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The Effect Of Eating Movement And Main Cutting Angle On The Result Of The Cylinders Of The Working Objects On The Cylindic Lathe Process

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ABSTRACT
A quality product is obtained from good cutting conditions. One of the deviations caused by the cutting conditions is the cylindrical process of the process, therefore in this study the effect of the feed motion (f) and the main cutting angle (Kr) on the cylindrical results of the workpiece surface on the cylindrical lathe process was carried out. The machining process is carried out with a depth of cut of 0.5 mm by varying the feeding motion (f) and the main cutting angle (Kr) with a constant spindle rotation (n) of the ST 37 workpiece which has a diameter of 30 mm and a length of 150 mm and is turned along ± 120 cm. mm using an HSS chisel. After the workpiece is turned, the cylindrical size of the workpiece is measured using Block – V and Dial Indicator. The results of this study found that, in the use of Kr = 90° (β = 60°, = 3°, = 27°) cylindrical value = 180 – 390 m, Kr = 70° (β = 50°, = 13°, = 27°) cylindrical value = 370 - 480 m, and Kr = 60° (β = 34 °, = 24°, = 32°) the cylindrical value = 510 – 860 m. Feeding motion has a great influence on the cylindrical surface, because the greater the feeding motion, the greater the cylindrical value. This is due to the less cylindrical in the workpiece during the machining process. The main cutting angle (Kr) also has a big influence on the cylindrical surface, because the smaller Kr, the greater the cylindrical value. This is because the use of a small Kr is not profitable because it will reduce the geometric accuracy of the product, in this case it will also affect the cylindrical result and cause the workpiece to become non-cylindrical (the cylindrical size is getting bigger).

Keywords:
Feeding motion, main cutting angle, cylindrical

INTRODUCTION

A lathe is a machine tool that is used to carry out a machining process and has the aim of producing a product[1]. In the face of rapidly developing technological developments, especially in the field of machinery. To get a good product, special skills are needed and must also pay attention to economic aspects so that maximum results are obtained and also save production costs. If these things are not owned then the goods produced cannot be marketed, and if they are still marketed, the sales results are not satisfactory because market demand must meet good quality standards.[2].

One of the characteristics of good machining results is the cylindrical process that is close to perfect.[3] Cylindrical process results are one of the deviations caused by the cutting conditions of the machining process, so the machining process must be planned properly[4]. Starting from this, of course, it is necessary to know the cutting parameters, namely the feeding and spindle rotation used to turn the material, because with the right feed and spindle rotation the results of turning will be good and the cylindrical level will be close to perfect.[5].

The cutting edge angle is also one of the parameters in the machining process that is useful in cutting[6]. Parameters in the machining process are very useful in determining the final result of a product, and the main cutting angle is one of the useful parameters, and also affects roundness/cylindricity. By changing the main cutting angle, the roundness/cylindricity of the workpiece will also be different[7].

Components with ideal roundness are very difficult to make, thus we must tolerate the existence of non-roundness within certain limits according to the purpose/function of the component. Roundness plays an important role in terms of: dividing the load evenly, facilitating lubrication, determining rotation accuracy, determining component life and determining adjustment conditions.[8]. The products produced from the machining process are very diverse, and one of them is the shaft[9]. The material used to turn this shaft is ST 37 and use HSS chisels, then vary the cutting parameters, namely the main cutting angle and feed motion.[10].

METHOD

The flow chart of the research carried out in this experiment is as shown in Figure 1.

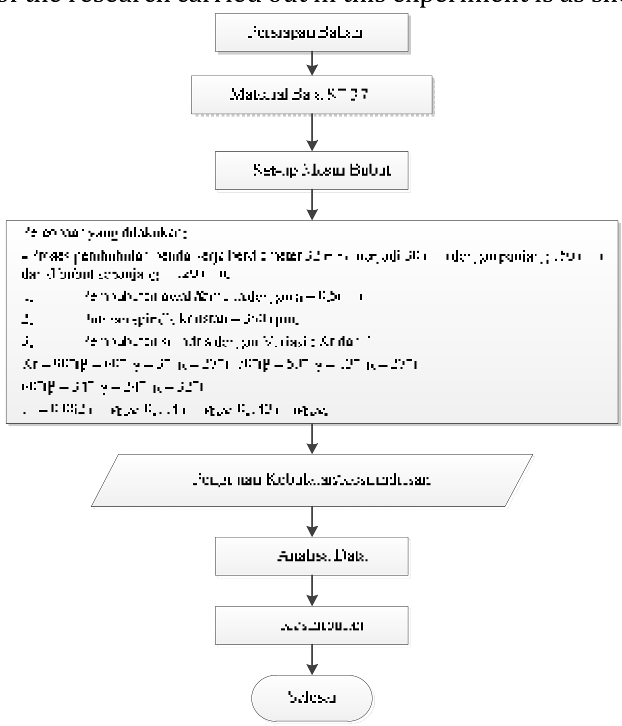

Figure 1. Research Flowchart

Research Steps

a. Prepare the dimensions of the workpiece to be used, namely ST 37 steel with a diameter of 32 mm, cut with a length of 150 mm as many as 18 workpieces.

