ASSESSING THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE SURFACE QUALITY OF STEEL MS1 AFTER WEDM

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The paper deals with the assessment of significance impact of selected technological parameters in Wire Electrical Discharge Machining on final quality of machined surface in terms of surface roughness. For determining the significance of impact of the individual technological parameters was used the statistical method Design of Experiments which is conventionally used for mathematical modelling the impact of selected technological parameters on quality indicators of machined surface previously untested experimental samples. The aim of the paper was, based on experimentally-made samples of alloyed steel MaragingSteel MS1 by WEDM technology, to select the technological parameters which significantly affect machined surface quality in terms of surface roughness parameter Rz.Here you should describe the paper idea in short.

KEYWORDS

Design of Experiments (DoE), Wire Electrical Discharge Machining (WEDM), technological parameters, surface roughness, product quality

1 INTRODUCTION

Design of Experiments (DoE) is among the methods enabling based on input information to define the importance of individual factors impact. DoE method is mainly used in pre-production stages of the production process. On the basis of appropriate planning of experimental settings of selected technological parameters in the machining process is monitored its impact of selected quality s. Into the WEDM (Wire electrical discharge machining) process enters a number of factors, i.e. technological but also the process parameters. However, not all these input factors have the same impact on output quality parameter. The aim of the experiment was, therefore, based on made samples from alloy steel MS1 through technology WEDM, to select the technological parameters, respectively their mutual combinations that significantly affecting the quality of machined surface in terms roughness parameters *Rz*[Batora 2000].Surface roughness parameter *Rz* has been elected because this parameter provides the best picture about the resulting quality of eroded surface in terms of roughness without any averaged values.

2 TECHNOLOGICAL PARAMETERS IN WEDM AND THEIR INFLUENCE ON QUALITY OF MACHINED SURFACE

Electrical discharge machining is one of the most progressive machining processes in which material removal occurs by influence of recurring electrical discharges between the anode and cathode, i.e. between the tool electrode and the workpiece with the presence of the insulator (typically dielectric)[Mankova 2000].Dielectric is a fluid with high electrical resistance which very little or does not conduct the electricity. Creation of electrical discharge between the tool electrode and the workpiece is caused by an electrical voltage and current of required parameters. WEDM is one way of electrical discharge machining, wherein a wire is used as a tool that is precisely guided using special equipment[Mankova 2000].Machining material is an electrode of opposite polarity than the polarity of the wire electrode. The main technological parameters in WEDM, which could to affect the final surface finish in terms of roughness parameters *Ra*, *Rz*, *Rq* and so on are Voltage of discharge U [V], Pulse off-time toff [μs], pulse on-time *ton* [μs], and Peak current I [A][Hasova 2015a].

The main technological parameters in WEDM and their expected impact on the machined surface roughness parameters [Hasova2015b]:

- *Peak current I* [A] - in general, with increasing the value of peak current all surface roughness parameters *Ra*, *Rz*, *Rq* increase; [Straka 2016c]
- *Pulse on-time* t_{on} [μs] in general, with increasing the value of pulse on- time all surface roughness parameters *Ra*, *Rz*, *Rq* increase; [Straka 2016c]
- *Pulse off-time* [μs] - in general, with increasing the value of pulse off- time all surface roughness parameters *Ra*, *Rz*, *Rq* decrease; [Straka 2016c]
- *Voltage of discharge U* [V] - in general, with increasing the value of voltage of discharge all surface roughness parameters *Ra*, *Rz*, *Rq* increase.[Straka 2016c]

Addition to the main technological parameters in the WEDM on the quality of the machined surface in terms of roughness parameters *Ra*, *Rz*, *Rq* influence also the process and service technological parameters which include for example, material properties of a wire electrode, reverse speed of wire electrode, properties of the workpiece, the quality and chemical composition of the dielectric liquids, and the like[Straka2016c].

