Scientific Journal of Impact Factor (SJIF): 3.134
ISSN (Online): 2348-4470
ISSN (Print) : 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2, Issue 1, January -2015

A REVIEW PAPER ON LATEST TREND ON FACE MILLING TOOL

B.R.Dabhi[1], K.V.Parmar[2]

[1]P.G.Student, M.E.(Cad/Cam), Atmiya institute of technology and science,Rajkot,dabhibhavesh90@gmail.com
[2]Assist.Prof, Mechanical Department, Atmiya institute of technology and science,Rajkot,kvparmar@aits.edu.in

Abstract:The paper explains about tool life, life of tool can be increased by proper selection of process parameters, geometry parameters, and machining parameters. The design of experiment has been used to study the effect of the main milling parameters such as feed rate, cutting speed, and depth of cut for tool life. Limiting factors to be consider are area for face milling and depth of slot. A tool life relational equation is developed according to Taylor Tool life equation and tool life is calculated. The effect of these parameters on the surface roughness has to be investigated by using Response Surface Methodology (RSM). Thus by Analyzing experimental and theoretically data optimization of process parameters are to be carried out.

Keywords-*Tool life, feed rate, depth of cut, cutting speed,Optimization, Response surface Methodology.*

I. INTRODUCTION

1.1Milling Machine

Milling machine is one of the most important machine tools in room as nearly all the operations can be performed on it with high accuracy.[10] The indexing head makes the machine suitable for so many purposes as exact rotation of job is possible by its use. Milling machine augments the work of lathe and can produce the plain and curved surfaces and also helical grooves etc. The milling machine may be so arranged that the several cutters are mounted on the arbor at the same time, thus increasing the metal removal rate and allowing several surfaces to be machined at the same time and also ensures accuracy.It is a process in which metal removal takes place when the work is fed past a revolving cutter. Its significance lies in its capacity to perform a large number of operations which no other single machine tool can perform. At the same time, it gives production at a fairly high rate within very close limits of dimensions.[10] Milling has largely replaced other machine tools like shapers, and planers for various kinds of operation.Milling machines can be used for machining flat surfaces, contoured surfaces, complex and irregular areas, surfaces of revolution, slotting, external and internal thread, gear cutting, helical surfaces of various cross-sections etc. to close tolerances for both limited and mass production.

Face milling is performed by a face milling cutter rotated about an axis perpendicular to the work surface. Face milling cutters with multiple-tooth inserts are used for removing metal high material removal rates. It generally consists of a large-diameter cutter body with a number of mechanically fastened inserted tools.

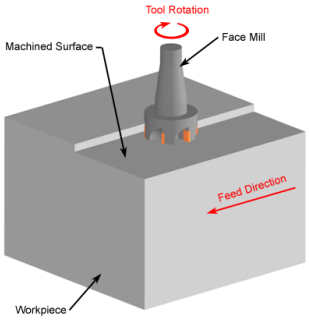

Fig 1: Face Milling [6]

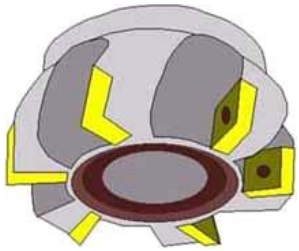

Fig 2: Face Milling Cutter [6]

1.2 Tool Life

During machining operation, the cutting edge of the tool gradually wears out and at certain it stops cutting metal. After a certain degree of wear, tool has to be re-sharpened to make use of it. Tool life is the useful cutting life of a tool expressed in time or some other unit. This period is measured from the start of cut until such time when the tool no longer performs the designed function defined by failure criteria. The period which tool cuts satisfactorily are called life. Thus it results in poor surface finish or dimensional in accuracy. Tool life is the period between two consecutive tool replacements.[10]

Taylor has given Taylor equation for finding tool life, which depend on cutting speed and Equation is given below,

$VT^n = C$

Where, C and n are constant, V is cutting speed (mm/min),T is Tool life in minutes.

