is compatible with the environment, the way in which a small amount of fluid inside the air jet, and place the slices sprinkled. The use of these methods in addition to reducing the intake of fluid shear, dry machining method restrictions removed, reduced friction to form an effective obaath reducing heat in the cutting position. A lot of research on the method of MQL stable cooling as a replacement and lubrication in the process of machining has taken place [10]. Silva et al. impact of three dry environment, traditional work of MQL lubricant on surface roughness and tool wear rate of alloy steel AISI4340 in the process of milling machine were examined. Figure 3 MQL device used to perform the experiment shows the [11 moisan studies on the effects of shear rate and the rate of progress, click on the tool wear in turning on the hard level health gears hardened steel Mn5Cr27 topical. The results suggest that the rate of progress was the main parameter on surface roughness affects [9]. Lubrication using the minimum shear as the process fluid is compatible with the environment, the way in which a small amount of fluid inside the air jet , and place the slices sprinkled. The use of these methods in addition to reducing the intake of fluid shear, dry machining method restrictions removed, reduced friction to form an effective reducing heat in the cutting position. A lot of research on the method of MQL stable cooling as a replacement and lubrication in the process of machining has taken place [10]. Silva et al. impact of three dry environment, traditional work of MQL lubricant on surface roughness and tool wear rate of alloy steel AISI4340 in the process of milling machine were examined. Figure 2 4 MQL device used to perform the experiment shows the [11]. Mopisan studies on the effects of shear rate and the rate of progress, click on the tool wear in turning on the hard level health gears hardened steel Mn5Cr27 topical. The results suggest that the rate of progress was the main parameter on surface roughness affects [9]. Lubrication using the minimum shear as the process fluid is compatible with the environment, the way in which a small amount of fluid inside the air jet and place the slices sprinkled. The use of these methods in addition to reducing the intake of fluid shear, dry machining method restrictions removed, reduced friction to form an effective reducing heat in the cutting position. A lot of research on the method of MQL stable cooling as a replacement and lubrication in the process of machining has taken place [10]. Silva et al. impact of three dry environment, traditional work of MQL lubricant on surface roughness and tool wear rate of alloy steel AISI4340 in the process of milling machine were examined. Figure 2 4 MQL device used to perform the experiment shows the [11].

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Figure 4: the shape of the device used to perform test MQL

And the partners, to examine the effect of lubrication on surface roughness in MQL method for steel turning 4340 and it became clear that using this method lowers the temperature of the cutting area and thus reduce the roughness of the surface [12]. Leo & Associates, to review the health attributes of steel surface GCr with the hardness of about 60 Rockwell c. The results showed that, under some circumstances, it is possible to shear waste there is tension stretching. As well as the level of roughness in turning parts with a higher hardness of 50 Rockwell c reduced thermal balance of heat and distribution partners in the workpiece hole deep in the process of working with the use of half-dry lubrication study. It is limited to the components of a work piece and temperature distribution analysis of a piece of work during the process of piercing the deep hole. Figure 5 milling temperature analysis shows [14].

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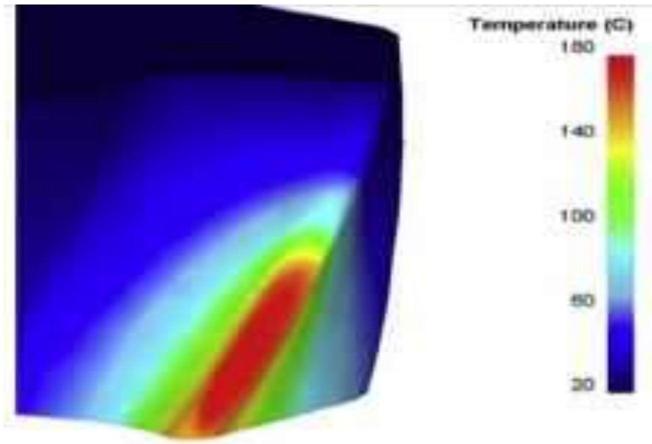