2.1 *Quality of machined surface after WEDM*

The quality of machined surface after WEDM can be assessed in several ways. It can be assessed in terms of roughness parameters *Ra*, *Rz*, *Rq*, in terms of overall depth of heat-affected zone, in terms of microstructure changes, changes in microhardness, or in terms of geometric, respectively, dimensional accuracy and the like[Krenicky 2012,Gerkova 2016].The machined surface after WEDM has a random isotropic profile which is formed by numerous craters with a characteristic shape and size. The crater, which formed after an electrical discharge, can be considered as a spherical segment defined by the maximum diameter and depth according to the following Fig. 1. The essential characteristics of the crater after electrical discharge is directly proportional to the size of the energy input and pulse on-time, whereby they have a major impact on the machined surface roughness parameters *Ra*, *Rz*, *Rq*, a total depth of heat-affected zone, and the geometric accuracy, and also total effectiveness of the electroerosive process.

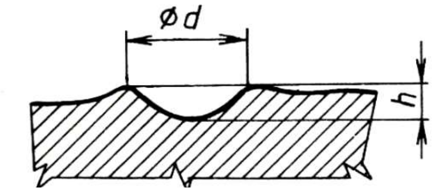

Figure 1. Crater [Mankova, 2000]

2.2 *Surface roughness parameter Rz*

An important qualitative indicator of machined surface after WEDM in terms of surface roughness is parameter *Rz* which characterizes the greatest height of unevenness profile without any averaged values[Panda 2016b].It is given by altitudinal characteristics of surface roughness which is determined by the distance between the line of peak profile and line of valley profile in the base length profile.[Panda 2016a] It reflects the time course of surface roughness, but its practical significance is very limited in that it has no direct relationship to any important physical quantity[Straka 2016c].It is actually the sum of the maximum valley depth Rv and the maximum peak height Rp in range of basic length lr. Maximum height of roughness profile *Rz* is defined by the formula[Gerkova 2016]:

$$Rz = Rv + Rp \tag{1}$$

Where:

Rp – maximum peak height in range of basic lenght lr,

Rv – maximum valley depthin range of basic lenght lr.

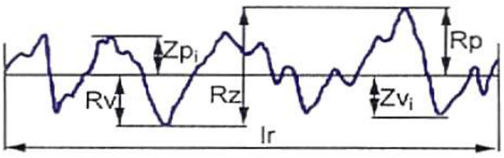

Figure 2. Diagram of the maximum height of profile *Rz*[Gerkova 2016]

In conventional machining processes, such as turning, milling, grinding, the machined surface roughness parameter *Rz* usually 3-4 times exceeds the parameter *Ra*[Krenicky 2015].

3 CONDITIONS OF EXPERIMENT

3.1 *Quality of machined surface after WEDM*

The used material of the experimental samples was the high-strength steel with the designation Maraging Steel MS1. This is a high-alloyed steel in the form of a powder which has been optimized in particular for processing in the systems EOSINT M. Its chemical composition can be designated in European classification 1.2709, in German classification as X3NiCoMoTi 18-9-5, and the US classification as 18% Ni Maraging 300. This type of steel is characterized by very good mechanical properties. It is easily thermo formable using thermal hardening by which receives high hardness and strength. A typical application of this steel is prototyping, injection moulds for light alloys, creating moulds and moulded parts etc. The following Tab. 1 illustrates the chemical composition of the high alloy steel with the designation Maraging Steel MS1[Hasova 2015a].

Table 1. Chemical composition of steel MS1 [Hasova, 2015a]

Ni	Co	Mo	Ti	Al	Cr	C	Mn, Si	P, S
17-19 %	8,5-9,5 %	4,5-5,2 %	0,6-0,8 %	0,05-0,15 %	≤ 0,5 %	≤ 0,03 %	≤ 0,1 %	≤ 0,01%

Following Tab.2 shows mechanical and physical properties of high- alloyed steel with designation Maraging Steel MS1.[HAŠOVÁ, 2015a]

Table 2. Mechanical and physical properties of steel MS1 [Hasova 2015a]

	Mechanical properties	Maraging steel MS1	
		As built	After age hardening
Mechanical properties	Tensile strength [MPa]	1100 ±100	1950 ± 100
	Yield strength (Rp 0.2 %) [MPa]	1000 ± 100	1900 ± 100
	Elongation at break [%]	8 ± 3	2 ± 1
	Hardness [HRC]	33 - 37	50 - 54
	Ductility [J]	45 ± 10	11 ± 4
	Testing cube density [kg/dm^3]	8.042	
Thermal properties	Thermal conductivity [W/m. °C]	15 ± 0.8	20 ± 1
	Specific heat capacity [J/kg. °C]	450 ± 20	450 ± 20
	Maximum operating temperature [°C]	400	400

For the production of the experimental sample was used for high-alloy steel with the designation Maraging Steel MS1 in powder form. Sintering of fine particles of the material was carried out using the technology Direct Metal Laser Sintering (DMLS). Sintering process consisted in the gradual sintering of powder MS1 using laser technology that has been applied in light layers until the reach the desired shape and size of the experimental samples. Basic dimensions of the experimental samples after sintering were 50x15x15 mm. On the following Figure 3 is shown the experimental sample after sintering.

