International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 3 Issue 1 ǁ Jan. 2015 ǁ PP.74-80

Investigations on Milling Tool: - A Literature Review

Sonal C Yogi*, Rahul kumar sen**, Mayank kumar Madia***, Pragnesh K Brahmbhatt****
**Phd Scholar, Department of Mechanical Engineering, Rai University, Ahmedabad (Guj.), India,*
***Assistant Professor Tatva Institute of Technological Studies, Modasa,*
****Assistant Professor Tatva Institute of Technological Studies, Modasa,*
*****Associate Professor, GEC Modasa, Department of Mechanical Department*

Abstract- *Milling machines are tools designed to machine metal, wood, and other solid materials. Often automated, milling machines can be positioned in either vertical or horizontal orientation to carve out materials based on a pre-existing design. The main aim of this paper is to focus on the study of effects of cutting tools on various materials while the parameters are kept constant and also by varying the parameters. A literature review was conducted to find the effects of different cutting tools on milling of different materials. It was found out that most of the work was done using single tool and single material and results were recorded. The literature review gives us idea to use more than one material and subject it to the single tool. And then a comparison can be made on the results that are recorded.*

I. INTRODUCTION

Milling cutters come in several shapes and many sizes. There is also a choice of coatings, as well as rake angle and number of cutting surfaces. The challenge of modern machining industries is mainly focused on the achievement of high quality, in term of work piece dimensional accuracy, surface finish, high production rate, less wear on the cutting tools, economy of machining in terms of cost saving and increase of the performance of the product with reduced environmental impact. End milling is a very commonly used machining process in industry. The ability to control the process for better quality of the final product is paramount importance. Surface texture is concerned with the geometric irregularities of the surface of a solid material which is defined in terms of surface roughness, waviness, lay and flaws. Surface roughness consists of the fine irregularities of the surface texture, including feed marks generated by the machining process. The quality of a surface is significantly important factor in evaluating the productivity of machine tool and machined parts. The surface roughness of machined parts is a significant design specification that is known to have considerable influence on properties such as wear resistance and fatigue strength. It is one of the most important measures in finishing cutting operations. Consequently, it is important to achieve a consistent tolerance and surface finish (Godfrey C. Onwubolu., 2005).

II. Features of a Milling Cutter

Shape: Several standard shapes of milling cutter are used in industry today, which are explained in more detail below.

Flutes / teeth: The flutes of the milling bit are the deep helical grooves running up the cutter, while the sharp blade along the edge of the flute is known as the tooth. The tooth cuts the material, and chips of this material are pulled up the flute by the rotation of the cutter. There is almost always one tooth per flute, but some cutters have two teeth per flute often, the words flute and tooth are used interchangeably. Milling cutters may have from one to many teeth, with 2, 3 and 4 being most common. Typically, the more teeth a cutter has, the more rapidly it can remove material. So, a 4-tooth cutter can remove material at twice the rate of a 2-tooth cutter.

Helix angle: The flutes of a milling cutter are almost always helical. If the flutes were straight, the whole tooth would impact the material at once, causing vibration and reducing accuracy and surface quality. Setting the flutes at an angle allows the tooth to enter the material gradually, reducing vibration. Typically, finishing cutters have a higher rake angle (tighter helix) to give a better finish.

Center cutting: Some milling cutters can drill straight down (plunge) through the material, while others cannot. This is because the teeth of some cutters do not go all the way to the centre of the end face. However, these cutters can cut downwards at an angle of 45 degrees or so.

Roughing or Finishing: Different types of cutter are available for cutting away large amounts of material, leaving a poor surface finish (roughing), or removing a smaller amount of material, but leaving a good surface finish (finishing). A roughing cutter may have serrated teeth for breaking the chips of material into smaller pieces. These teeth leave a rough surface behind. A finishing cutter may have a large number (4 or more) tooth for removing material carefully. However, the large number of flutes leaves little room for efficient swarf removal, so they are less appropriate for removing large amounts of material.

