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TENDENCIES IN SHAPE COPYING ELECTRIC EROSION PROCESSING

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ABSTRACT

The electric erosion processing procedure belongs to the most general category of concentrated energies processing methods, in which the material sampling is discontinuously and cumulatively produced, the dimensional processing action being the cumulated result of certain elementary erosion processes, temporally and spatially concentrated between a transfer object and an object to be processed. Thus, one can state that the researchers in this new field of modern technology focus today on a higher processing productivity, on reducing the cost price of the transfer object, and, of course, on improving the quality of the processed surface and of the dimensional precision. The present paper presents the most recent experimental researches conducted at the "Lucian Blaga" University of Sibiu, Romania, into the modelling and optimisation of the objective-functions, in the electric erosion processing with shape copying and with magnetic actuation.

1. INTRODUCTION

The electric erosion processing is part of the most general category of concentrated energies processing methods, in which the material sampling is discontinuous and cumulative, the action of dimensional processing being the cumulated result of certain basic erosion processes, temporally and spatially concentrated between a transfer object and an object to be processed. [1]

Appeared during the last decades, nonconventional procedures bridge the gap generated by the implementation in industry of certain metals that are difficult to process by classical procedures, by the increasing complexity of the work in this field, and as well by the higher productivity standards, especially in tool rooms.

Thus, one cans state that the researchers in this new field of modern technology, [1, 2] mainly focus on the improvement of processing productivity, on the reduction of the cost price of the transfer object, and, naturally, on the improvement of the processed surface quality.

2. EXPERIMENTAL RESEARCHES

Starting from the need of acquiring more information on the process of material sampling in the electric erosion dimensional processing with or without exterior magnetic actuation, compared with the active experimental programmes designed so far, certain experimental researches have been conducted during which the processing of certain couples of material with various features has been modelled. [2] Thus, the statistic experimental analysis of the classic experiments package refers to the processing of the P30 sintered hard alloys, using transfer objects made of materials such as electrolytic copper, OL37 steel, graphite. The objective has been to perform the experimental statistic modelling and optimisation of certain objective functions of the following types: the processing productivity, the wear of the transfer object, the relative wear, and especially, the quality of the processed surface, measured by the roughness parameter Ra. The following independent variables have been taken into account: the magnetic field strength, the electric field strength, the impulse time and the downtime. The last two types of independent variables have been considered as constant during the process of material sampling and equal to certain technologically significant values. [2] The following table presents the experimental data (Table 1).

TABLE 1. EXPERIMENTAL DATA

„STATISTIC DATA SYSTEM 2000”							
	Input data (independent variables) - physical values -			Objective functions - physical values -			
	H [A·spire]	logH [A·spire]	I [A]	Q_p [mm^3/min]	Q_e [mm^3/min]	γ [%]	Ra [μm]
1.	0	1.00000	5.0	1.0093	0.5654	78.0131	8.0
2.	800	2.80209	10.0	3.4666	0.5323	20.5321	3.8
3.	4200	3.90115	12.5	9.1524	0.9402	10.1616	1.6
4.	12000	4.10612	17.5	6.9740	1.6810	18.6354	4.0
5.	22000	4.60915	17.0	5.4675	1.7230	33.9637	5.2

The statistic experimental analysis, modelling and optimisation of the abovementioned objective functions, the calculation of the regression coefficients that characterise and follow the objective functions equations, have been performed by means of the “STATISTIC DATA SYSTEM 2000” software package. [2, 3] The experimental results, presented in the tables above, have been quantified by means of the plane variation curves of the statistically optimised abovementioned objective functions. The first experimental package has antithetically presented the electrolytic couple used for the manufacturing of the transfer object and a set of samples made of P30 sintered hard alloy. The second classic experimental programme has been completed by using graphite transfer objects and samples made of P30 carbide. In both cases, the dimensional processing without magnetic actuation is difficult, in fact almost impossible to perform. [2] Suggestive graphical representations of the first experimental programme of the Ra objective function are presented in figure 1. [2] The maximum value of processing productivity is reached for a current of (15 A) at a value of the magnetic field strength of approximately 4500 AS. For the same numerical values, imposed and respectively experimentally determined, the objective function quality of the processed surfaces expressed by mean arithmetic deviation of the roughness profile, R_a [μm], has a minimum working value, which is very beneficial from the applicative point of view. [2]. A similar, and in fact expected, conclusion was that drawn from the analysis of the level curves that characterise the relative wear. [2] The processing of hard sintered P30 diagrams is preferable as sampling procedure when the transfer object is made of graphite.

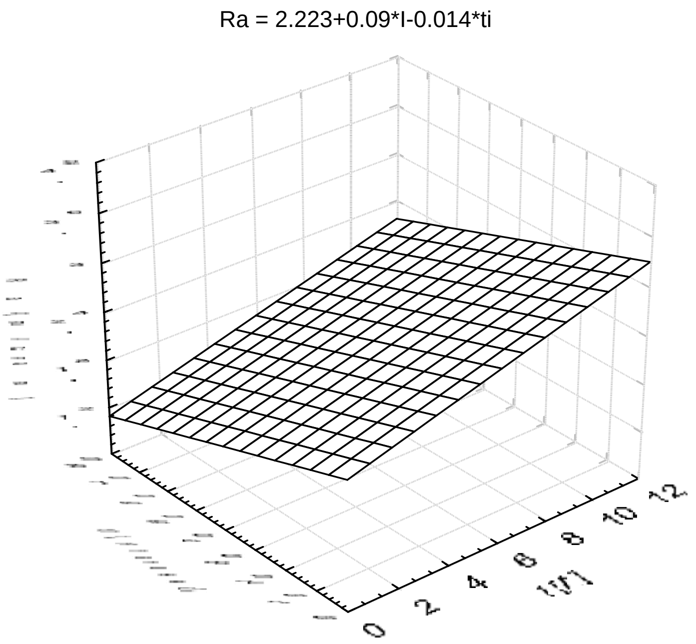

FIGURE 1. THE EVOLUTION OF THE R_a PARAMETER

In this situation, the designed experimental programme led to the conclusion that the processing productivity maximum was obtained for a value of the magnetic field strength H [AS] of 2050 AS, the relative wear minimum was obtained for a magnetic field strength H [AS] of 1950 AS, while a very good quality of the processed surface was obtained for a magnetic field strength H [AS] of approximately 4800 AS. [2]

3. CONCLUSIONS

Taking into account all the conclusions drawn after running all the classic experimental programmes, led and completed by means of the Package of Programmes titled „STATISTIC DATA SYSTEM 2000", [2, 3], the results were validated by means of certain active experimental programmes and it was concluded that the actuation of the dimensional processing procedure by electric erosion leads to a substantial increase in productivity, helps to reduce the wear of the transfer object, all these added to an improvement of the processing precision and especially of the processed surface quality.

The regressive modelling and optimisation o the aforementioned objective function leads to experimental results, which attest once more that, especially in the processing of sintered hard alloys, the overlapping of magnetic fields with the aforementioned processing procedure leads to a widening of the range of applicability of the analysed procedure with considerable good and very good results. [2]

It is necessary to highlight also the fact that the aforementioned numerical values, which reflect the magnetic field strength, experimentally obtained in different situations, can change depending on the circumstances created by the electric erosion processing procedure.

4. REFERENCES

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