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A Review on Optimization of Machining Parameters for Different Materials

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Abstract: For the new products, it is necessary to acquire new technologies to produce and process them. Mostly the product quality depends upon on the surface roughness, fatigue life improvement, corrosion resistance, aesthetics, precision fit of mating surfaces etc., because this affects on product quality. This paper provides literature review on machining parameters, such as cutting speed (Vc), feed (f) and depth of cut (t), of different material.

Keywords: Fatigue life improvement, Corrosion Resistance, Aesthetics, Parameters, Optimization, and Materials.

1. INTRODUCTION

In today's manufacturing systems it is necessary to adopt new technologies, because the challenge of modern machining industries is mainly focused on achieving high quality, in term of component accuracy, surface finish, high production rate and to increase the product life with lesser environmental impact. It is necessary to change and improve existing technology and develop product with reasonable price. So, it is necessary control the process parameters in any manufacturing process. The typical controllable machining parameters for the machines are speed, feed, depth of cut, also it depend on tool geometry, cutting environment, tool material, work material, etc. which affect desired output like material removal rate, surface roughness, power consumption, tool wear, vibration etc. The optimization of machining parameters and also need to determine which parameters are most significant factors for required output. Different approaches are used to optimize machining parameters for different materials that determine which parameters are most significant for desired output. Usually, the selection of appropriate machining parameters is difficult and relies heavily on the operators' experience and the machining parameters tables provided by the machine-tool builder for the target material. Hence, the optimization of operating parameters is of great importance where the economy and quality of a machined part play a key role. Proper selection of tools, parameters, and environmental conditions for specific quality requires a more methodical approach by using experimental methods and mathematical and statistical models as machining parameters.
This paper focuses on the optimization of different parameters that applied on material and compare the methodologies.

2. LITERATURE SURVEY

Vaibhav Gaikwad and Vijay Kumar S. Jatti at [1], provided Taguchi's method for Optimization of material removal rate during electrical discharge machining of cryo-treated NiTi alloys. NiTi alloy which has unique properties such as biocompatibility, high strength, high corrosion resistance, shape memory effect etc. Because of high strength of NiTi, it is difficult to machine it by conventional machining processes, hence to machine this advanced material non-conventional machining processes i.e. electric discharge machining is employed EDM.EDM is the processes in which electrical energy is transferred into the thermal energy and erosive action leads to removal of material using flushing fluid. The optimization of material removal rate during machining of NiTi alloy in die sink electrical discharge machine. Gap current, pulse on time, pulse off time, work piece electrical conductivity, and tool conductivity were considered as input process variables. Based on the analysis it was found that work electrical conductivity, gap current and pulse on time are the significant parameters that affect the material removal rate. Based on optimal setting of input parameters and the obtained material removal rate lies between the calculated confidence interval. Hence, Taguchi's method is useful in optimizing single objective of electrical discharge machining process parameters.

Kuldip Singh Sangwanetal [2] shows that Optimization of Machining Parameters to Minimize Surface Roughness using Integrated ANN-GA approach that provides the ANN-GA method for determining the optimum machining parameters leading to minimum surface roughness. To check the competence of the ANN-GA method for optimization and prediction of surface roughness, a real machining trial has been discussed in this study. A feed forward neural network is established by collecting the data achieved during the turning of Ti-6Al-4V titanium alloy. The MATLAB toolbox has been used for exercise and testing of neural network model. The fore cast results using ANN indicate good arrangement between the predicted results and experimental results. The analysis of this training proves that the ANN-GA method is capable of forecasting the optimal machining constraints. It has been observed that feed is the main influencing parameter for the minimization of surface roughness. It has also been observed that the increase in depth of cut and cutting speed decrease the surface roughness.

Taoyuan Zhang et.al [3] shows the Scenarios in multi-objective optimization of process parameters for sustainable machining. Sustainable machining needs to consider multiple objectives for fulfilling environmental and economic requirements. Pareto front usually employed to present multi-objective optimization results. However, the Pareto fronts are difficult to understand and inefficient when there are more than 2 objectives. In detail, by enumerating and characterizing all the 128 scenarios in sustainable machining operation involving 7 objectives including energy, cost, time, power, cutting force, tool life and surface finish. Results show that all the scenarios can be converted to single-objective situation which has a unique solution or a set of conflicting bi - objective cases which can be represented as a single Pareto front. At present, supportable machining process has been generally needed by manufacturing industry to report the financial pressure from growing energy price and the political burden from legislation on decrease of environmental effect. There are a number of methods to reduce the energy consumption in the machining practice by using single-objective optimization practices. Still, a sustainable machining practice needs to reflect multiple objectives for satisfying environmental and economic requirements. Unfortunately, present machining optimization methods are restricted in their capabilities when multiple objectives essential to be measured. The optimal outcomes attained are not complete and may comprise biases and assumptions. Also, the optimizing procedure is not effective and problematic to understand. a scenario-based systematic policy was established and reported to deliver a all-inclusive result for decision makers to solve machining optimization difficulties with sustainability attentions. To address the issues raised up from present research contributions and attain the objectives set. By computing and characterizing the issues in sustainable machining process involving 7 objectives including time, cutting force, power, energy, cost, tool life and surface finish, 128 developments can be recognized and categorized into 3 key problem scenarios: zero-objective, single-objective and general multi-objective.