Coatings: The right tool coatings can have a great influence on the cutting process by increasing cutting speed and tool life, and improving the surface finish. Polycrystalline diamond (PCD) is an exceptionally hard coating used on cutters which must withstand high abrasive wear. A PCD coated tool may last up to 100 times longer than an uncoated tool. However the coating cannot be used at temperatures above 600 degrees C, or on ferrous metals. Tools for machining aluminum are sometimes given a coating of TiAlN. Aluminum is a relatively sticky metal, and can weld itself to the teeth of tools, causing them to appear blunt. However it tends not to stick to TiAlN, allowing the tool to be used for much longer in aluminum.

Shank: The shank is the cylindrical (non-fluted) part of the tool which is used to hold and locate it in the tool holder. A shank may be perfectly round, and held by friction, or it may have a Weldon Flat, where a set screw, also known as a grub screw, makes contact for increased torque without the tool slipping. The diameter may be different from the diameter of the cutting part of the tool, so that it can be held by a standard tool holder.

III Previous Research

P.FallboEhmer, C.A. Rodroaguez, T. Oe zel, T. Altan [1] gave a brief overview of HSC technology and presents current progress in high performance machining of cast iron and alloy steels used in die and mold manufacturing. This work covers: theoretical and experimental studies of tool failure and tool life in high-speed milling of hard materials, optimization of CNC programs by adjusting spindle RPM and feed rate (program OPTIMILL) to maintain nearly constant chip load in machining sculptured surfaces, and prediction of chip, stresses and temperatures in the cutting tool as well as residual stresses in the machine surface layer. Experimental studies are conducted using a 4-axis high-speed milling machine. Tool materials evaluated include carbides, coated carbides, and PCBN. Work piece materials investigated include H-13 at 46 HRC, P-20 at20±40 HRC and cast iron.

Barstad, Terje [2] have done machining tests with two different milling cutters on NTNU (32 and 63 mmcutters). One of the tests was not successful (32 mm cutter), while the other (63 mm) showed a large improvement potential for Volvo Aero Norway (VAN). In a comparative analysis of tool life, VAN's existing tool supplier showed better results than two other tool supplier companies. Re grinded tools, gave an equivalent or marginally worse tool life. Surface integrity after ceramic milling was studied in a separate experiment. The work piece was cut up in pieces, and polished so the thickness of the deformed layer could be studied in a microscope (30 – 60 μm). This experiment was repeated with a lower radial cut and the use of MQL, this resulted in a thinner deformed layer (9–13 μm), and unfortunately this was not within VAN's 5 μm requirement.The improvement potential in today's ceramic milling operations was calculated during two machining tests at VAN. When the cutting speed and feed was increased (from Vc(nom) = 1100 to 1283 m/min, and from fz = 0.08 to 0.10 mm/tooth), the productivity increased by 46 %. Since the tool life was the same, a cost saving of 23 and 25 % can be achieved for the 80 and 63 mm cutter respectively. If the machining centre had coped with the increased spindle load, the recommended parameters from the NTNU tests could have been used (Vc (nom) = 1283 m/min, fz = 0.16 mm/tooth).This would have increased the total productivity with 133 % and a cost saving of 50 and 58 %.

Per Wiklund, Sandvik CoromantAB Ragnar Larsson Chalmers [3] University of Technology. The work presented in this report represents the first tests of those different insert geometries and prototypes. The inserts are tested according to already known test methods, developed and used at Sandvik Coromant, but evaluated with a multivariate data analysis tool called Modde. (L. Eriksson, E. Johansson 2008) The drawbacks and benefits with this computer program are investigated as well as the different insert geometries and the behavior of the different wear types and their affection on the insert life. The results points towards the importance of collecting accurate data when measuring, as well as giving recommendations for further testing, where it should be possible to optimize the geometry of the tool to reach as long life as possible.The parameters to further investigate concerning the geometry is the clearance angle and the chamfer width.

Vedat Savas ,Cetin Ozay [4] Presents a performance assessment of rotary end milling at the tangential contact.With this shape of the contact, process has been more stable. At the last decade due to the fact that cutting tools have a quenching problem, Turn-milling has been developing in manufacturing technology for processing hard steels, where in both the work piece and the tool are given a rotary movement simultaneously. Thus, cutting edges have a time for quenching. The objective of present work was to investigate process of tangential turn-milling for machining of work pieces within the normally available range of speed and feeds to explore its advantages.The investigations have been laid mainly on surface roughness and timing process.The experiments have been conducted for tangential turn-milling of mild steel work piece.