Figure 5: shape analysis of milling temperature

Tedslan and partners working with the hole process of liquid lubrication, dry and half dry and wear the tools, how to form filings, force, torque and surface roughness obtained in this study are. Based on the results of these researchers, lubrication in the case of dry and semi-dry leads to less tool wear, while surface roughness obtained with more dry lubrication mode from other modes hosting [15]. And colleagues conducted a series of experiments to investigate the effect of lubrication and abrasion on the semi-arid roughness surface machining on the lathe work operation. Based on its results, with the use of this type of lubrication, the surface roughness of machining and tool wear due to the reduction of the temperature of the area of machining, reduced [16]. The surface roughness levels DAS and colleagues in the process of turning hard alloy 4340 steel harder work by means of tools, coated examined. In the test the impact of three rate parameters, shear velocity and depth of progress cutting the check and it became clear that the rate of progress and the shear velocity, in order of greatest influence on their surface roughness [17]. Regression equations for the frequency of applications models.

Data simulation analysis of milling machine in this section about how modeling and correctness of the presented models will be discussed. In accordance with the issue terms the conditions of simulated laboratory for all the parameters affecting the process of milling machine. Effective rotational parameters present in the

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work load tool speed, line speed and motion vector times the depth. With seven different simulation can be the effect of all these parameters on surface roughness of view. The different modes is shown in Figure 6.

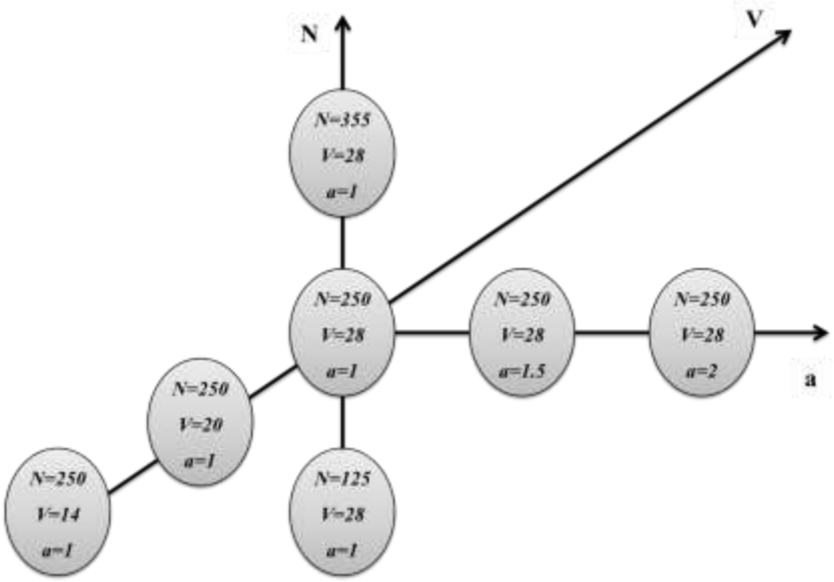

Figure 6: parameters affecting the process of milling machine

Three dimensional simulation modeling is the process of milling machine using ABAQUS/Explicit 6.10.1 software. Number of vector based on ISO filings tools equal DNMG 11 04 08-1125 SF. Schematic view of the diamond and its dimensions and shape in Figure 7,8 is shown.

Figure 7: schematic view of the diamond

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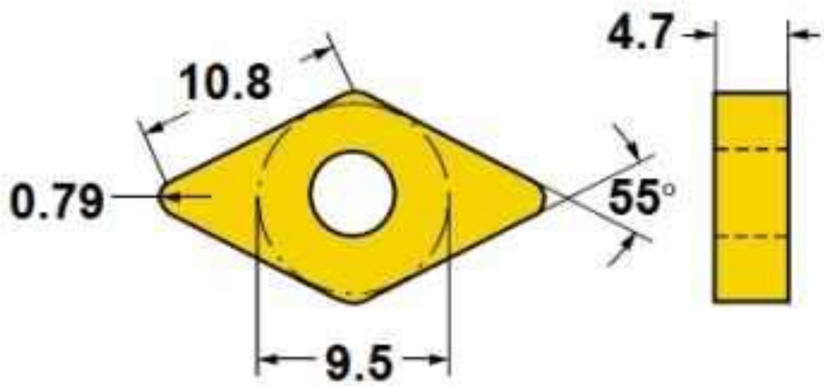
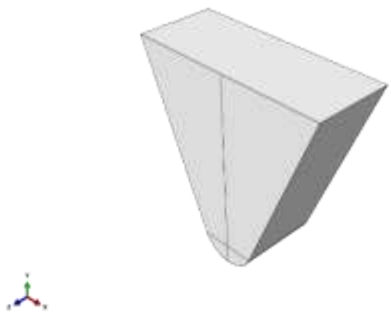


Figure8: Diamond dimensions are in mm.