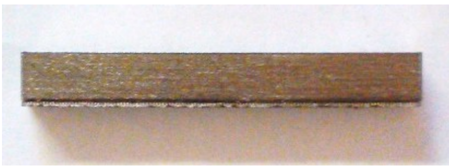

Figure 3. Experimental sample of steel MS1

3.2 *The technical equipment used for the manufacturing of and quality measurement of the determined area of experimental samples*

The experimental sample made of high alloyed steels with the designation Maraging Steel MS1 using DMLS technology was subsequently machined by electroerosion technology in the device CHMER EDM G32F by full cut without prior heat treatment. Used electroerosion equipment CHMER G32F is applicable for eroding of material without immersion of the workpiece, the air dielectric fluid into the working space is realized by means of upper and lower pressure nozzle. Electroerosion equipment CHMER G32F consists of several separate parts - mechanical drive individual working tool and workpiece axes, the system rewinding wire electrode, treatment equipment and distribution of dielectric fluid, equipment for cooling, and dielectric fluid control unit[Straka

2014b]. On the following Fig. 3 is mentioned electroerosion CHMER G32F equipment that was used to produce of the experimental samples of material MS1.

Figure 4. WEDM equipment CHMER G32F used for machining of experimental samples of MS1 material MS1 [Gibas 2009]

During eroding samples was used as a tool of brass wire electrode with a diameter of 0.25 mm and the strength of 900 MPa. As the dielectric it was used deionized (demineralized water) with the electrical conductivity less than 150 µS.cm^{-1}. Measuring the quality parameters *Ra*, *Rz*, and *Rq* of eroded surface of experimental made samples was carried out by means of a contact roughness tester Mitutoyo SJ 210, which is shown in Fig. 5. It is a contact measuring device with the bearing surface suited for the measurement of surface roughness with the application in a production environment. It has a simple intuitive guidance through the main menu. Measurement results are displayed on a screen measuring equipment individually or in groups. It also allows the view the calculated profile and BAC / ACD graphs, including an assessment of tolerances. Transmission of measurement data is possible through the slot by Micro-SD card [GAMIN 2015].

Figure5. Contact roughness tester Mitutoyo SJ 210 used for experimental measuring the roughness parameter of eroded surface [Gamin 2015]

3.3 *Evaluation method*

Assessing the influence of selected technological parameters (factors) for WEDM and their mutual combination of the qualitative parameter of eroded surface roughness *Rz* was carried out using a statistical method Design of Experiments (DoE). This method allows assess the degree of significance of individual factors that significantly affect the manufacturing process and its outcomes[Tosenovsky 2012].It also allows predict the optimum setting values of individual factors on the output quality parameters [Panda 2016b].This is a mathematical mean of allowing in practice to quantify the significance of the factors used in the production process.

4 EXPERIMENT REALIZATION AND RESULTS

The main aim of the experiment was with the use of DoE method to identify the technological s in WEDM that significantly influence the final quality of the machined surface of the material MS1. These results are then useful in determining the optimal values of the main technological s that significantly influence the final quality of the machined surface in terms of minimizing the value of the*Rz*.

4.1 *Determination of the evaluated variable*

In the method DoE is in the first step necessary to determine an observed variable which in this case is represented by parameter *Rz*. This is one of surface roughness parameters that best describes the nature of the eroded surface after WEDM.