Mohd ezuwanizam[5] in his paper he was to obtain an optimal setting of turning process parameters cutting speed, feed and depth of cut, which may result in optimizing tool life of TiN coated carbide inserts while milling aluminum 6061.It is shown that the tool wear in end milling decreases with the increase in feed, radial depths of cut and cutting. From the experiment it is found that the effect of axial depth of cut on tool life is not so significant. The speed effect is dominant followed by the feed and the axial depth of cut. For end-milling of aluminum alloy 6061, the optimum condition that is required to maximize the coated carbide tool life are as follow: cutting speed of 180m/min, federate of 0.2 mm/rev, axial depth of 1.5 mm.

M. Nouari, A. Ginting [6] a study on the performance of alloyed carbide tools during dry machining of the titanium alloy Ti-6242S, commonly used for aero engines. Experimental tests were conducted using two kinds of alloyed carbide tool inserts: the uncoated carbide tool (tool A) and the multi-layer CVD-coated tool (tool B). Tool failure modes and wear mechanisms for both tools were examined at various cutting conditions. The localized flank wear (VB) was found to be the predominant tool wear for both tools A and B. At VB close to 0.3 mm, a brittle fracture (cracking, flaking and chipping) was noted, a plastic deformation was significantly observed and a phenomenon of coating delamination was noticed. Adhesion wear (attrition and galling) and diffusion wear have been the wear mechanisms of tools A and B. Coating delamination was the initial wear mode of tool B; it occurred after a few seconds of cutting time. The performance of the uncoated and the multi-layer CVD-coated alloyed carbide tools was analyzed in terms of tool life and surface finish.

M Kayhan and E Budak [7] presented an empirical attempt to understand tool life under vibratory cutting conditions. Tool wear data were collected in turning and milling on different work materials under stable and chatter conditions. The effects of cutting conditions as well as severity of chatter on tool life were analyzed. The results indicated significant reduction in tool life on account of chatter, as expected. They also show that the severities of chatter, and thus the vibration amplitude, greatly reduce the life of cutting tools. These results can be useful in evaluating the real cost of chatter by including the reduced tool life. They can also be useful in justifying the cost of chatter suppression and more rigid machining systems.

Surasit Rawangwong, Jaknarin Chatthong, Julaluk Rodjananugoon,Romadorn Burapa, and Worapong Boonchouytan [8] investigated the effect of main factors on the surface roughness in nodular cast iron FCD 400 face milling by carbide tool. The results obtained from the analysis which used in the automotive industry, manufacture of molds and other parts of the industries. The etching experiments using semi-automated milling machine Obraeci Strojie brand FGV 32 model. Concerned the material was nodular cast iron FCD 400 using inserts carbide tool. The factors study used a speed, feed rate and depth of cut. Preliminary experiments showed that the depth of cut does not affect the surface roughness fix depth of cut at 2 mm. The experiment illustrated that the factor affecting surface roughness was feed rate and cutting speed with tendency for reduction of roughness value at lower feed rate and greater cutting speed, it was possible determine a facing condition by means of the equation Ra = 1.07 - 0.000655 speed + 0.000562 feed rate leading this equation goes to use is in limitation speed 500-1,000 rpm. at feed rate 160-315 mm/min. From the experiment is to confirm the result of a comparison between the equation and the action value. The result from the experiment of mean absolute percentage error of the equation of surface roughness is 3.5

Recep Yigit, Fehim Findik, Erdal Celik[9] evaluated tool life performance of multilayer hard coatings for machining of spheroidal graphite cast iron.TiCN+TiC+Al2O3+TiN and TiCN+TiC+Al2O3+TiN multilayered coatings with different thicknesses were fabricated on WC substrates using high temperature chemical vapor deposition (HTCVD). These cutting tools with hard multilayered coating systems were used in the longitudinal turning of spheroidal graphite cast iron under the cutting conditions encountered in the work. To investigate the tool life performance in cutting tools coated by HTCVD, cutting experiments were performed using a CNC turning bench with 3 different cutting tools having multilayered hard coatings and an uncoated insert with square edges, and a type of spheroidal graphite cast irons. The tests were done under various combinations of speed, feed, and depth of cut. Tool life based on flank wear was considered to compare the 3 cutting tools. Tool performance was evaluated with respect to tool wear, surface roughness, and cutting forces at 4 different cutting speeds in the range 125-200 m/min.