Figur9: view of geometry and partitioning tools

Rigid tools of the type defined in the software .Geometry and packaging tool in the form of a sizeable . Elastic-plastic material model with hard for example, the definition of. Thermal effects of regardless. For this reason that the rate of cooling pieces in the very act. Figure 4 6 geometry and packaging shows a sample A total of 18 diamonds in accordance with the conditions of the experiments on the circular radius of the environmental Assembly, according to figure8,9 cm3 between the projectile and the level of contact with the surface of the samples node contact penalty algorithm was used. The level of the existing nodes and all the diamonds in the high level instances have the possibility of making calls. Hence ,was defined for them. Boundary conditions and the load applied to the samples and tools in accordance with Figure 4 8. The typical elements of a node with a brick type eight-point and integral control (C3D8R) and the elements of the rigid elements of the diamond type) R3D4). Figure 8 and figure9 shows examples. how to mesh layout elements.

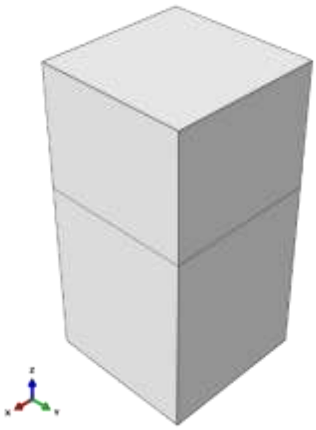


Figure10: view of geometry and partitioning example

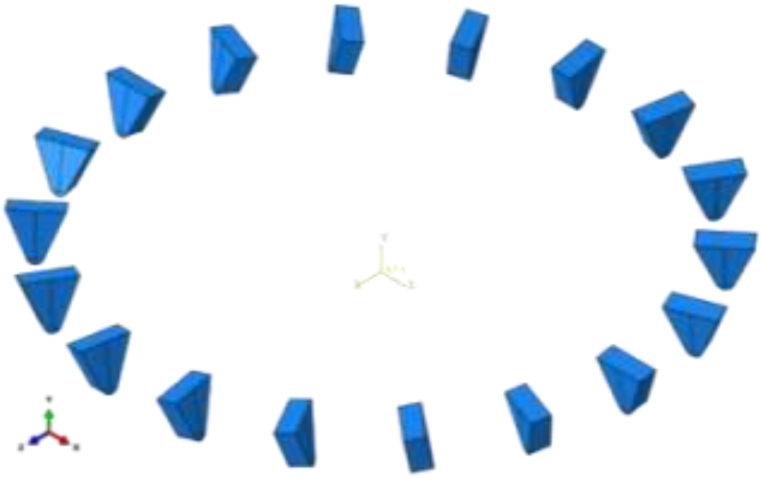


Figure11: view of assembling the diamond

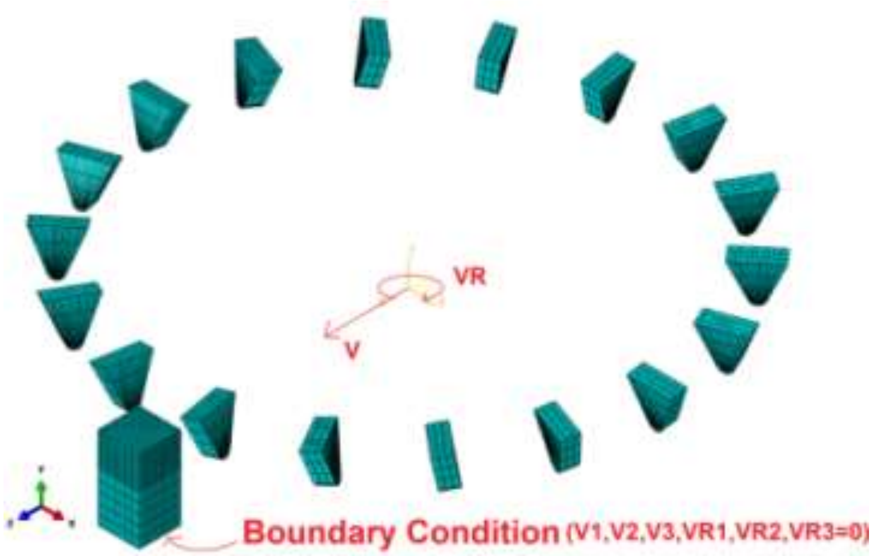


Figure12: boundary conditions and load the sample tool and chip (V = rotational speed and linear speed = VR)