4.2 *Selection of factors and their levels*

The next step in the method of DOE is to identify the main technological parameters which can likely to significantly affect the final quality of the machined surface after WEDM. The following Tab. 2 presents a selection of the main technological s, are likely to impact significance considered a quality parameter of surface roughness *Rz*. It also indicates the coded label which will then be used for manufacturing of samples and measuring of achieved quality of machined surface after WEDM in terms of roughness s*Rz*. Individual technological s are indicated in Table 3 as factors. Technological parameter voltage of discharge is indicated as a factor A, pulse off-time as a factor B, pulse on-time as a factor C, and peak current as a factor D. Output qualitative of machined surface *Rz* after WEDM is referred to as factor Y. The experiment was considered with the minimum and maximum settings of the selected process s, while the technological parameterVoltage of discharge were the values for minimum 75V and maximum 95V, for Pulse off-time were the values of minimum 2µs and maximum 6 µs, for parameter Pulse on-time were the values of minimum 20 µs and maximum 40 µs, and for parameter Peak current were parameters minimum 5A and maximum 6A. In coding the minimum values of the individual technological parameters were coded as -1 and maximum values as +1.

Table 3. Input and output parameters and its code marks

Input parameters	Factor	Min. value	Max. value	Code for min.	Code for max.
Voltage of discharge [V]	A	75	95	-1	+1
Pulse off-time [µs]	B	2	6	-1	+1
Pulse on-time [µs]	C	30	40	-1	+1
Peak current[A]	D	5	6	-1	+1
Output parameter					
Surface roughness *Rz* [µm]	Y				

4.3 *The election of experiment plan*

When applying the method DoE is necessary to determine the appropriate number of experiments that have to be carried out. The number of required experiments can be determined by equation (1) based on the number of considered the factors[Tosenovsky 2012]:

$$2^{factor\ number} = 2^4 = 16 \qquad (2)$$

Where 2- the number of levels.

When applying complete set of experiments, in which would be tested of all possible combinations of chosen factors, it would be carried out 16 experiments. In this case was selected a half plan called Taguchi plan, in which suffices to create half number of experiments (16/2=8). Following Tab. 4 shows designed plan of experiments indicated that the experimental samples were produced using the WEDM technology. The individual experiments are in Tab. 4 marked as E1 to E8 in order to target the analysis of the results of experimental measurements. Value -1 indicates the minimum value of the input parameter and the value +1 represent the maximum value of the input parameters.

Table 4. Plan of experiments

Experiment	A	B	C	D
E1	-1	-1	-1	-1
E2	-1	-1	+1	+1
E3	-1	+1	-1	+1
E4	-1	+1	+1	-1
E5	1	-1	-1	+1
E6	1	-1	+1	-1
E7	1	+1	-1	-1
E8	1	+1	+1	+1

4.4 *Experiment realization*

Experimental samples were produced according to the proposed plan of experiments DoE by electrical erosion equipment CHMER EDM G32F. On the following Fig. 6 can be seen in different parts of the cutting E1 to E8 on a sample of steel MS1. Each section marked on the sample represents other mutual combination of technological parameters during WEDM.

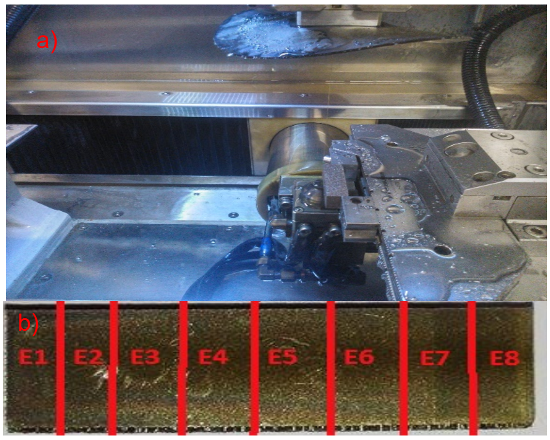

Figure6. Experimentally manufactured samples of steel MS1 using WEDM technologya) Sample during WEDM; b) designation of individual areas E1 to E8

The experimental sample made of steel MS1 by WEDM technology was subsequently tested using the touch roughness tester MitutoyoSurftest SJ 210. The measurement process is shown in Fig. 7. The measurement was performed individually in each of the cut according to a predetermined plan of the experiment. The individual parts of cut were divided into three areas, namely the upper area, middle area and lower area. Due to the elimination of measurement errors it was in each of the field by 6 repeated measurements of roughness parameters of which was subsequently calculated the average value of the parameter *Rz*.