Shreemoy Kumar Nayaketal [4] implement the philosophy of Multi-Objective Optimization of Machining Constraints During Dry Turning of AISI 304 Austenitic Stainless Steel With Grey Relational Analysis, it shows that The current study aims at considering the effect of different machining parameters such as feed (f), cutting speed (Vc) and depth of cut (t) on different rout in trials throughout dry turning of AISI 304 austenitic stainless steel. ISO P30 rating uncoated cemented carbide supplements were used a cutting tool for the existing drive. Three key characteristics of machines such as cutting force (Fc), material removal rate (MRR) and surface roughness (Ra) stood measured. Effort was extra made to concurrently enhance the machining parameters with grey relational analysis. Recommended parametric grouping built on the studied routine principles (i.e. MRR, Fc and Ra) was found to be Vc =45m/min, f=0.1mm/rev, t=1.25mm. A positive test is there also accepted to backing the analysis and an enhancement of 88.78% in grey relational grade (GRG) was noted. The effect of cutting speed on surface roughness, chip features and tool wear throughout turning of AISI 304 steel was calculated.

Tekiner and Yeşilyurt (2004) utilized unique process sound technique to determine optimal condition of cutting speed and feed in order to achieve favorable chip form and minimum flank wear, built-up edge and surface roughness. It is reported that The optimization of cutting speed and feed in order to obtain favorable performance characteristics. Taguchi technique is a powerful tool intended for design of experiments (DOE) which attends as a basis for optimization of several engineering processes. Taguchi design was practiced to study the effect of machining constraints on material cutting force, removal rate and surface roughness throughout dry machining of AISI 304 austenitic stainless steel. The grey relation study was accepted to improve the machining parameters in turning process.

H. Dong, Y. Liu et.al.[5] practices innovative approach Optimizing Machining Parameters of Compound Machining of Inconel718. Compound machining (CM) composite with electrical discharge machining (EDM) and arc machining to practice difficult-to-machine materials particularly for the space materials such as Inconel718. An exhilarating material removal rate (MRR) and a small diameter of overcut (DOC) may be expected in this approach. An appropriate choice of machining parameters plays a key role in CM ofInconel718. So, a various machining parameters affecting MRR and DOC for instance peak current, electrode rotation speed and peak voltage were examined. This paper highlights the mutual effect of these parameters in CM. In direction to get the optimal grouping of the several machining parameters such as peak current, electrode rotation speed and peak voltage, the mathematic model of MRR and DOC was studied in current work. The independent variable value of peak current, electrode rotation speed and peak voltage was limited respectively. A mathematical model of objective function concerning the machining parameters and the dependent variable such as MRR and DOC was projected by operating the reply surface methodology (RSM) in CM of Inconel718. This responsive model is time saving as well as efficient in determining the combined influence of peak current, electrode rotation speed and peak voltage on MRR and DOC.

Rajkamal Shuklaetal [6] describes Choice of parameters for advanced machining processes with firefly Algorithm. Advanced machining processes (AMPs) are generally used in industries for machining composite geometries and intricate outlines. In this paper, two important processes such as electric discharge machining (EDM) and abrasive water jet machining (AWJM) are measured to get the optimal values of replies for the given set of process parameters. The firefly algorithm (FA) was attempted to the measured processes to get enhanced parameters and the outcomes obtained are matched with the results given by preceding researchers. The difference of process parameters with admiration to the responses are plotted to approve the optimum results

obtained using FA. AMPs are supposed to be one of the greatest developing progressive methods used in manufacturing industry. Materials processing with high accuracy are in demands of the current years, so, their study directed to the development of complex machine, ultimate strength, and temperature and corrosion tough materials with other potentials. Machining of these materials by using of traditional machining procedures rise the machining time with high consumption of energy and rate. Fireflies are one of the great god creations whose life style of living is fairly diverse from other creature and based on their behavior, Yang and Xingshi developed an algorithm in 2008 named as the Firefly Algorithm (FA). Fireflies are portrayed by their flashing lights and this light has two purposes, one is to interest breeding associates and subsequent is to deter potential beast of prey. This flashing light obeys physics rule that intensity (I) of light decreases with the increase of distance (r), as per the equation I = 1/r2. They act as an LC-oscillator that charges and discharges the light at regular time interval, h = 2p. This work employs a non-traditional optimization technique FA to obtain the optimal solution for EDM and AWJM process. The optimum values of performance parameters and corresponding process parameters are obtained. The results obtained using FA as single objective optimization of the performance parameter for EDM and AWJM are found better when compared with the results of the past researchers.

CONCLUSION

This work presents a literature review on optimization of cutting parameters for different material surface roughness in turning. This paper focuses on different parameter and parameters play a very vital role for the machining and utilized in the industries

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