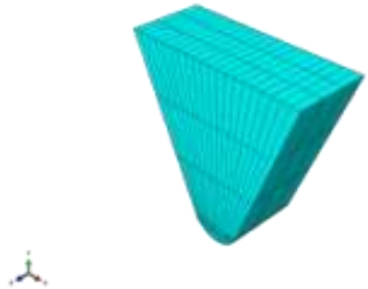


Figure13: somehow supply diamonds

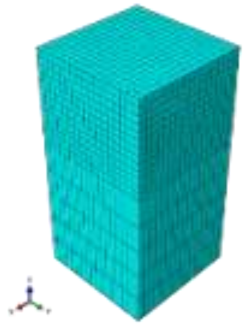


Figure14: somehow typical packaging elements

Contour Mises equations tension at the beginning, middle and end of the process is shown in Figure15 milling machine. Also, the examples and the isolated elements after the completion of the process is shown in Figure16.

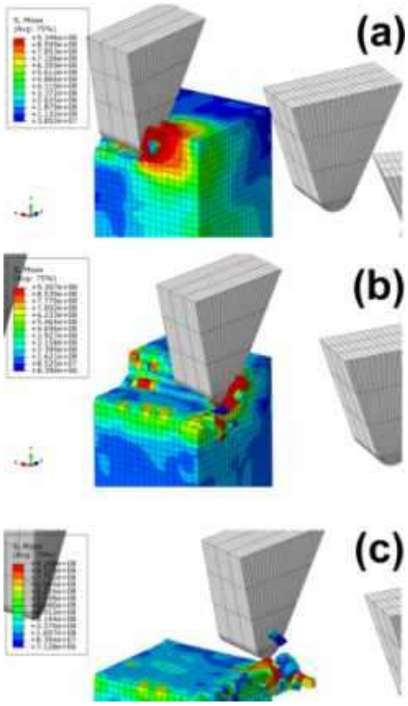


Figure15: Mises equations during the process of stress contour milling machine (a: b: the beginning of the process, in the middle of the process and the end of the process: c)

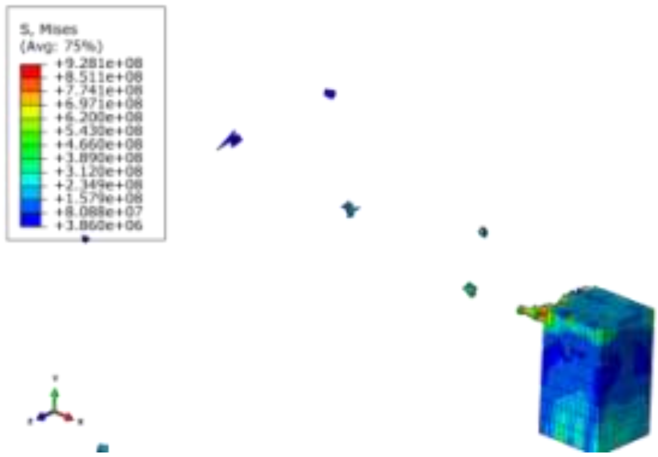


Figure16: a view of the sample and of the isolated elements

Calculation of roughness parameters here it is necessary to define the parameters of roughness. The main objective of this study was to investigate, because different conditions on surface roughness of milling machine. Surface roughness generally result from the manufacturing process or the terms of the article. The most important parameter for roughness parameters often describe the topography of the surface. These parameters using the vertical displacement on the surface can be defined. According to the standard ISO 4287 roughness parameters are of average height, Ra Rq Rt Chi sum of squares of maximum height and roughness, subtracting the minimum measured along the route. These parameters are calculated by the following relations.Calculation of roughness parameters here it is necessary to define the parameters of roughness. The main objective of this study was to investigate, because different conditions on surface roughness of milling machine. Surface roughness generally result from the manufacturing process or the terms of the article. The most important parameter for roughness parameters often describe the topography of the surface. These parameters using the vertical displacement on the surface can be defined. According to the standard ISO 4287 roughness parameters are of average height, Ra Rq Rt Chi sum of squares of maximum height and roughness, subtracting the minimum measured along the route.

