Serbian Tribology Society

SERBIATRIB '11

12th International Conference on Tribology

Faculty of Mechanical Engineering in Kragujevac

Kragujevac, Serbia, 11 – 13 May 2011

GRAPHICS WHICH CONNECT BASIC ROUGHNESS PARAMETERS IN FINISH TURNING FOR TWO KIND OF STEEL

Sava St. Sekulic[1], Nemanja Tasic[1], Branislav Bogojevic[1]
[1]Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, Serbia, bane.bogojevic@gmail.com

Abstract: *The relationship between individual roughness parameters of a machined surface is approximately given by tables. More accurate relationships between maximal roughness height and mean aritmetic deviation of the profile from mean line and bearing ratio mean aritmetic deviation of the profile from mean line in exponential and linear form are also given. Expreimental results were processed, for statistical valid sample N = 78 > 50, pointed strong correlation between roughness parameters.Combined graphics between all three parameters based on previous models are given, in the paper.*

Keywords: *Roughness, Maximal roughness, Mean roughness, Bearing ratio.*

1. INTRODUCTION

Relationship between particular parameters of roughness is given very often in simplified form. Independent of kind of process and work piece material, and another conditions which follow the process.

For example relationship between the maximal roughness height and arithmetic deviation of the profile feom the mean line, i.e. their numerical values, is given in the table (German standard DIN 4767/70) and relationship of the mean height is ten points and the aritmetic deviation of the profile from the mean line according to Yugoslav JUS M.A1.020/79, with a remark on the approximation.

Relationship between maximal height of the roughness and the mean arithmetic deviation of the profile from the mean line $R_{max} = f(R_a)$, in exponential form.

$$R_{max} = 6,1595\ R_a^{\ 0,98}$$

is given independent on the conditions which follow the process. However, that the exponent in the last equation is approximatly one, it can be concluded that, between maximal roughness height and mean arithmetic deviation of the profile, there is a proportionality, i.e.

$$R_{max} = 6,16\ R_a$$

The correlation between bearing ratio and mean roughness height, for finish turning for a statistically valid sample, in exponential

$$R_{max} = B\ R_a^{\ a}$$

$$p_n = B\ R_a^{\ a}$$

and linear form

$$R_{max} = aR_a + b$$

$$p_n = B\ R_a^{\ a}$$

have been used, in this paper.

2. EXPERIMENTAL INVESTIGATION

The material of the work pieces was: 1. constructional steel C.0645 (JUS) (DIN St60). According to JUS standard, the chemical composition is provided as follows: 0,43% C, 0,29% Si, 0,79% Mn, 0,015% P and 0,001% S, and mechanical charasteristics: tensile strenght of material σ_m = 740 N/mm^2 yield strenght σ_v = 360 N/mm^2 and elongation δ_5 = 17%, 2. constructional steel for the improvement C.4732 (JUS) (DIN 22CrMo4). Chemical composition: 0,42% C, 0,27% Si, 0, 63% Mn, 11% Cr, 0,16 % Mo, 12% P and 0,010 S. Mechanical charasteristics: tensile strenght of material σ_m = 680 N/mm^2.

The experiments were performed on the universal lathe “Potisje – Morando” PA21, motor power 10kW and number of spindle revolutions from 20 to 2000 rev/min. As a cutting tool the cutter for finish turning JUS K.C1.052/65 (ISO 3), holder cross sectional area 12x20 mm^2, with insert A10 (JUS K.C1.006), back rake angle $\gamma = 12^o$ and noes radius r = 0,5 , 0,9 and 1,6mm, was used.

The roughness parameters were measured using the Perth-O-Meter, type “Universal”.

For the purpose of giving providing enough reliable relationships between varialbe values for both of investigated materials, the statistically valid sample of N = 78 > 50, are taken.

Standard data processing, using the least squere method next relationships

$$R_{max} = AR_a{}^b \qquad p_n = aR_a{}^b$$

$$R_{max} = CR_a + D \qquad p_n = cR_a{}^d$$

i.e., for steel C.0645

$$R_{max} = 6,16320 \quad R_a{}^{0,93606} \qquad (r=0,92)$$

$$R_{max} = 5,1968\ R_a + 2,\ 3992 \qquad (r=0,88)$$

$$p_n = 145,5030\ R_a{}^{-0,58961} \qquad (r=0,92)$$

$$p_n = -\ 7,2778\ R_a + 106,1370 \qquad (r=0,90)$$

steel C.4732

$$R_{max} = 5,87092 R_a{}^{0,96249} \qquad (r=0,96)$$

$$R_{max} = 5,1928\ R_a + 2,0800 \qquad (r=0,88)$$

$$p_n = 149,0265\ R_a{}^{-0,5578} \qquad (r=0,93)$$

$$p_n = -\ 7,50003\ R_a + 109,0871 \qquad (r=95)$$

are given.

By them we have high correlations coefficient. Combining Figure 1. and Figure 2., so to coner scale R_a, graphics which connect all three parameters R_{max}, R_a, p_n, Figure 3., are given. So, if the one roughness parameter is known we can determine another two.