Figure7. Measurement of roughness parameters of the steel MS1 samples after WEDM

The measured values of roughness parameters *Rz* in individual areas of experimental sample specimen is shown in the following table. 5, the value Ȳ represents the average value of the parameter *Rz*, Y1 and Y3 are averaged roughness values measured at the upper, middle and lower of the sample. Ȳ value will be used for the analysis the experiments E1 to E8.

Table 5. Measured values of roughness parameters *Rz* in individual areas of experimental sample

	A	B	C	D	Y1	Y2	Y3	Ȳ
E1	75	30	2	2	12.79	12.99	12.95	12.91
E2	75	30	6	5	18.99	19.05	19.07	**19.04**
E3	75	40	2	5	13.36	13.37	13.42	13.39
E4	75	40	6	2	15.16	15.26	15.31	15.24
E5	95	30	2	5	16.61	16.61	16.66	16.63
E6	95	30	6	2	13.45	13.97	14.02	13.81
E7	95	40	2	2	15.32	15.38	15.41	15.37
E8	95	40	6	5	16.03	16.05	16.07	16.05

From the measured values of roughness parameters *Rz* in individual areas of experimental sample set out in Tab. 5 can be observed the maximum average value of the output parameter Ȳ = 19.04 in the experiment labelled E2.

To determine the main effect of each factor on the output parameter is required its detailed analysis.[ŽITŇANSKÝ, 2013] The Tab. 6 shows the main effects of the factors of the output parameter Ȳ. The calculation is as follows: the value A1 is the value at which the parameter A had the value 75 V. The main effect of the output Ȳ is calculated as the mean value of the surface roughness of all the experiments, where A = 75 V (average of roughness in experiments E1, E2, E3, E4). Analogous procedure is applied for values A2, A3 and D2. Value Ȳ is the value of the average roughness of all experiments.

Table 5. The main effect of output Ȳ

Values of parameters	Experiments	Main effect of output Ȳ
A1=75 V	E1, E2, E3, E4	15.14333
A2=95 V	E5, E6, E7, E8	15.465
B1=30 µs	E1, E2, E7, E8	15.59667
B2=40 µs	E3, E4, E7, E8	15.01167
C1=2 µs	E1, E3, E5, E7	14.5725
C2=6 µs	E2, E4, E6, E8	16.035833
D1=2 A	E1, E4, E6, E7	14.33417
D2=5 A	E2, E3,E5, E8	16.27417
Ȳ	E1, E2, E3, E4 E5, E6, E7, E8	15.30416667

The following Fig. 8 graphically shows the main effect of each factor on the output parameter Ȳ.

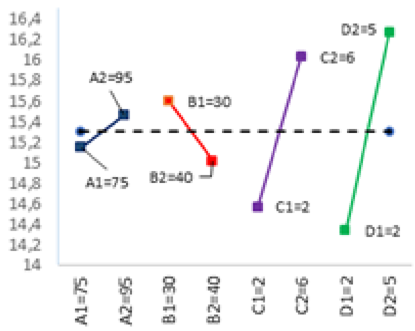

Figure 8. The main effect of individual factors A, B, C, D

From the above graph is clear that the greatest effect on output parameter Ȳ, e.g. machined surface roughness parameter *Rz* of steel MS1 after WEDM, have the values of technological parameters identified as factors C and D. On the contrary, technological parameters identified as factors A and B did not show a significant effect on output parameter Ȳ, e. g. machined surface roughness parameter *Rz*.

Assessing the interactions of individual factors

On the following charts Fig. 8 to Fig. 14 is graphical representation of the interactions of technological parameters marked factors A, B, C, D to the output parameter Ȳ, i.e. machined surface roughness parameter *Rz*. The x-axis is the sequence number of mutual combinations, and the y-axis is the reference factor Ȳ. Interaction between factors, we find as the average values of the individual endpoint experiments in which was used given combination of factors and levels.