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$$R_a = \frac{1}{n}\sum_{i=1}^{n}|y_i| \qquad 1$$

$$R_q = \sqrt{\frac{1}{n}\sum_{i=1}^{n}{y_i}^2} \qquad 2$$

$$R_t = (y_i)_{max} - (y_i)_{min} \qquad 3$$

That's it, i've spot height y_i track measuring height. Roughness parameters for the different modes using the vertical displacement of the specified nodes on the surface is measured. First, you need a source for each line the path to be set in a way that the total area of the top and bottom of this line with the curve equals zero. Then, the height of all points of origin on the basis of this line can be corrected. Finally using the relationships (1) as (3) measurable parameters of

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roughness. The parameters for the three different track that is similar to the laboratory measurement of the model components were limited . The final roughness parameters of roughness parameters measured in the average of the three route was calculated.

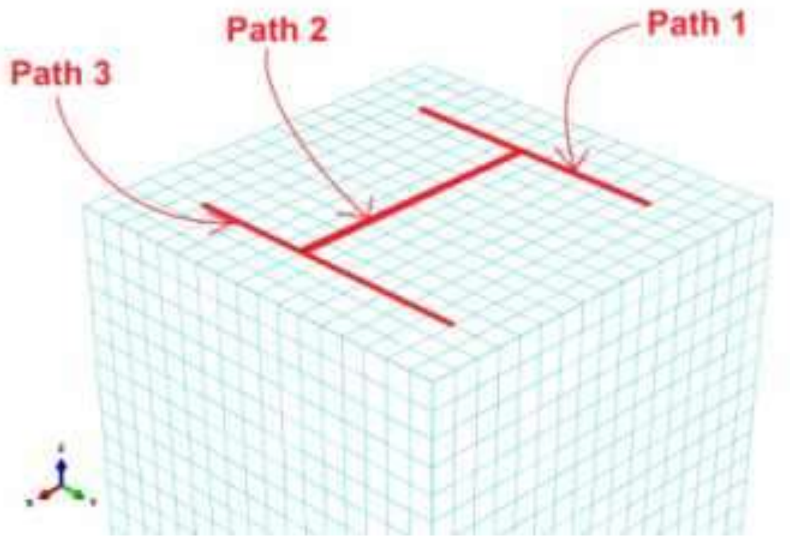

Figure 17 roughness: paths

Check to ensure the accuracy of the energy model for analysis of model components, when the pseudo stability processes using explicit halgar will be analysis, shall be applicable to the internal energy of the kinetic energy. This ratio must always be less than 10%, otherwise the answer is not enough accuracy obtained . These conditions for all the samples. Figure18 internal energy changes to kinetic energy ratio according to the time of the show.

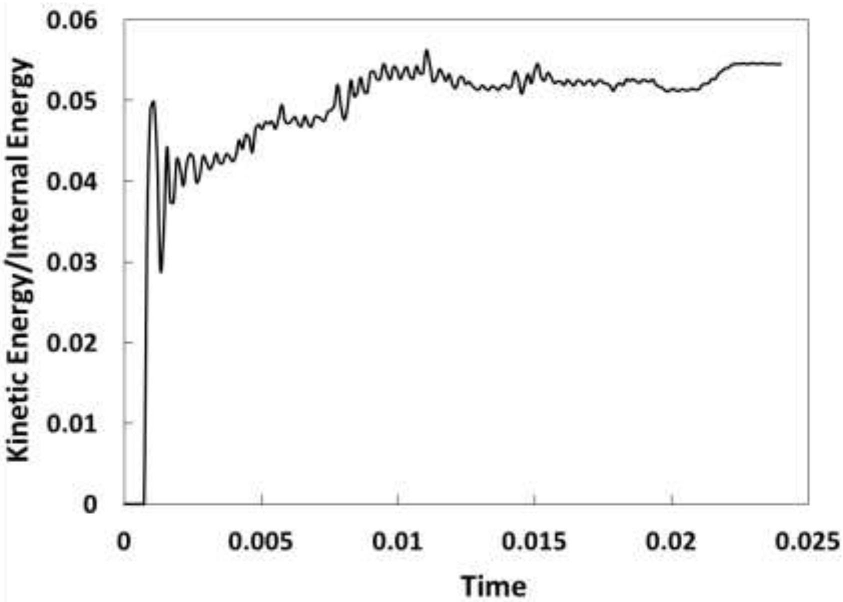

Figure18: energy changes to kinetic energy inside during the process of milling machine in the sample

