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A LITERATURE SURVEY ON MACHINING WITH DIFFERENT TYPES OF MATERIALS BY CNC MILLING MACHINE

R.Sundaramoorthy*, Dr.R.Ravindran
Assistant Professor, Hindusthan Institute of Technology, Coimbatore, India.
Associate Professor, Dr.Mahalingam College of Engineering&Technology, Pollachi, India.

ABSTRACT
This paper discuss of the literature review of aluminum alloys on CNC. Now a days CNC milling is the most important milling operation, widely used in most of the manufacturing industries due to its capability of producing complex geometric surfaces with reasonable accuracy and surface finish along with flexibility and versatility. Aluminum alloys are used in engineering design chiefly for their light weight, high strength-to-weight ratio, corrosion resistance, and relatively low cost. They are also utilized for their high electrical and thermal conductivities, ease of fabrication, and ready availability. This paper highlights the major open points and gives the different machining parameters of the aluminum alloy in CNC milling operations.

KEYWORDS: CNC, Surface roughness, MRR, Genetic Algorithm, Optimization.

INTRODUCTION
Computer Numerical Control (CNC) is one in which the functions and motions of a machine tool are controlled by means of a prepared program containing coded alphanumeric data. CNC can control the motions of the workpiece or tool, the input parameters such as feed, depth of cut, speed, and the functions such as turning spindle on/off, turning coolant on/off. The benefits of CNC are (1) high accuracy in manufacturing, (2) short production time, (3) greater manufacturing flexibility, (4) simpler fixturing, (5) contour machining (2 to 5 –axis machining), (6) reduced human error. The drawbacks include high cost, maintenance, and the requirement of skilled part programmer. The applications of CNC include both for machine tool as well as non-machine tool areas. In the machine tool category, CNC is widely used for lathe, drill press, milling machine, grinding unit, laser, sheet-metal press working machine, tube bending machine etc. Highly automated machine tools such as turning center and machining center which change the cutting tools automatically under CNC control have been developed. In the non-machine tool category, CNC applications include welding machines (arc and resistance), coordinate measuring machine, electronic assembly, tape laying and filament winding machines for composites etc.

LITERATURE REVIEW
K. Kadirgama et al[1], Develop a surface roughness prediction model for 6061-T6 Aluminium Alloy machining using statistical method. The purposes of the study are to develop the predicting model of surface roughness, to investigate the most dominant variables among the cutting speed, feed rate, axial depth and radial depth and to optimize Surface Roughness Prediction Model of 6061-T6 Aluminium Alloy Machining Using Statistical Method the parameters. Response surface method (RSM) based optimization approach was used in that study. It can be seen from the first order model that the feed rate is the most significantly influencing factor for the surface roughness. Second-order model reveals that there is no interaction between the variables and response.

Sakir Tasdemir et al[2], Studied on the effect of tool geometry on surface roughness in universal lathe. From the research The ANN approach has been applied accurately to a turning for predicting surface roughness. The biggest advantage of ANN is simplicity and speed of calculations. The present work is concerned with exploring the possibility of predicting surface finish. It is found that neural networks can be used to find out the effective estimates of surface roughness. The proposed methodology has been validated by means of experimental data on dry turning of carbide tools. The methodology is found to be quite effective and utilizes fewer training and testing data. The experimental data and the developed system analyses showed that ANN reduces disadvantages such as time, material and economical losses to a minimum.

Uros zuperl et al[3], Proposed that the selection of machining parameters is an important step in process planning. Therefore a new evolutionary computation technique is developed to optimize machining process. Particle Swarm Optimization (PSO) is used to efficiently optimize machining parameters simultaneously in milling processes where multiple conflicting objectives are present. First, An Artificial Neural Network (ANN) predictive model issued to predict cutting forces during machining and then PSO algorithm is used to obtain optimum cutting speed and feed rates. The goal of optimization is to determine the objective function maximum (predicted cutting force surface) by consideration of cutting constraints.

Hazim et al[4], Developed a surface roughness model in End Milling by using Swarm Intelligence. From the studies, data collected from CNC cutting experiments using Design of Experiments approach. Then the data obtained were used for calibration and validation. The inputs to the model consist of Feed, Speed and Depth of cut while the output from the model is surface roughness. The model is validated through a comparison of the experimental values with their predicted counterparts. A good agreement is found from this research. The proved technique opens the door for a new, simple and efficient approach that could he applied to the calibration of other empirical models of machining.