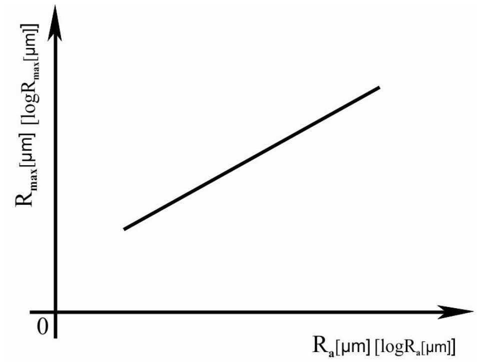

Fig. 1

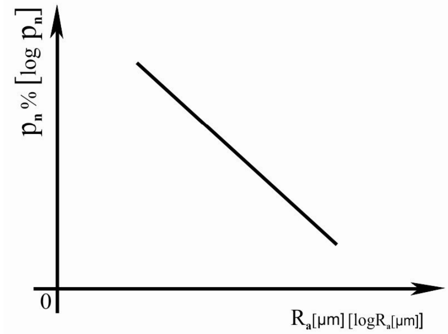

Fig. 2

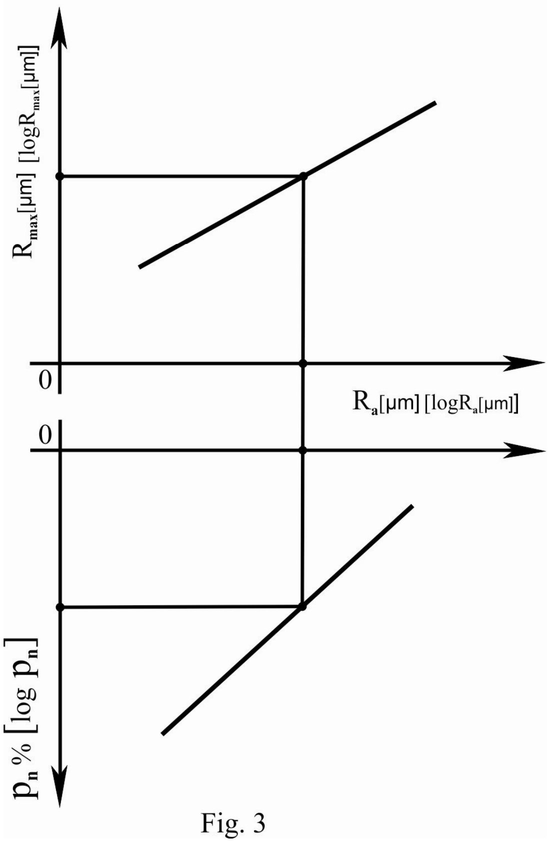

Fig. 3

For the previously work pieces of two materials, we have on Figure 4. to Figure 7. graphics in exponential and linear coordinates.