b. Setting up the lathe includes the depth of cut (a), feeding motion (f) and constant spindle rotation (n). In this process the depth of cut is constant, namely 0.5 mm, but the variation of the cutting angle of the chisel (Kr) and the feeding motion is by using a chisel with a cutting angle of 90°(β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°), 60°(β = 34°, = 24°, = 32°) and feeding 0.082 mm/rev, 0.114 mm/rev, 0.143 mm/rev.

c. Carry out the machining process used for research, namely the initial lathe process with a cutting depth of 0.5 mm, this aims to reduce the diameter from 32 mm to 31 mm and also to level the workpiece so that it is cylindrical. Furthermore, the final turning with a cutting depth of 0.5 mm is from a diameter of 31 mm to 30 mm, where when carrying out the second lathe process the turning process is carried out without using a tail stock and using a chisel with a variation of the cutting angle (Kr).
d. Repeating the lathe process with variations in feeding motion and different cutting angles of the chisel, which is 2 times in order to achieve results
e. more specific and accurate measurements.
f. Each time the turning process, the tool that has been used must be replaced with a new one according to the main cutting angle (Kr). So each turning the workpiece uses a new tool.
g. Measure the cylindrical/spherical surface of the lathe.
h. Make a data table about the roundness of the surface of the object being tested and a table about cylindrical.
i. Process the data obtained.

Data retrieval

1. Collecting data from the workpiece, the end circle of the workpiece (the part that first touches the chisel) is divided into 12 parts. On the longitudinal section that has been turned, 6 points are marked and each point is 20 mm apart.
2. The workpiece is placed on a v-block and a dial indicator is placed on the workpiece.
3. Set up on the dial indicator first is done by adjusting the feeler needle attached to the workpiece, so that the value shown on the dial indicator is right at the zero position. The zero position in this experiment is at every point 1 and at every position 1.
4. The first data retrieval is carried out at point 1 by rotating the workpiece clockwise from position 1 back to position 1. And then the Dial Indicator touch needle is shifted to point 2 at position 1 which also rotates the workpiece clockwise from position 1 to return. to position 1. For the next points done in the same way.
5. Furthermore, data collection is carried out at each point, where at each point there are 12 parts that must be taken data.
6. The data obtained is then entered into a table, which is then analyzed as cylindrical.

RESULTS AND DISCUSSION

From the calculation of the basic elements of the lathe process, it is found that the feed motion has a large effect on the cylindrical value of the surface. At n = 360 rpm (constant), at feed (f) = (0.082 mm/r, 0.114 mm/r, 0.143 mm/r), and with a depth of cut (a) = 0.5 mm, the average cylindrical value was obtained. more increasing. With increasing feed motion, the surface cylindrical value increases, this is because the greater the feed motion, the faster the cutting time. With the faster cutting time, the feed speed will increase and cause the growling speed to increase. The motion of eating also affects the cross section of anger, the greater the movement of eating,

From the calculation of the cutting width and chip thickness (b and h), it is found that the main cutting angle (Kr) has a large effect on the cylindrical surface value. At (Kr) = 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°) and 60° (β = 34° , = 24°, = 32°) it is found that the smaller the main cutting angle (Kr), the greater the cutting width of the chip (b) and with increasing feeding motion will decrease the thickness of the chip (h). A small chip thickness (h) will reduce the cutting temperature, while a large chip width (b) will accelerate the heat propagation process on the tool so that the tool temperature will be relatively low so that the tool life will be higher and the cutting speed can be increased.

The research data were taken from each specimen and differentiated according to the main cutting angle (Kr) and feeding motion (f). In this study, data collection was carried out at each point (each specimen contained 6 points) and each point contained 12 positions. Experiments for each variation of the Main Cutting Angle (Kr) and Feeding Motion (f) were carried out 2 times / 2 specimens.