Tool wear is a time dependent process. As cutting proceeds, the amount of tool wear increases gradually. But tool wear must not be allowed to go beyond a certain limit in order to avoid tool failure.Every machining operation is based on certain parameters such as machining parameters, geometric and process parameters.Machining parameters are cutting speed, Feed Rate, Depth of cut. Geometric Parameters are tool geometry. Process parameters are coolant, Rigidity of machine, work piece material. The life of tool is depends upon these parameters and thus selection of optimum parameters will enhance the life of tool.

1.3 Optimization

To get optimize result RSM (Response Surface Methodology) will be used. It is a collection of mathematical and statistical techniques for empirical model building. By careful design of experiments, the objective is to optimize a response (output) which is influenced by several independent variables (Input variables). An experiment is a series of tests, called runs, in which changes are made in the input variables in order to identify the reasons for changes in the output response.The application of RSM to Design optimization is aimed at reducing the cost of expensive analysis methods (for example finite element method or CFD Analysis) and their associated numerical noise.

1.3 Problem Statement

Tool life and tool wear is directly dependent on cutting parameters such as cutting speed, feed rate, depth of cut, tool geometry tool rake angle. So by optimizing process parameter tool life can be optimized.

1.4 Objectives

(A)To estimate tool life for CNC face milling tool.(B)To analyze process parameters, feed rate, depth of cut, and cutting speed which directly affect tool life.(C)Analytical data and experimental data are compared.

II.LETRATURE REVIEW

S NizamSadiqet. al [1] This paper explores about the role of Titanium Aluminum Nitrite on OHNS materials gives better surface finish and tool life with minimum cost. In this Experimental Investigation of face milling operation of OHNS steel plates with different process parameters like spindle speed, feed rate and depth of cut and to find optimal machining conditions of minimum surface roughness (Ra).

Nitin B. Katrodiyaet. al **[**2**]**This paper gives an information about the surface roughness, which depend on many parameter like feed rate (F), depth of cut (D), spindle speed (S), cutting path followed by tool. The focus of current report is to find effect of cutter paths used in the milling process on surface roughness. Here the different cutting path are one directional, back & forth and spiral are considered as cutter path strategies. The cutter path strategies greatly influenced to the surface finish of the work pieces.

Kannan.S et. al [3]The work enlights the parameters influence on Material Removal Rate (MRR) and Surface Roughness (SR) in aluminum as a work piece material. The selection of milling parameters such as spindle speed, feed rate and depth of cut are essential for improving the productivity and part quality. This work formulates the relationship between input and response variables for improving the face milling performances. The Response Surface Methodology (RSM) is utilized for making the relationship between independent and dependent variables. Finally, the selection of the best parameter is important to the manufacturing industries in order to improve the productivity and product quality through scientific approach.

Prasanna P Kulkarniet. al[4] The aim of this research is to investigate the effect of tool nose radius under different cutting conditions and their effect on tool life, surface roughness. Tool nose radius has significant influence on tool life and surface finish. Experiment was carried out on grey cast iron. Any change in the cutting feed leads to a corresponding change in the cutting temperature, so the cutting feed should influence the tool wear rate. when the cutting temperature is higher than the optimal cutting temperature, then any increase in the cutting feed should lead to an increase in the tool wear rate. There are many parameters that have effect on tool life and surface roughness in machining of various materials. From the literature it is clear that in order to enhance the productivity in terms of tool life, surface finish with variation of cutting parameters, tool materials and tool geometry.

N. S. Pohokaret. al **[**5**]** In this paper machining parameters, cutting speed, feed, depth of cut, and geometric parameter rake angle are considered. The tool life is estimated using a calculator created through MATLAB programming. Taguchi and ANOVA methods are applied for the design of the experiment and to find the optimum values of the parameters selected. The trials are then carried out a VMC machine located in nearby industry. The flank wear and face wear are measured and the tool life is estimated. The results obtained through both the approaches are then compared and an optimum combination of parameters is suggested and value of the tool life for that combination is estimated. Thus tool geometry of a milling tool is designed for rough milling operation by optimizing rake angle.