S. Thamizhmanii, S. Hasan analyzed the surface roughness [10] cutting tool forces and tool wear in machining casted gray iron. The methodology adopted was turning process from other machining process. The turning is the widely employed manufacturing process. The tests were conducted by designing various cutting speed, feed and a constant depth of cut. In turning casted gray iron, flank wear, crater wear and built up edge are the common phenomenon. from the tests were the formation of flank wear, crater wear while machining the casted gray iron. Further research is possible in the direction measuring the residual stresses and the vibration of the cutting tool. There are some limitations in carrying the tests namely vibration of the tool, tool wear and length of work piece. The constraint in measuring depth of crater wear was due to non availability of technology devices and equipments. However, the length of crater wear was measured for analyzes.

Tae-Hong conducted [11] an experimental and theoretical investigation for high speed machining of AISI 4140 medium carbon steels and AISI D2 tool steels which are classified as being difficult to machine materials. An experimental program was carried out to determine the cutting forces, chip formation, the secondary deformation zone thickness and surface roughness at different cutting speeds using a 0.4mm and 0.8mm nose radii ceramic tools and -7° rake angle for annealed (virgin) AISI 4140 and heat treated AISI 4140 steel. Another series of experiments was carried out on the annealed (virgin) and heat treated AISI D2 with 0.4mm, 0.8mm and 1.2mm nose radii CBN (Cubic Boron Nitride) tools under various cutting conditions. A theoretical model is developed by taking into account the flow stress properties of the AISI 4140 (0.44% carbon content) to use with the Oxley Machining approach. To find the flow stress data for AISI D2 tool steel, the Johnson and Cook empirical constitutive equation is used as the constitutive model. In addition, the magnitude of tool radius should be also considered to determine the prediction of cutting performances. To account for the effect of nose radius edge in hard machining, a simplified geometrical method is used to model the parameters for application in the Oxley Model and works for the cutting conditions considered here. These extensions to the Oxley machining theory were verified by experimental results. These results show a good agreement between the Oxley machining theory and hard machining experiment at data. The research work described in this thesis provides useful data for hard machining conditions.

Asier Ugartea, b, Rachid M'Saoubia, Ainhara Garay b, P.J. Arrazolab [12] examined Machining behaviour of Ti-5553, Ti-6Al-4V mill-annealed (MA) and Ti-6Al-4V solution treated and aged (STA) alloys was studied in different interrupted cutting operations using PVD coated cemented carbide tools. Single tooth face milling was employed to study the wear behaviour and tool life of the coated tools that were further inspected using scanning electron microscopy. The results indicated that a poor machinability was observed for Ti-5553 when compared to Ti-6Al-4V (STA) and Ti-6Al-4V (MA). This was found to correlate reasonably well with an increase of work material adhesion severity on the cutting tool that resulted in an increased chipping and led to catastrophic tool failure. Series of orthogonal interrupted cutting tests were performed subsequently to investigate the role of work material and cutting data on the chip formation, mechanical loads and frictional conditions at the tool-chip contact. A detailed analysis of the chip segmentation characteristics of the different Ti alloys is provided and the results are employed in different analytical models to assess the shear strain, strain rate and segmentation frequency. Finally, a comparison of Ti-5553 and Ti-6-4 (MA) in interrupted turning is presented where the differences in terms of cutting temperature are discussed.

Sanjib kumar Hansda [13] Concluded that the Cutting speed has significant influence on growth or progression of flank wear. Rapid tool wear took place at high cutting speed (Vc = 200 m/min) where, systematic growth of tool wear was observed for Vc = 100 m/min and Vc = 150 m/min. As the cutting speed increased average flank wear also increased for a particular machining duration. Cutting speed also has important effect on various chip characteristics. When cutting speed increased, chip thickness and chip reduction coefficient decreased. Hence, colour of the chips has all along been yellow. Thin and continuous chips were obtained at high cutting speed i.e. Vc = 200 m/min. From the present study it is recommended to use cutting speed in the range of 100-150 m/min particularly when machining under dry condition.