Table 1. Research data Kr = 90° (β = 60°, = 3°, = 27°). and F = 0.082 mm/r specimen 1

Position	point1	Point 2	3 point	4 point	5 point	6 point
1	0	50	70	110	80	60
2	100	-20	80	80	-20	10
3	120	-50	90	50	20	50
4	80	50	80	80	10	100
5	110	30	120	60	-20	100
6	80	-20	100	90	-10	80
7	50	20	80	50	10	110
8	100	30	80	50	20	20
9	80	60	90	100	-50	60
10	110	50	10	80	-30	50
11	-10	20	110	50	10	80
12	50	-60	110	-20	-50	50

Furthermore, the research data table for the main cutting angle 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°), 60° (= 34°, = 24°, = 32°). with feedrate 0.082 mm/r, 0.114 mm/r, 0.143 mm/r.

Radar charts are made based on the values obtained from measurements using a dial indicator measured at 12 positions for each point analyzed. Radar charts are useful for viewing roundness. From this radar graph, it can be seen that the surface profile value for each position, if the number indicates a positive value, then that position indicates a high surface and if at a position the value is negative, the surface indicates a low surface, and a zero value indicates a flat surface.

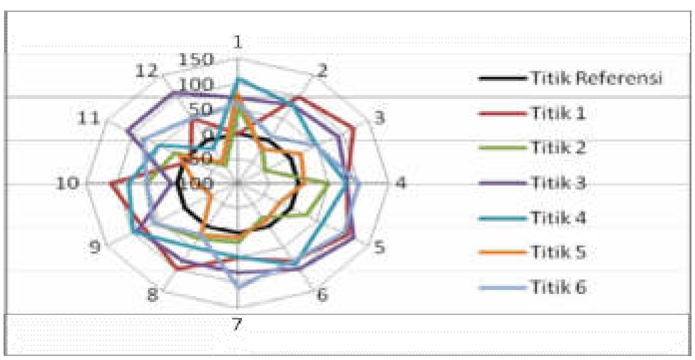

Figure 1. Radar Graph Kr = 90° (β = 60°, = 3°, = 27°). And F = 0.082 mm/r (specimen 1).

Radar graphs for principal cutting angle 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°), 60° (β = 34 °, = 24°, = 32°) with feedrate 0.082 mm/r, 0.114 mm/r, 0.143 mm/r

The following is an example of a roundness calculation and a roundness comparison chart for a principal cutting angle of 90° (β = 60°, = 3°, = 27°) with a feed motion of 0.082 mm/rev. Next is the calculation (table) and roundness graph for the main cutting angle 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°), and 60° (β = 34°, = 24°, = 32°) with feedrate of 0.082 mm/rev, 0.114

mm/rev, 0.143 mm/rev is attached in appendix 3. An example of calculating roundness for angle Kr = 90° (β = 60°, = 3°, = 27°) and F = 0.082 mm/rev (Speciment 1).

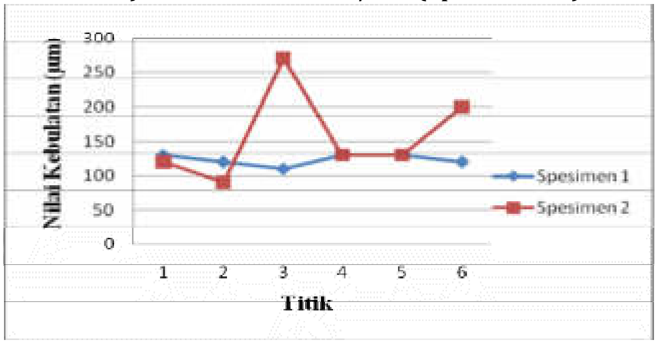

Figure 2. Comparison Graph of Roundness Kr = 90° (β = 60°, = 3°, = 27°) and F = 0.082 mm/r

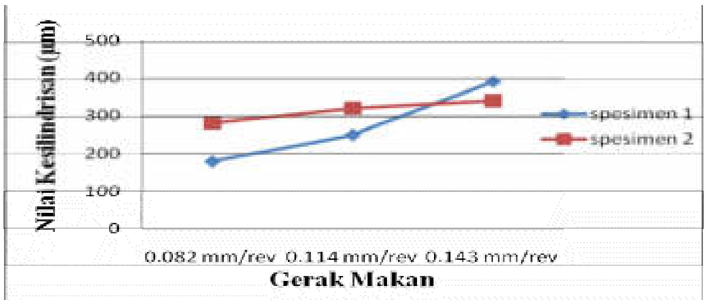

Figure 3. Cylindrical Graph Kr = 90° (β = 60°, = 3°, = 27°)

