AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
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Application of Intelligent Techniques in Wire Cut Process

A Thesis Submitted in Partial Fulfillment for the Requirements of the M. Sc. in Mechanical Engineering

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Statement

This thesis is submitted as partial fulfillment of M. Sc. Degree in Mechanical Engineering, Faculty of Engineering, Ain Shams University. The author carried out the work included in this thesis, and no Part of it has been submitted for a degree or qualification at any other scientific entity.

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Abstract

Wire Electro-Discharge Machining (WEDM) has established itself as the most important alternative of non-traditional machining processes to produce complex shapes and contours, without having residual stresses. An experimental work is presented for longitudinal turning process based on electrical discharge machining using the wire electrode for machining steel k316 as an example of poor machineability materials. A rotary spindle is designed with some specifications and mounted on a conventional four-axes WEDM machine to allow generating cylindrical forms.

Several experiments are conducted to study the effect of predominant cutting parameters including five input variables: the depth of cut, gap, rotational speed of workpiece, pulse off time and pulse on time (design variables) on the performance measuring parameters, average surface roughness (Ra) and material removal rate (MRR) as indicators of cost effectiveness and efficiency for the machining process. The experimental work was done for longitudinal turning operation by changing one of the design variables and keeping the others constant to illustrate the effect of each of these variables individually on the responses. Selection of optimum electrical discharge machining parameters combinations for the purpose of obtaining higher cutting efficiency and accuracy is the aim and challenge

task .To achieve this aim, many improvements had been studied in WEDM and still under research as shown in literature review.

Artificial neural network model will be proposed as one of the artificial intelligence techniques to build a model with multi variables for the purpose of predicting the performance measuring parameters accurately as a function of most significant design variables without need for carrying out extra experiments. A neural network with a back-propagation algorithm and a feed forward structure has been developed for this proposed model. The proposed model was trained using experimental data available from experimental work conducted as will be discussed in later chapters. Training and verification of this proposed model had been carried out using experimental data. The network was built and trained using MATLAB Neural Networks Toolbox. To verify the accuracy and generalization of the proposed model, a new set of experimental data that haven't been used during training phase, were introduced to the network as new inputs and we compare outputs from the model with the experimental outputs.

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