Mandara D. Savage et al[5], Developed a multilevel, in-process surface roughness recognition (M-ISRR) system to evaluate surface roughness in process and in real time. Key factors related to surface roughness during the machining process were feed rate, spindle speed, depth of cut and vibration that had generated between tool and workpiece. The overall MR-M-ISRR system demonstrated 82% accuracy of prediction average, establishing a promising step to further development in-process surface recognition systems.

W. Wang et al[6], Studied on the surface roughness of brass machined by micro-end-milling miniaturized machine tool. The cutting parameters considered were spindle speed, feed rate, depth of cut and tool diameter. They applied statistical methods, such as ANOVA and RSM to analyze the experiment data. From their experiment, they found that the value of surface roughness increase linearly with the increasing of the tool diameter and spindle speed. Feed rate played an important role when the parameters are constant.

Babur Ozcelik et al[7], Developed a statistical model by response surface methodology for predicting surface roughness in high-speed flat end milling process under wet cutting conditions by using machining variables such as spindle speed, feed rate, depth of cut and step over. They observed that, the order of significance of the main variables is as total machining time, of cut, step over, spindle speed and feed rate, respectively.

M. Brezocnik et al[8], Proposed the genetic programming approach to predict surface roughness based on cutting parameters (spindle speed, feed rate and depth of cute) and on vibrations between cutting tool and workpiece. From their research, they conclude that the models that involve three cutting parameters and also vibrating, give the most accurate predictions of surface roughness by using genetic programming. In addition, feed rate has the greatest influence on surface roughness.

CUTTING PROCESS VARIABLE

Cutting process has many constraints that must be satisfied for a meaningful optimization of machining process. In milling machining process constraints like Surface finish requirements, Speed on the machine tool, available feed rates, etc are considered. A multi objective parameter optimization problem can be formulated as follow:

$$\text{Minimize or Maximize } [f_1(x), f_2(x), \ldots, f_n(x)]$$
$$\text{subject to}$$
$$g_j(x) \geq 0 \qquad j = 1,2,\ldots,m$$
$$h_j(x) = 0 \qquad j = 1,2,\ldots,p < n$$

where x is a n-dimensional design variable vector, $f_i(x)$ is the objective function, $g_j(x)$ and $h_j(x)$ are inequality and equality constraints.

GENETIC ALGORITHM

Genetic algorithm (GA) is a popular evolutionary algorithm, which has been applied in optimization of metal cutting operations, especially in the optimization of machining operations with an objective function. The problem of the optimal machining condition selection has been analyzed by many researches. Some of the authors analyzed the optimum cutting speed that satisfies the basic manufacturing criteria's is shown in fig 1.

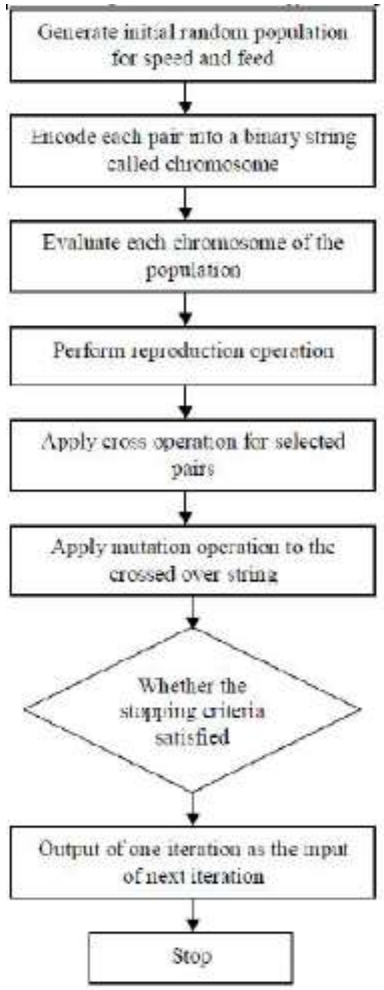

Figure 1. Flowchart of a Genetic Algorithm

SURFACE ROUGHNESS

Turning, milling, grinding and all other machining processes impose characteristic irregularities on a part's surface. Additional factors such as cutting tool selection, machine tool condition, speeds, feeds, vibration and other environmental influences further influence irregularties.