III. MATERIAL AND METHODOLOGY

2.1 Work piece

Work-piece material will be Oil Hardened Nickel Steel (OHNS) Die material. Table shows chemical composition of material.

Table 1: Chemical Composition of OHNS Die material

Steel type	Quality	AISI	Typical analysis in %				
			C	Mn	Cr	W	V
OHNS die Steel	OHNS	01	0.95	1.00	0.50	0.5	0.10

2.2 Machine Tool

Face milling have to be carried out with help of face milling cutter. Face milling cutter consist of two slots in which inserts have to be placed. Insert will be used for face milling operation.

2.3 Machine

Experiment can be performed on any Vertical Machine center**.**

2.4 Consideration of Experiment

One of the main objectives of this experiment is to increase the tool life on a specified material by optimizing process parameters. Surface roughness will be measured for all runs. It is very difficult to consider all factors while calculating the tool life. So for this work, the tool life is dependent on feed rate, depth of cut, cutting speed. Experiment will be conducted by considering three input parameter Feed rate, Depth of cut and Cutting Speed. The total experiment will be 27. Limiting factor can be taken as a area for face milling. Corner radius of an insert has to be measured for tool life.[

IV. CONCLUSION

Thus by performing experiments by considering three levels of Feed rate, depth of cut and cutting speed. So by performing experiments optimized parameters can be identified for maximum tool life by limiting the machining area. Thus reduction in corner radius will lead to reduction in tool life. With help of Response Surface Methodology it can be proved theoretically.

REFERENCES

PAPER

[1] S NizamSadiq, T R Raguraman, D Thresh Kumar, R Rajasekaran and T T M Kannan, "Optimization Of Milling Parameters Of OHNS Steel Using Tialn Coated Cutter By Design Of Experiment Technique",International Journal of Mechanical Engineering and Robotics research, Vol. 3, January 2014**.**

[2]Nitin B. Katrodiya and Harshad D. Patel, "Investigation of the Effect of Cutting Parameter by Using Different Cutting Path for End Milling Operation on Surface Roughness", IJSRD - International Journal for Scientific Research & Development, Vol. 2, Issue 03, 2014.

[3] Kannan. S, Baskar. N, "Modeling and Optimization of Face Milling Operation Based on Response Surface Methodology and Genetic Algorithm", International Journal of Engineering and Technology (IJET), Vol5 Oct-Nov 2013.

[4] Prasanna P Kulkarni, Kiran J O, Deeleepkumar S G, "Effect Of Tool Nose Radius And Cutting Parameters On Tool Life, Surface Roughness In Turning Of Grey Cast Iron", Vol. 6 Mar 2014

.[5] N. S. Pohokar and B. B. Bhuyar, "Tool life Estimation of CNC End milling Tool by Optimizing Geometry and Machining Parameters", International Journal Of Mechanical Application Research (IJMEAR), Vol -3, Oct-Noc 2012.

[6] M. Subramanian, M. Sakthivel, K. Sooryaprakash, R. Sudhakaran, "Optimization of end mill tool geometry parameters for Al 7075 – T6 machining operations based on Vibration amplitude by response surface methodology", Measurement 46(2013) 4005 – 4022.

[7]Z.O. Liu, X. Ai, H Zhang, Z. T. Wang, Y Wan, "Wear patterns and mechanisms of cutting tools in high speed face milling", Journal of material processing technology 129(2002)222-226.

WEBSITES

[8] http:/www.sandvick.com/insert.pdf

[9] http:/www.kanametal.com

BOOKS

[10] Production Technology, Khanna Publication by R. K. Jain.

