International Journal For Technological Research In Engineering
Volume 8, Issue 4, December-2020 *ISSN (Online): 2347 - 4718*

STUDY ON THE EFFECTS OF CUTTING WIDTH ON QUALITY AND ELECTRICITY COSTS WHEN THE SURFACE ON BEMATO BMT 1440E LATHER

Sang – Nguyen Van, Huy - Nguyen Van, Lanh- Thanh Le
Department of Technology
Dong Nai Technology University, Dong Nai, Viet Nam

ABSTRACT: The machine is very popularly used in factories, vocational schools and universities in Viet Nam, especially the Bemato BMT 1440E lathe, which has been widely used by businesses and schools. But using and choosing the right cutting mode to minimize power costs and achieve product surface quality are the factors that this paper researches and introduces. Therefore, the focus of this paper will focus on researching and selecting the most appropriate depth of cutting to reduce power costs in the face machining process and to meet surface roughness requirements. machining top lathe products on the Bemato BMT 1440E lathe

Key words: Lathe, depth of cut, quality, electricity cost

1. INTRODUCTION

This paper uses the object, scope and research equipment of Bemato BMT1440E lathe, flap shoulder tool, turning material is steel fabrication after machining C45 casting, turning technology is front face , the influencing parameters selected for research are depth of cut (t) affecting product quality and specific power costs. The research method is based on machining theory on machine tools. Using experimental research method in machine manufacturing to determine the target function, on that basis, establish the relationship between the objective function and the influence parameter. Using the optimal problem solving method to find out the appropriate use mode of the Bemato BMT 1440E lathe.

Figure 1: Bemato BMT1440E universal lathe

Table 1. Technical Data Sheet of the Bemato1440E lathe

Order	Technical specifications	Value
1	Model 1440E	360x1000mm
2	Diameter of rotation on machine tape	360mm
3	Diameter of rotation on knife table	250mm
4	Distance between two centers	1000mm
5	Diameter of rotation on groove	520mm

6	Machine tape width	190mm
7	Number of shaft speeds	9
8	Axle speed range	80 – 2000 vòng/ph
9	Hollow shaft hole	40mm
10	The shaft tip	D1- 4 cam lock
11	The shaft tip	MT No 5
12	Passive hole taper	MT No 3
13	Moving the passive tube	110mm
14	Move the tool table horizontally	175mm
15	Move the knife cart	100mm
16	Metric thread cutting	(30) 0,4 - 0,7 mm
17	Thread cut inch	(30) 4 - 56 bước/inch
18	Vertical knife intake	0,068 – 1.872 mm/vòng
19	The amount of eating knife is horizontal	0,034 – 0,936 mm/vòng
20	Weight machine	600 Kg
21	Size machine	1905x762x1473 mm

Figure 2. Turning tools and workpieces

2. SELECTING EFFECTIVE PARAMETERS AND METHOD OF DETERMINATION

2.1. Select the parameters that affect the goal function

- Group of elements belong to billet: experiment with a type of billet is steel C45
- Group of factors belong to machining mode: The factor affecting the target function to be studied is the symbolic depth (t)

2.2. Method of determining specific electricity costs

To collect data during the experiment I determined the specific electricity cost through the specific power variation of the cutting process. So I measure non-electrical quantities by electrical quantities (amperage). The reason for performing the above measurement is due to the change in power before and during cutting of the blade, from which the power difference to convert to non-electrical quantities is known [3]

- Power before cutting

$$N_0 = \sqrt{3}.I_0.U_0.\cos\varphi_0 . \qquad (1)$$

N_0 – No load wattage (W).
I_0. - No load current (A).
U_0.- Low voltage network voltage (V).
$\cos\varphi_0$. Power factor no load.

- Power while cutting.

$$N_1 = \sqrt{3}.I_1.U_1.\cos\varphi_1 . \qquad (2)$$

N_1 - Total power consumption
I_1. - The current when cut has the maximum value.
U_1 - Low voltage network voltaeg (V).

$\cos\varphi_1$. Power factor has load.