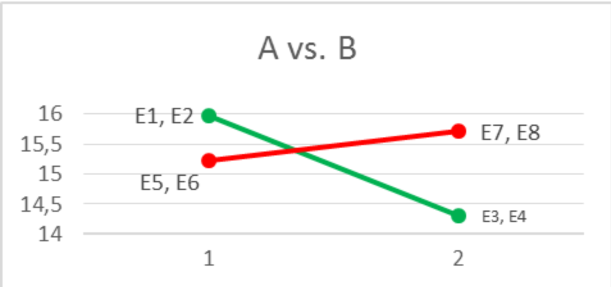

Figure 9. Interaction between A and B

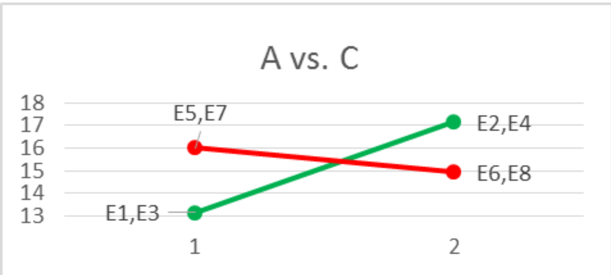

Figure 10. Interaction between A and C

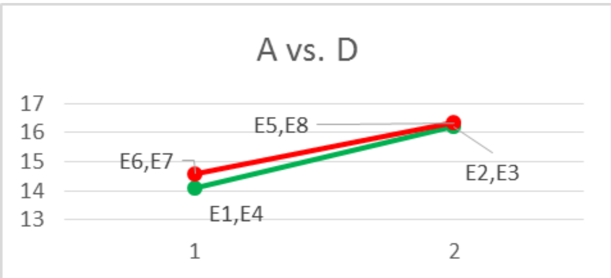

Figure 11. Interaction between A and D

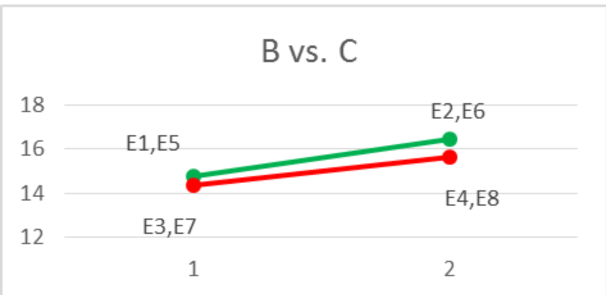

Figure 12. Interaction between B and C

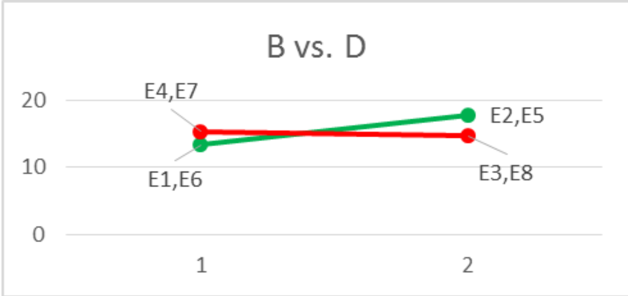

Figure 13. Interaction between B and D

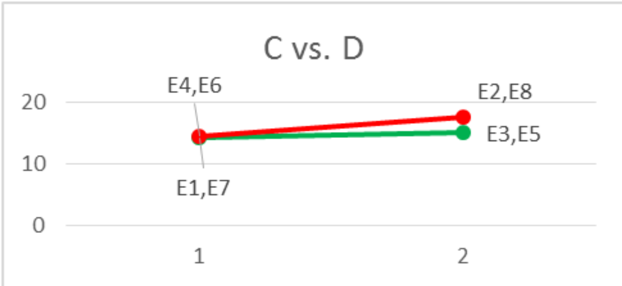

Figure 14. Interaction between C and D

Of these graphic dependences in Fig. 8 to Fig. 14 can be observed that the greatest effect to the output parameter Ȳ e.g. machined surface roughness parameter *Rz* of steel MS1 after WEDM have interactions between factors A vs. B, A vs. C, B vs. D. Conversely, the least effect on the output parameter Ȳ, i.e. machined surface roughness parameter *Rz*, are interactions between factors A vs. D, B vs. C, C vs. D.