From Figure 3, it can be seen that with the use of the chisel the main cutting angle is constant 90° (β = 60°, = 3°, = 27°) with variations in the feed motion resulting in a greater cylindrical value. This is because the greater the feeding motion, the larger the workpiece becomes non-cylindrical, and affects the cylindrical value. For the cylindrical graph above, in the specimen graph 1 at an angle variation of 90° with a feeding motion of 0.143 mm/r the cylindrical level is the largest, because the workpiece is not cylindrical (the largest) among the experiments on the ST 37 steel specimen with the use of a cutting angle (Kr). 90° (β = 60°, = 3°, = 27°), with a cylindrical value of 180 m to 390 m.

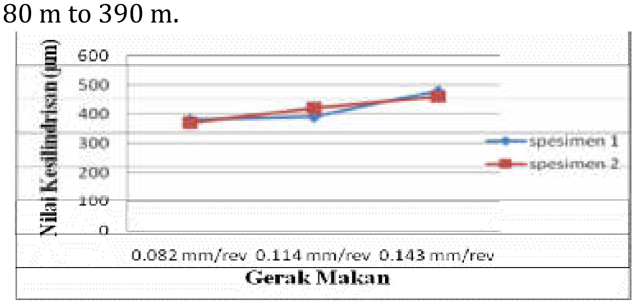

Figure 4. Cylindrical graph of Kr = 70° (β = 50°, = 13°, = 27°).

From Figure 4, it can be seen that with the use of the chisel the main cutting angle is constant 70° (β = 50°, = 13°, = 27°) with variations in the feed motion resulting in a greater cylindrical value. This is because the larger the feed motion, the larger the workpiece becomes non-cylindrical, and affects the cylindrical value. In the graph above, it can be seen that between specimen 1 and specimen 2 there is a deviation of the cylindrical value that is not too large, because during the experiment there was no deviation of the non-cylindrical workpiece which was not too high, with a cylindrical value from 370 m to 480 m.

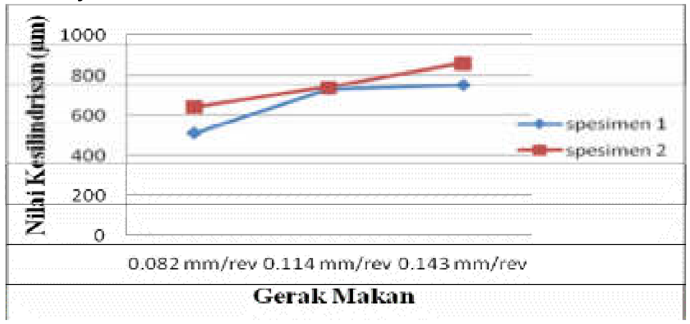

Figure 5. Cylindrical Graph Kr = 60° (β = 34°, = 24°, = 32°)

From Figure 5, it can be seen that with the use of a constant principal cutting angle of 60° (β = 34°, = 24°, = 32°) with variations in feeding motion, the cylindrical value is greater. This is because the larger the feed motion, the larger the workpiece becomes non-cylindrical, and affects the cylindrical value. In experiments with the use of a chisel the main cutting angle of 60° (β = 34°, = 24°, = 32°) there is a workpiece with the highest cylindrical level among other experiments Kr = 90° (β = 60°, = 3°, = 27°) and Kr = 70 ° (β = 50°, = 13°, = 27°). both in specimen 1 and specimen 2, with cylindrical values of 510 m to 860 m.

From Figure 6, it can be seen that with the use of a chisel with the main cutting angle getting smaller, namely Kr = 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, = 27°), and 60° (β = 34°, = 24°, = 32°) with the higher feed motion (f) = 0.082 mm/r, 0.114 mm/r, and 0.143 mm/r resulted the greater the cylindrical value. The cylindrical value is 180 m to 860 m.