During the experiment, I only conduct experiments when the voltage is stable. From (1), (2) we see The power consumed during cutting is

The power consumed during cutting is:

$$N = N_1 - N_0 = U.\sqrt{3}.(I_1 - I_0).\cos\varphi \qquad (3)$$

3.6. Determination method of machining surface roughness

Measure the surface roughness of the product after turning with the TR200 roughness tester with computer connection, after the machining I use the TR200 gauge to measure the surface roughness of the product directly, the roughness value is displayed. on the LCD screen, from which we can determine the roughness of the product after machining [5]

3. EXPERIMENT AND RESULTS

3.1. Experimental equipment

- The experimental equipment is the lathe Bemato BMT 1440E
- The speed of rotation of the main shaft has 9 levels from 80-2000 rpm
- The amount of 12-level horizontal knife feed from 0.034 - 0.936 mm / round

3.2. Measuring instruments

Power measuring instrument as shown in figure 3

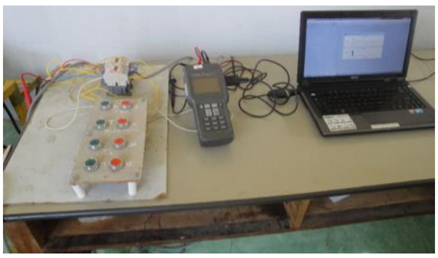

Figure 3. Fluke tester computer connected

Surface roughness measuring instrument: tools due to roughness are shown in figure 4

3.3. Measurement results

Table 2. Influencing parameters of cutting depth on specific power cost and roughness Spindle speed n = 950 rpm, φ = 5^O, S= 0.3 mm / round

Numerical order	Cuttting depth (t)	Measured times	U_t	I_O	I_1	$\cos\varphi_t$	N_t	T (s)	F (m^2)	N_r (Wh/m^2)	Ra
1	0,2	1	230.15	5.66	8.24	0.43	442.24	11	0.001965	687.68	1.33
		2	230.27	5.66	8.45	0.42	467.36	11	0.001965	726.74	1.36
		3	231.29	5.66	8.57	0.41	477.96	11	0.001965	743.23	1.37
2	0,4	1	231.30	5.63	8.05	0.42	407.19	11	0.001965	633.18	1.22
		2	232.37	5.63	8.11	0.43	429.20	11	0.001965	667.40	1.25
		3	232.20	5.63	8.08	0.44	433.55	11	0.001965	674.17	1.28
3	0.6	1	231.50	5.88	8.46	0.44	454.66	11	0.001965	707.00	1.47
		2	230.26	5.88	8.47	0.44	454.50	11	0.001965	706.74	1.48

3.4. Methods of processing experimental data

3.4.1. Check the experiment data determine the minimum number of repetitions

To check whether the measured data comply with the standard law or not I use the criterion Person (χ2) [6]. Divide the measured measurements of the output quantity (Y1) into L groups such that each group has 5 or more output quantities (Y1) the number of groups is calculated by the formula

$$L = 1+3,2.\text{Lg } n \quad (4)$$

n- Number of exploration experiments (n= 15)

The middle value of the group: $Y_1^{\bullet} = (y_{1-L} + Y_i)/L$, (i = 1…k)

Experimental standard error: $$S^2 = \frac{1}{n-1}\sum_{i=1}^{n} n_i (y^{\bullet} - \overline{y})^2 \quad (5)$$

The standard value χ^2_{tt} is calculated using the formula

$$\chi^2_{tt} = \frac{\sum_{i=1}^{n}(n_i - p_i.n)^2}{p_i.n} \quad (6)$$

$$P_i = e^{-\lambda.y_n} - e^{-\lambda.y_1}$$

p_i - theoretical probability of the group's random quantity

;

y_n- small value of the group; y_l- big value of the group; $\lambda = -1/\bar{y}$

The minimum number of replicates for each experiment was determined by the formula

$$m = \frac{\tau^2 . s^2}{\Delta^2} \quad (7)$$

m - number of repetitions per experiment;

τ - Student criteria look the table;

S - experiment variance;

Δ - absolute error

3.4.2. Method of processing experiment results

After conducting the experiment, the experimental results are processed by experimental planning software to determine the uniformity of the variance, the regression model and check the regression model compatibility [7]

3.5. Results of single factor experiments

After the preparation work was completed, we conducted experiments to replace the number into the formula (6), to determine the standard Person $\chi 2tt = 5.34$ which is smaller than the standard Person looking up table ($\chi 2b = 9{,}49$), the experimental data followed the normal distribution law, substituting the number for Equation (7), determined the number of repetitions for each experiment m = 2.54 taking m = 3

3.5.1. Effect of depth of cut (t) on specific electricity costs

The experiment is performed as follows: Changing the cutting depth t1 = 0.2mm; t2 = 0.4mm; t3 = 0.6mm; t4 = 0.8mm; t5 = 1mm, cutting speed corresponding to the value n = 950 rpm, the main angle of inclination is fixed φ = 50, the amount of the fixed feed tool S = 0.3mm / round. Experimental results and data processing are recorded in the table 2, using the experimental planning software and data processing program, get the following results

- Regression model: $\mathbf{Nr_3 = 779{,}4 - 445{,}28.t + 503{,}57.t^2}$ (8)

Kokhren stansard calculation values follow $G_{tt} = S^2_m / \sum_{u=1}^{N} S^2_u$, $G_{tt} = 0{,}292$,

Fisher standard calculation values follow $F_{tt} = \frac{S^2}{S^2_e}$, $F_{tt} = 3{,}63$.

