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mgr inż. Anatol Kałasznikow

SYSTEM WSPOMAGANIA DECYZJI DOBORU PARAMETRÓW CIĘCIA PLAZMOWEGO DLA POTRZEB REDUKCJI KOSZTÓW WYTWARZANIA

promotor: dr hab. inż. Sławomir Kłos, prof. UZ
promotor pomocniczy: dr inż. Marek St. Węglowski

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Summary

According to the Production Engineering Committee of the Polish Academy of Sciences (PAN), the field of production engineering is divided into ten scientific and research areas. The dissertation presented fits into two areas (II and VII) [61]:

- **II - Selected problems in engineering of manufacturing processes.** This area covers the processes of managing the processing of materials for consumer goods, through the manufacture of machine elements, the forming of shapes, the changing of dimensions, surface modification, bonding and others. It also deals with issues related to employee working time resources and means of production and the flow of materials and information,
- **VII - Decision support systems**. Management of production knowledge. A section of this area deals with methods for the analysis of decisions, mathematical models and instruments of artificial intelligence.

This dissertation presents the impact of plasma cutting parameters, including cutting speed and intensity of current, the quality and cost of the product and the service life of burner consumables. The quality of the product is understood as the tolerance value of perpendicularity, dimensional tolerances, the roughness of the cut edges and the influence of heat, interacting on the micro-structural changes of the steel tested. The dissertation indicates one of the ways in which a decision support system might be developed, in order to reduce production costs.

The work consists of ten, interrelated chapters.

1. The first chapter introduces the subject matter of the dissertation and justifies its subject matter.
2. The second chapter deals with plasma cutting issues. The characteristics of plasma cutting technology and the definitions used, are presented. Cutting parameters and their impact on the quality of the cut edges are described. The construction of the plasma torches available and their component operating parts, are presented and described. At the end of this chapter, an analysis of the available literature and a summary of it are presented.
3. The third chapter formulates the goal, the thesis and scope of the thesis.
4. The fourth chapter presents ways to calculate the cost-effectiveness of the plasma cutting process.
5. The fifth chapter is devoted to decision support systems (DSS), describes their genesis and development and presents manufacturers of the applications that support decisions, regarding plasma cutting processes.

6. The sixth chapter proposes the methodology of experimental research and a method for analysing the costs of plasma cutting. The requirements set by the applicable standards and the methods for selecting the most important plasma cutting parameters, are discussed.
7. The seventh chapter presents the test stands, on which the qualitative analysis of the cut, sample boards was carried out.
8. Chapter eight - "***Own research and analysis of research results***", is a chapter divided into eight sub-chapters:
   8.1. In the first sub-chapter, the most important parameters of the plasma cutting process were selected using the Delphi method,
   8.2. The second sub-chapter presents the results of steel plate cutting tests, taking into account specific variable cutting parameters. The cut steel plates were numbered and prepared for the testing of product geometry,
   8.3. The geometry of the cut plate samples was tested in the third sub-chapter. On the basis of 3D scanning, a geometrical analysis of the cut edges was carried out, taking into account: the ranges of tolerance of their perpendicularity, their dimensions, the width of the cut groove and the size of the resulting beads- or dross- of the plates tested,
   8.4. In the fourth sub-chapter, an analysis of the geometrical results of the sample plates scanned, was made,
   8.5. The next sub-chapter presents the results of the study on the impact of the speed and the intensity of the current, on the surface roughness; the test was carried out using the contact method,
   8.6. The sixth sub-chapter deals with the impact of the speed and the intensity of the current on the structural changes of cut sheets. For the measurement of micro-hardness HVO1, the Vickers' method was used.
   8.7. The seventh sub-chapter was devoted to determining the cost-effectiveness of plasma cutting. The analyses were performed in two ways: using a logarithmic, non-linear function, that is, the least-squares method and by performing a specified number of punches and cutting lengths of the sample plates, while measuring the consumption of electric energy. In both cases, electricity consumption was the primary cost of the plasma cutting. At the end of the seventh sub-chapter, the author of this dissertation conducted additional researchin order to verify the cost-effectiveness of the plasma cutting process. Additional studies showed that the tests carried out in this dissertation will have

a utilitarian significance for the company,

8.8. In the eighth sub-chapter, an analysis of the service life of the operating parts of the plasma torch was carried out,

8.9. The ninth sub-chapter describes the decision support system in the plasma cutting process and presents the method of operation of the software developed.

9. The ninth sub-chapter of the thesis is devoted to a summary of all the results and the formulation of the final conclusions. The conclusions include plans for further research.
10. The tenth chapter is devoted to the direction of further research.
11. The first appendix to the dissertation presents the importance of the cutting processes selected and carried out in companies producing steel structures, along with their impact on the quality of products. The second appendix is devoted to the manufacturer of metal products and his need to increase competitiveness by reducing production costs. The production cycle of a typical business entity from the micro- and small enterprise sector is described and the importance of plasma cutting technology in the manufacture of metal products is presented.

The dissertation ends with a list of drawings, tables and references. As the number of attachments is very high, it has been decided to submit appendices 3 to 10 on electronic data carriers.

Keywords: sheet metal cutting technologies, plasma cutting, decision support system, plasma cutting parameters, the costs of plasma cutting, plasma burner, plasma burner consumables, 3D scanning, roughness tests, micro-hardness tests.