American Society of Mechanical Engineers, 1985 Roughness is essentially synonymous with tool marks. Every pass of a cutting tool leaves a groove of some width and depth. In the case of grinding, the individual abrasive granules on the wheel constitute millions of tiny cutting tools, each of which leaves a mark on the surface. Roughness ays an important role to determine how a real object interacts with its environment. Rough surfaces usually wear more quickly and have higher friction coefficients than smooth surfaces.

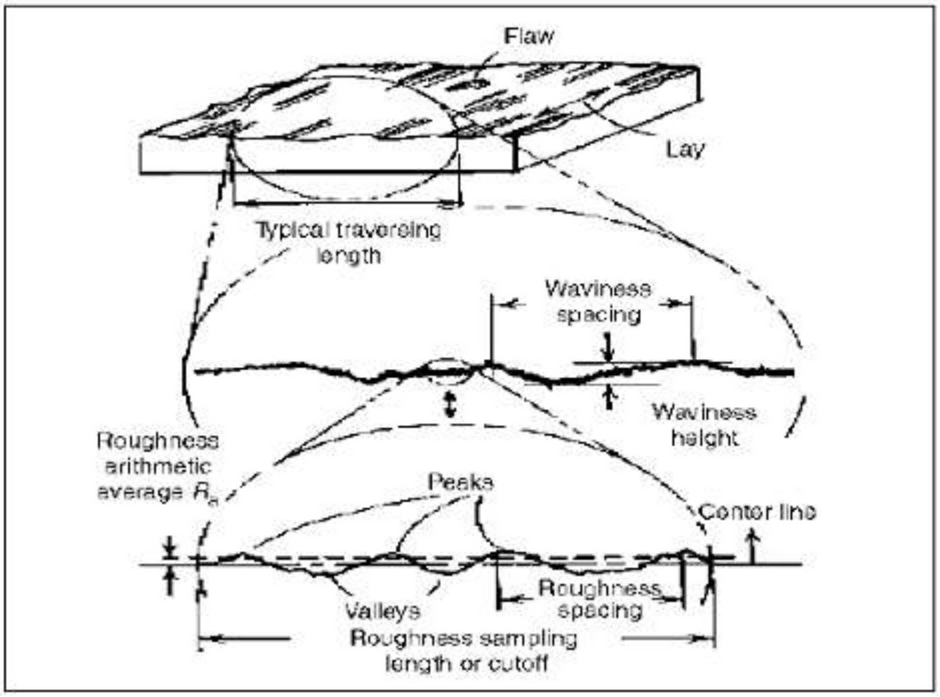

Fig 2.Surface Texture

Source: Surface Texture [Surface Roughness, Waviness, and Lay], ANSI/ASME B 46.1.

Roughness is often a good predictor of the performance of a mechanical component, since irregularities in the surface may form nucleation sites for cracks or corrosion. Although roughness is usually undesirable, it is difficult and expensive to control in manufacturing. Decreasing the roughness of a surface will usually increase exponentially its manufacturing costs.

This often results in a trade-off between the manufacturing cost of a component and its performance in application (K. Kadirgama et al., 2008).Surface roughness is used to determine and evaluate the quality of a product, is one of the major quality attributes of an end-milled product.

In order to obtain better surface roughness, the proper setting of cutting parameters is crucial before the process take place (Dr. Mike S.Lou et al., 1999).

This good-quality milled surface significantly improves fatigue strength, corrosion resistance, or creep life (Huynh, V.M. and Fan, Y., 1992). Thus, it is necessary to know how to control the machining parameters to produce a fine surface quality for these parts. The control factors for the machining parameters are spindle speed, feed rate and depth of cut and the uncontrollable factors. such as tool diameter, tool chip and tool wear (Julie Z.Zhang et al., 2006).

Material Removal Rate (MRR): Material removal rate (MRR) is defined as the material is removed per unit time. Its unit is mm^3/sec. MRR = V*f*d mm^3/sec V = Cutting Speed (in mm/sec) f = Tool feed (in mm) d = Depth of cut (in mm)

CONCLUSION

From the above discussion we found that most of the researchers had taken input parameters Spindle speed, feed, axial depth of cut, radial depth of cut and in some cases other parameters such as tool diameter, total machining time environment, nose radius etc. and facing output parameters surface roughness, material removal rate, tool life, vibration. From the literature review it studied the different approaches for the machining parameters with the optimum utilization. Recent days the machining parameter play a very vital role for the machining and utilized in the industries.

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