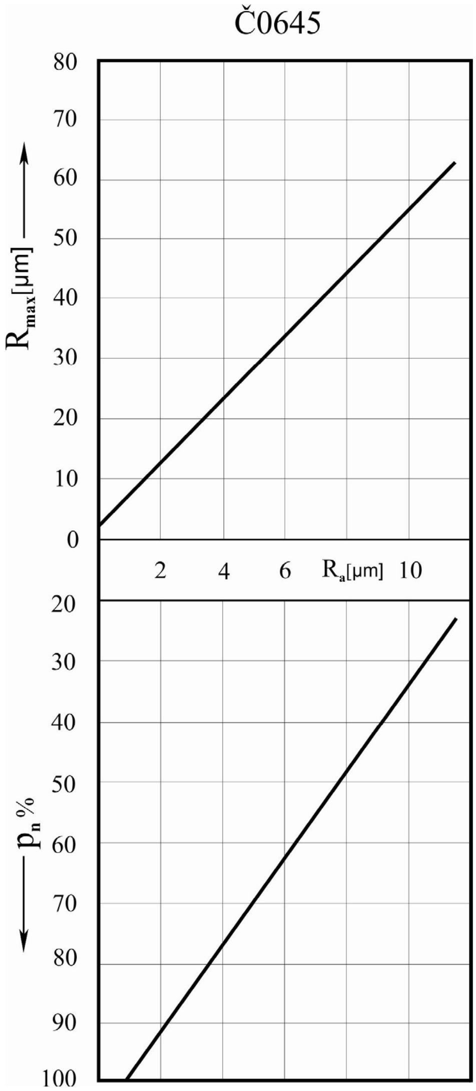

Figure 4

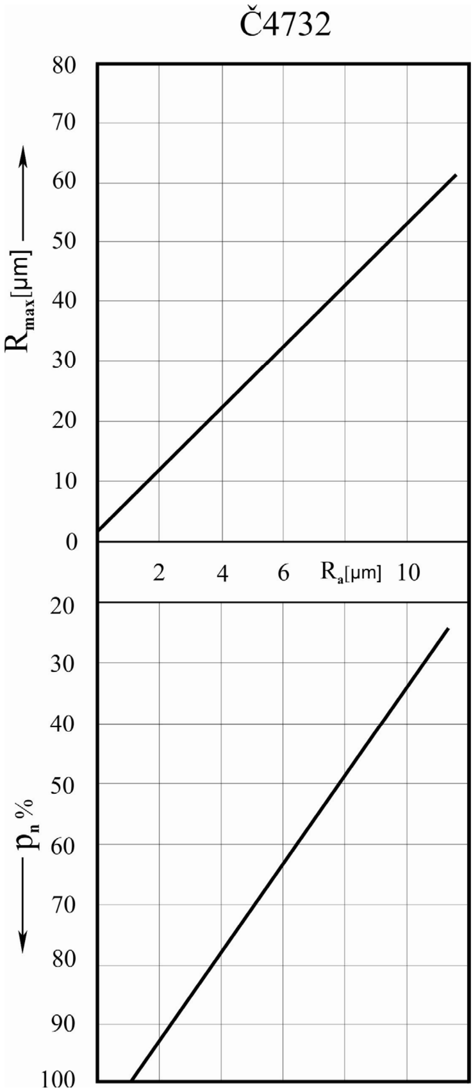

Figure 6

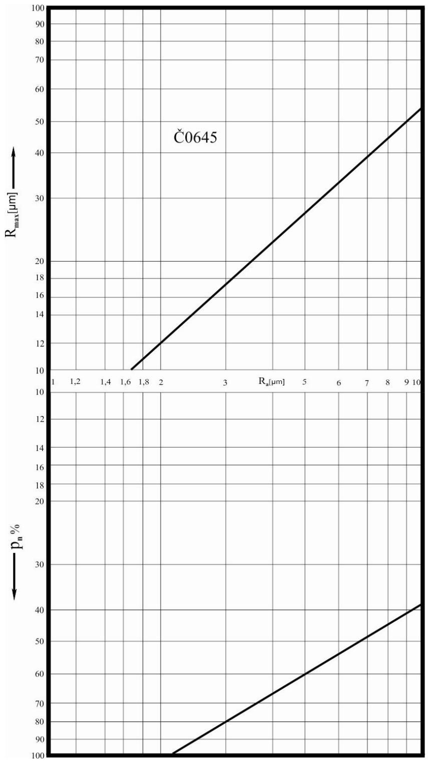

Figure 5

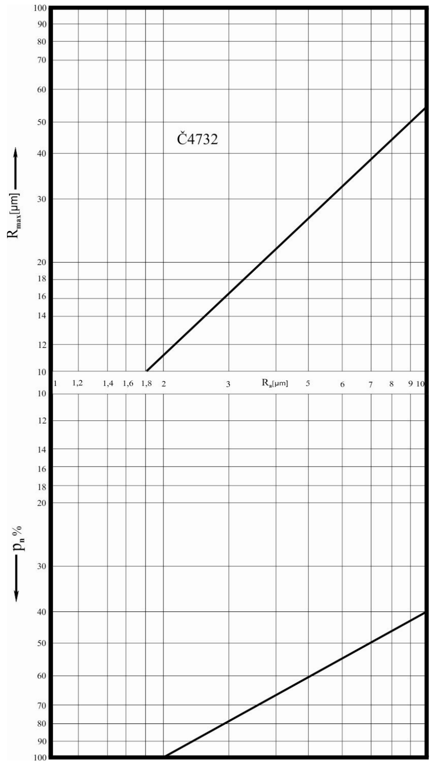

Figure 7

3. CONCLUSION

Refering to the above mentioned we conclude:

- combine graphics which connect all three roughness parameters if one of them is known that other two can be directly easy determined.
- graphics in exponential and linear form can be equaly used, but linear is more appropriate.

REFERENCES

[1] Dyachenko, P.E., and all., About elaboration International standard of machined surface roughness Surface Quality machine elements, Papers of Seminar of the surface quality Proceedings A, Edition AN SSSR Moscow, 1959. (in Russian)

[2] Sekulic, S., Kovac, P., Correlation between the maximal roughness height and aritmetic deviation of the profile from the mean line of machined surface in finish turning, Tribology in Industry, vol. VIII, No.1, 1986. (in Serbian)

[3] Sekulic, S., Kovac, P., Correlation between bearing ratio and mean aritmetic deviation of profile from mean line of machined surface. Proceedings International Conference on Advanced Manufacturing and Technology – AMST 187, October, 1987., Opatia (in Serbian)

[4] Sekulic, S. Correlation between the maximal roughness height and aritmetic deviation of the profile from the mean line of machined surface in finish turning, Abstracts of the papers of the World Tribology Congress, London, September, 1997., p.791.

[5] Sekulic, S., Correlation between some roughness parameters of the machined surface in finish turning, Proceedings of the conference: Situation and Perspective of Research and Development in Chemical and Mechanical Industry, Book 1: Mechanical Engineering, 22-24, 10, 2001, Krusevac, pp. 364-369.

[6] Sekulic, S., Correlation between roughness parameters of the machined surface in finish turning in Proceedings VIII International Symposium INTERTRIBO 2002, 14-17, 10, 2002, Stara Lesna – Tatarska Lomnica, 2002, pp. 85-88.