The effect of factors

The effect of factor is the impact which causes changeover of factor Ȳ from the lower level (-1) to the upper level (+1). There are several ways of calculating the effects of factors. In this case, signed method was used. The signed method can be defined as multiply of the two vectors which consists in multiplying a row vector of the evaluated of factor marks with column (vector) of experimental results. The individual effects are calculated as follows[TOŠENOVSKÝ, 2012:

$$efect_A = \frac{\sum A}{\frac{(number\ of\ interactions + average)}{2}} \qquad (3)$$

Example for calculating of effect $_A$:

$$efect_A = \frac{\sum A}{\frac{(number\ of\ interactions + average)}{2}} == \frac{-12.91 - 19.04 - 13.38 - 15,24 + 16.63}{\frac{16}{2}}$$

Analogous effects continue the calculation of the factors B, C, D, and their mutual combinations AB, AC, AD, BC, BD, CD, ABC, ABD, ACD, BCD, ABCD. The resulting effects are calculated in the following table.

Graphical evaluation of the effect of factors

In our case it does not occur the repetition of individual experiments and so it is used a graphical method for determining the relevant factors, specifically normal probability plot. In the graph it is plotted on the horizontal axis the effect and on the vertical axis relative cumulative frequency:

$$P_i = \frac{100*(i-0,5)}{m} \qquad (4)$$

Where : i= 1,2,......, m; m is number of factors and its interactions.

Table 7. Calculated effects of individual factors and their mutual combination

	Factors	1	2	3	4	5	6	7	8	∑	effect
1	A	-12.91	-19.04	-13.38	-15.24	16.63	13.81	15.37	16.05	1.29	0.16
2	B	-12.91	-19.04	13.38	15.24	-16.63	-13.81	15.37	16.05	-2.34	-0.29
3	C	-12.91	19.04	-13.38	15.24	-16.63	13.81	-15.37	16.05	5.85	0.73
4	D	-12.91	19.04	13.38	-15.24	16.63	-13.81	-15.37	16.05	7.76	0.97
5	AB	12.91	19.04	-13.38	-15.24	-16.63	-13.81	15.37	16.05	4.30	0.54
6	AC	12.91	-19.04	13.38	-15.24	-16.63	13.81	-15.37	16.05	-10.12	-1.27
7	AD	12.91	-19.04	-13.38	15.24	16.63	-13.81	-15.37	16.05	-0.77	-0.10
8	BC	12.91	-19.04	-13.38	15.24	16.63	-13.81	-15.37	16.05	-0.77	-0.10
9	BD	12.91	-19.04	13.38	-15.24	-16.63	13.81	-15.37	16.05	-10.12	-1.27
10	CD	12.91	19.04	-13.38	-15.24	-16.63	-13.81	15.37	16.05	4.30	0.54
11	ABC	-12.91	19.04	13.38	-15.24	16.63	-13.81	-15.37	16.05	7.76	0.97
12	ABD	-12.91	19.04	-13.38	15.24	-16.63	13.81	-15.37	16.05	5.85	0.73
13	ACD	-12.91	-19.04	13.38	15.24	-16.63	-13.81	15.37	16.05	-2.34	-0.29
14	BCD	-12.91	-19.04	-13.38	-15.24	16.63	13.81	15.37	16.05	1.29	0.16
15	ABCD	12.91	19.04	13.38	15.24	16.63	13.81	15.37	16.05	122.43	15.30
16	$\bar{Y}$	12.91	19.04	13.38	15.24	16.63	13.81	15.37	16.05	122.43	15.30

The calculated probabilities of the various factors and the interaction between them are in the following Tab. 8 and following the graphic effects can be found in Fig. 15. The probabilities are calculated using the formula (4), after the individual effects ranked from smallest to largest.

The following graph on Fig. 16 are shown absolute the effects of individual process parameters identified as factors A, B, C, D, and their interaction to the output parameter $\bar{Y}$, i.e. machined surface roughness parameter*Rz*arranged from smallest to largest.