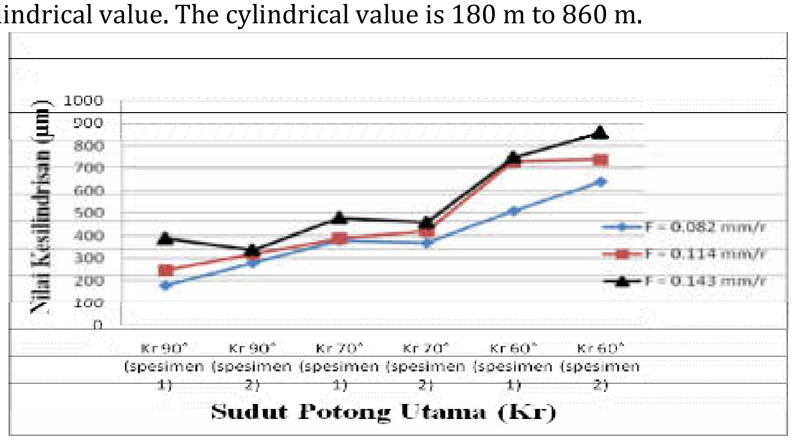

Figure 6. Cylindrical Graph of the Main Cutting Angle (Kr).

Discussion

Figure 3 of the cylindrical graph above shows that the use of a chisel with a cutting angle of 90° (β = 60°, = 3°, = 27°) (constant) with variations in the feed motion of 0.082 mm/r, 0.114 mm/r, 0.143 mm/ r there is an increase in the cylindrical value, which is because the workpiece becomes non-cylindrical as the feeding motion increases. The workpiece with the highest cylindrical value with the use of this chisel occurred during the experiment with a variation of the feed motion of 0.143 mm/r on the workpiece specimen 1.

Figure 4 of the cylindrical graph above shows that the use of a chisel with a cutting angle of 70° (β = 50°, = 13°, = 27°) (constant) with variations in the feed motion of 0.082 mm/r, 0.114 mm/r, 0.143 mm/ r there is an increase in the cylindrical value because the workpiece becomes non-cylindrical as the feeding motion increases. In the experiment with the use of Kr = 70° (β =

50°, = 13°, = 27°), the cylindrical value of the workpiece was higher than the experiment with the use of a chisel with Kr = 90° (β = 60°, = 3 °, = 27°).

Figure 5 shows that the cylindrical graph above shows that the use of a chisel with a cutting angle of 60° (β = 34°, = 24°, = 32°) (constant) with variations in the feed motion of 0.082 mm/r, 0.114 mm/r, 0.143 mm/ r there is an increase in the cylindrical value because the workpiece becomes non-cylindrical as the feeding motion increases. In the experiment with the use of Kr = 60° (β = 34°, = 24°, = 32°), the cylindrical value was the highest from the use of the chisel with Kr = 90° (β = 60°, = 3°, = 27°) or chisel Kr = 70° (β = 50°, = 13°, = 27°).

Figure 6 of the cylindrical graph above shows that the use of a chisel with a variation of the cutting angle (Kr) 90° (β = 60°, = 3°, = 27°), 70° (β = 50°, = 13°, α = 27°), and 60° (β = 34°, = 24°, = 32°) with variations in the feed motion of 0.082 mm/r, 0.114 mm/r, 0.143 mm/r there was an increase in the cylindrical value due to the workpiece becoming not cylindrical as the feeding motion increases.

Of the three principal intersecting angles Kr = 90° (β = 60°, = 3°, = 27°), Kr = 70° (β = 50°, = 13°, = 27°), and Kr = 60° (β = 34°, = 24°, = 32°) which is shown in the graph above, it is found that by using the main cutting angle (Kr) the smaller the cylindrical value is. This is because the use of a small Kr is not profitable and reduces the geometric accuracy of the product in this case also affects the cylindrical result and causes the workpiece to become non-cylindrical (the cylindrical value is getting bigger).

From the three feeding movements shown in the cylindrical graph above, it is found that the greater the feeding motion, the greater the cylindrical value. This is because the larger the feed motion, the larger the non-cylindrical workpiece and the greater the cylindrical value of the process.

CONCLUSION

In the research results of the cylindrical lathe process, there are 2 factors that significantly affect the cylindrical results of the cylindrical lathe process, namely the main cutting angle (Kr) and feeding motion (f) this is due to: The smaller the main cutting angle is Kr = 90° (β = 60°, = 3°, = 27°), Kr = 70° (β = 50°, = 13°, = 27°), and Kr = 60° (β = 34°, = 24°, = 32°), the greater the cylindrical value. The greater the feeding motion (f), the greater the cylindrical value.

In this lathe process, the cylindrical value close to zero (the best) is obtained at the prime cutting angle Kr = 90° (β = 60°, = 3°, = 27°). and feed motion (f) 0.082 mm/r on specimen 1. And high cylindrical values were obtained at the main cutting angle Kr = 60° (β = 34°, = 24°, = 32°) and feed motion (f) 0.143 mm/r in specimen 2.

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