The convergence of elements to check convergence conditions for the mesh model milling machine N = 250, 28 = V and mm5/1 = a were considered. Sample level equal to equal height and mm4 mm4 × mm10. The size of the elements at a high level over the course of 5 steps to reduce the sample answers converge, Figure19. The selected size is equal to 500, 400, 300 and 250 µm. Convergence results for the different parameters of roughness in the shape of 4 16. As can be observed, the slight changes to the parameters of roughness for smaller size of four microns. Therefore it can be concluded on the 300 Micron size answers converge.

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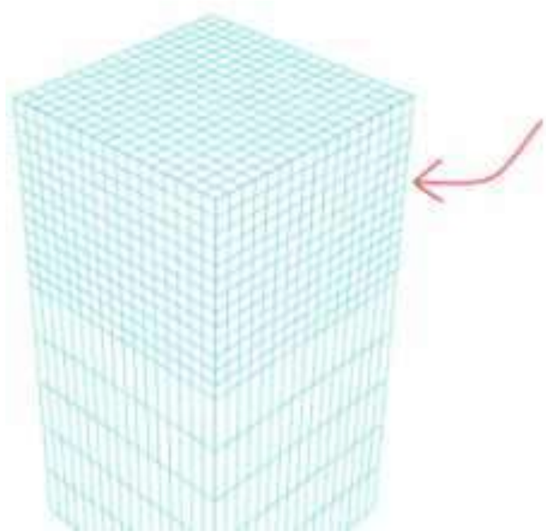

Figure19: change the size of the area elements

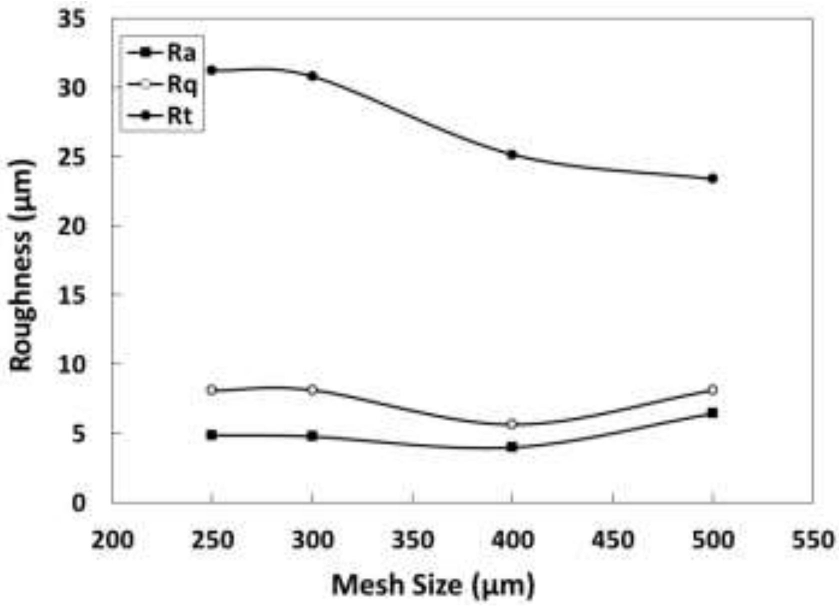

Figure20: changes the parameters of roughness according to the size of the elements

the geometry after effect - - get the proper size elements should also review the sample size. Therefore, in order to scratch the right height for model after a few specific simulation. Then, three different sizes were considered for the surface of the sample. The effect of changing the geometric dimensions in Figure 4 18. It is known that a significant change as a result of changes in the parameters of surface roughness dimensions will not be viewing. Therefore, the value for the level of sample × mm4 mm4.