Similar to the above, test for the uniformity of variance Gtt = 0.292 <Gb = 0.615. The variance of the experiment is considered homogeneous. Check the model compatibility Ftt <Fb, the model is considered compatible [4].

From the obtained results we plot the correlation between the specific power cost and the depth of cut in Figure 5

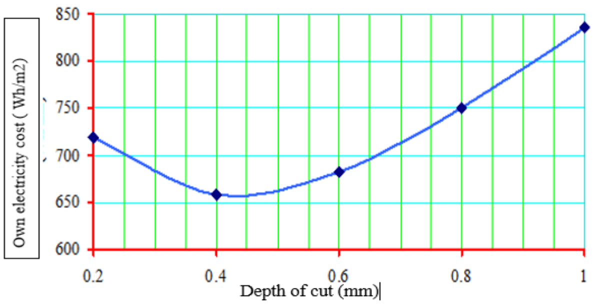

Figure 5. Effect of cutting depth on specific electricity cost

For the depth of cut (t): from regression equations (8), (9) and graphs 5 and 6 show that the depth of cut t = 0.4 mm, the specific power cost and roughness are small Best.

3.5.3. Practical experiment according to optimal mode

After determining the optimal using mode of the lathe, I re-test the optimal lathe calculated in the above section, the experimental results after processing are listed in the table

Table 3 Experimental results for face-turning turning according to optimum mode of cutting depth

Numerical order	The goal function	The optimal value is calculated according to the theory	Experimental value according to the optimal mode	Error
1	Own electricity cost Nr_{min} (Wh/m^2)	681,85	710.78	4,41%
2	Surface roughness Ra_{min} (µm)	1.325	1.345	2,29%

Comment: From the results obtained in Table 3, I have the following comment

The error between the experimental value of the specific energy cost function of the lathe at the optimal mode and the theoretical calculated value is 4.41%, from which the optimal value found above is completely believed. Dependable

The error between the experimental value of the surface roughness and the theoretical value is 2.29%, so the optimal value calculated in the above section is completely reliable

4. CONCLUSION

After studying the article, I have drawn some of the following conclusions.

1. The paper has analyzed and selected the research objective function which is the specific power cost and the surface roughness function, selected the factor affecting the target function is depth of cut, built construct a method of determining the target functions

2. By the method of solving the multi-objective optimization problem, the topic has determined the appropriate use mode of the Bemato BMT 1440E lathe when turning the head face with C45 billet, the cutting depth t = 0.4 mm with the turning modes identified above, the specific power cost and surface roughness are the smallest Nrmin = 681.85 Wh / m2 and Ramin = 1,325µm

REFERENCES

[1]. Boley B, *The determination of temperature, stresses, and deflection in two – dimensional thermoelastic problems – jour*. Of the aeronautical sciences, Vol.23. Nr.1, 1956, p.67 -75

[2]. Boley B,Weinerj, *Theory of thermal tresses – John Willey and sons Inc*.,Third print, 1966, Newyork – London – Sidney

[3]. Iwamura Y., Rybicki E., *A transient elastic- plastic thermal stress analysis of flame forming – Trans of the ASME*, Journal of eng. For ind., Febr. 1973, p.163-171

[4]. Jahanshahi A., *Quasi – static stresses due to moving temperature discontinuity on a plane boundary – Trans. Of the ASME, Jour*. Of applied mechanics, Dec. 1966, p.814-816

[5]. Johns D., *Thermal stress analyses – Pergamon press*, First edition, 1965, Oxford-London – Edinburgh – New York – Paris – Frankfurt.

[6]. Landau H., WeinerJ., Zwicky E., *Thermal stress in a viscoelastic-plastic plate with tempeture dependent yield stress – Trans*. of the ASME Journal of applied mechanics, june 1960, p297-302.

[7]. McKee R., Moore R., Boston O., *A study of heat developed incylindrical grinding – Transactions of the ASME* , Jannuary 1951, p.21-34

[8]. Norman C. Fraz (1958) , *An Analysis of the wood – Cutting process* , Annarbor, Michigan, United States of America.

[9]. Tarasov L., *Some metallurgical aspects of grinding – Repring from the book "Machining – theory and practice*", American Society for metals.

[10]. Wheels key to hight – speed grinding –*Metalworking production*, May 1968, p.48-51