Table 8. Probabilities for individual factors

i	factor	effect	Pi
1	AC	-1.265	3.333
2	BD	-1.265	10.000
3	B	-0.293	16.667
4	ACD	-0.293	23.333
5	AD	-0.097	30.000
6	BC	-0.097	36.667
7	BCD	0.161	43.333
8	A	0.161	50.000
9	AB	0.538	56.667
10	CD	0.538	63.333
11	C	0.732	70.000
12	ABD	0.732	76.667
13	D	0.970	83.333
14	ABC	0.970	90.000
15	ABCD	15.304	96.667

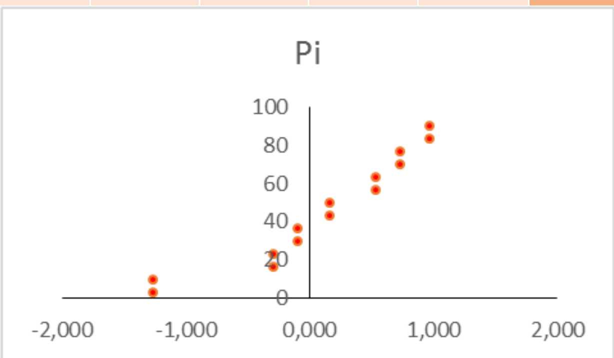

Figure 15. Probability plots of effect

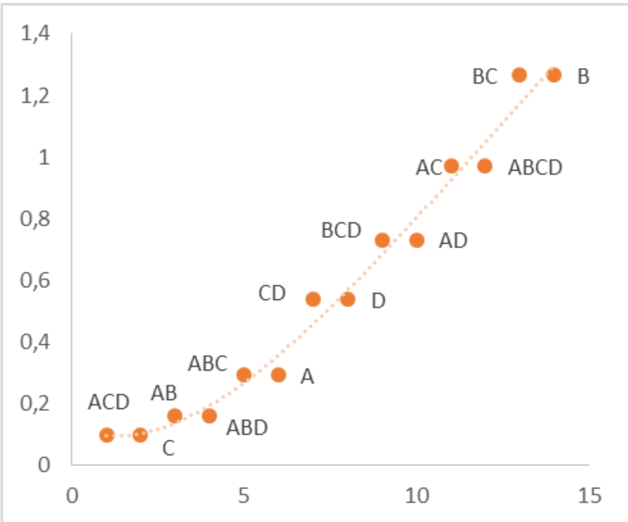

Figure 16. Graph of the absolute effects in ascending order

From mentioned graph in Fig. 16 can be observed that the greatest effect of factors on the output parameter $\bar{Y}$, i.e. machined surface roughness parameter *Rz* of steel MS1 after WEDM, has a factor B, i.e. technological parameter Pulse off-time, and interaction of factors BC, i.e. the process parameters pulse off-time and pulse on-time. On the contrary, the smallest effect of factor on the output parameter $\bar{Y}$, i.e. machined surface roughness parameter *Rz*, has factor C, i.e. technological parameter pulse on-time, and interaction of factors ACD, i.e. technological parameters voltage of discharge, pulse on-time and peak current, but also the interaction of factors AB, i.e. technological parameters voltage of discharge and pulse off-time.

5 CONCLUSION

The aim of the paper based on experimental measurements was to assess the significance of the impact of the main technological parameters on the resulting quality of machined surface roughness parameters of steel MS1 after WEDM. In the introduction were selected the technological parameters that generally expect the significant impact on quality indicators of machined surface after WEDM in terms of roughness parameters. Among these include technological parameters voltage of discharge *U* [V], pulse off-time t_{off}[µs], pulse on-time *ton* [µs] and peak current *I* [A]. In assessing the impact was used statistical method Design of Experiments by which were identified the main effects of selected technological parameters and their mutual interactions on output parameter, i.e., roughness parameter *Rz*. Based on analysis of the results of experimental measurements was already identified the number of important facts. In terms of the impact assessment the significance of the main effects of individual factors, i.e. technological parameters indicates that the largest effect on output parameter, on resulting machined surface roughness parameter *Rz* have the technological parameters- peak current *I* and pulse on-time t_{on}. Less pronounced impact on output parameter,i.e. resulting machined surface roughness parameter *Rz* have the technological parameters- voltage of discharge *U* and pulse off-time. From the assessment of the significance of the impact of mutual interactions between technological parameters indicates that significantly influence each other combinations of process parameters: pulse off-time - pulse on-time and voltage of discharge - pulse on-time. Less significant impact on output parameter i.e. resulting machined surface roughness parameter *Rz* have combination of technological parameters Voltage of discharge - pulse on-time - peak current and interaction voltage of discharge - pulse off-time

ACKNOWLEDGMENTS

The research work is supported by the VEGA Grants No. 1/0409/13; No. 1/0381/15and by the KEGA Grant No. 027TUKE-4/2014.

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