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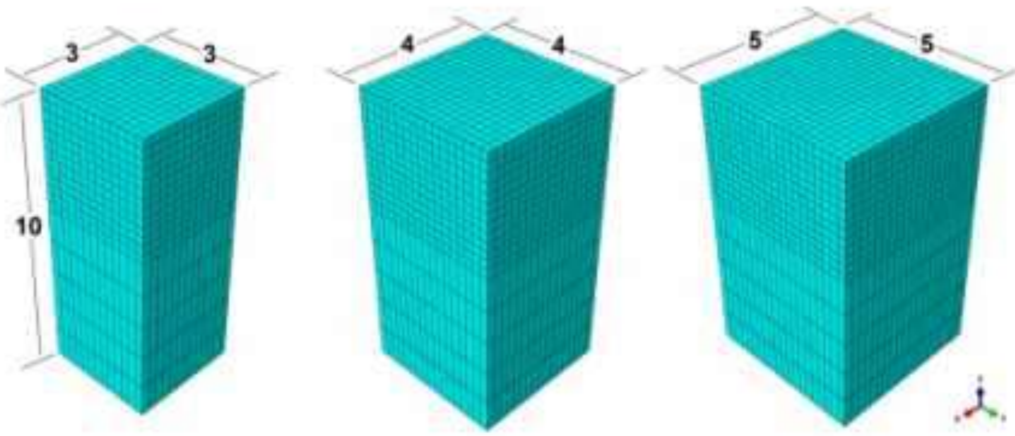

Figure 21: three different sample dimensions

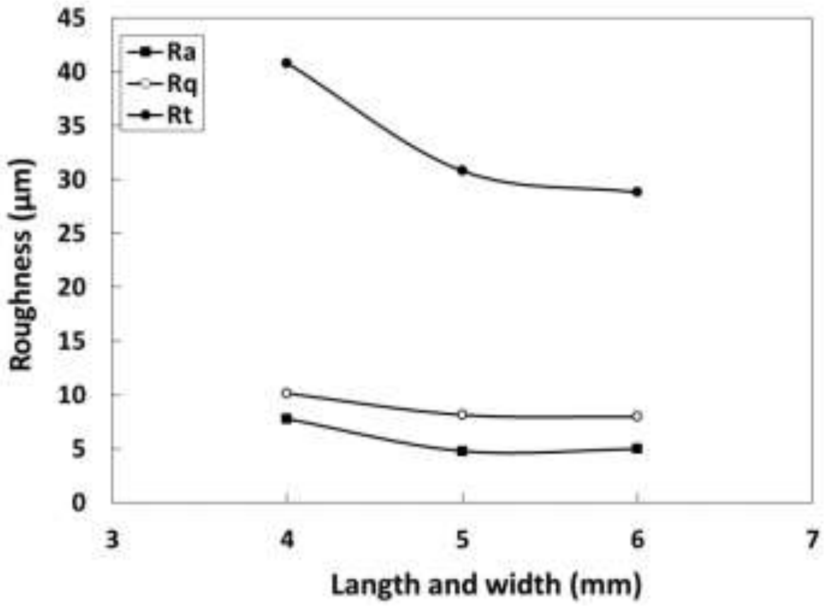

Figure22: effect of roughness parameters on geometry

The conclusions

in this study a comprehensive review for the effect of different parameters on the surface roughness of the samples after the process of milling machine by testing and simulation.

In the case of the numerical results and the experimental measurements was discussed.

The ability of the model components are presented in the limited case of different effects on the forecasts examine the values shown.

On this basis, the following conclusions can be stated: a three-dimensional finite element model for simulating a real process of milling machine was provided. Results of laboratory measurements of roughness surface with numerical results very good match showed that the accuracy and capability of a finite element model presented in this study suggest.

The most important influence factors on process of pellet woman numeric and laboratory to be examined. Based on the results it became clear that with the increase in rotational speed of tools reduced roughness parameters.

The decrease in the speed of the progress of the quality level of the sample after process will increase milling machine.

Roughness of the surface with the increase in the rate of filings taking a notable increase.

The following suggestions can be used to improve and continue the research proposal:

the effect of different milling machine tools, check the waste created tension arising from the process of milling machine for experimental and numerical investigation of the effect of crystal structure on the milling machine and hard surface of the sample in different conditions impacting on the life of the milling machine parts, fatigue and stress on the thermal effect of roughness influence the final processes of waste samples, such as grinding, polishing after milling machine

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