Mohamad.Nouilati [14] Investigated the machining performance of a series of commercially available coated tungsten based cemented carbides, with 55o diamond shape, during finish turning of AISI 1018 steel under dry conditions. The inserts tested had a coatingofTiN,Al2O3,TiN/Al2O3and TiC/Al2O3/TiN respectively. For comparison, uncoated cemented tungsten carbide was also tested under the same cutting conditions. The coated tools exhibited superior wear resistance over the uncoated tool. The TiC/Al2O3/TiN coated tool had the lowest flank wear due to the high abrasive resistance of the TiC layer. The Al2O3 coated tool showed superior wear-resistance over the TiN/Al2O3 coated tool due to the TiN coating that deteriorated the effect of the Al2O3 outer layer. The TiN coated tool showed the least wear resistance with respect to the other coated tools. Surface roughness appeared to increase with flank wear while oscillating for all the tested tools except for the TiN coated tool. The TiN coated tool produced a relatively consistent surface roughness that was not significantly affected by the flank wear under the conditions tested. The coated tools produced lower surface roughness compared to the uncoated tool, except for the TiN/Al2O3 coated tool, which produced considerably higher surface roughness. The reason for this however was the geometry of the chip breaker, rather than the coating materials, which produced longer chips that came in contact with the work piece during the machining process. The TiC/Al2O3/TiN coated tool produced the lowest surface roughness of all the tools tested.

Vedat.Savas[15]presented performance assessment of rotary end milling at the tangential contact. With this shape of the contact, process has been more stable. At the last decade due to the fact that cutting tools have a quenching problem, Turn-milling has been developing in manufacturing technology for processing hard steels, where in both the work piece and the tool are given a rotary movement simultaneously. Thus, cutting edges have a time for quenching. The objective of present work is to investigate process of tangential turn-milling for machining of work pieces with in the normally available range of speed and feeds to explore its advantages. The investigations have been laid mainly on surface roughness and timing process

Mohd Ezuwanizam Bin Masral [16] discussed the Optimization of Tool Life in Milling. The objective of the paper is to obtain an optimal setting of turning process parameters –cutting speed, feed and depth of cut, which may result in optimizing tool life of TiN coated carbide inserts while milling aluminium 6061. Data is collected from FANUC Robodrill CNC milling machines were run by 15 samples of experiments. A dimensional-accuracy model for the end milling of aluminum alloys under dry conditions is presented. To build the quadratic model and minimize the number of experiments for the design parameters, response surface methodology (RSM) with a Box-Behnkin method is used to design the table in MINITAB packages. The inputs of the model consist of feed, cutting speed and depth of cut while the output from the model is tool life and tool wear was measured using Image Analyzer microscope. The model is validated through a comparison of the experimental values with their predicted counterparts. A good agreement is found where from the RSM approaches which reliable to be use in tool wear prediction. The direct and interaction effect of the machining parameter with tool wear were analyzed and plotted, which helped to select process parameter in order to reduce tool wear which ensures quality of milling. It is shown that the tool wear in end milling decreases with the increase in feed, radial depths of cut and cutting. From the experiment it is found that the effect of axial depth of cut on tool life is not so significant. The speed effect is dominant followed by the feed and the axial depth of cut. For end-milling of aluminium alloy 6061, the optimum condition that is required to maximize the coated carbide tool life are as follow: cutting speed of 180m/min, federate of 0.2 mm/rev, axial depth of 1.5.

CoolantT.SenthilKumar,G.Mahadevan, T.R.Vikraman [17] explained that Surface finish is one of the prime requirements of industrial machining. The purpose of this project is focused on the analysis of optimum cutting conditions to get lowest surface roughness in turning. This paper presents an experimental study to investigate the effects of cutting parameters like spindle speed, feed, depth of cut and nano material added type of coolant on surface finish on EN-8 by HSS M2 tool. The objective was to establish correlation between cutting speed, feed rate, depth of cut and type of coolant to optimize the turning conditions based on surface roughness. The study was conducted through RSM method with the help of Design Expert 8.0 software. We have used Servo cut of Indian oil or cool edge SL of Castrol used with water in a ratio of 1:20 as per manufacturer specification. The experiment conducted with 3 different speed, feed and DOC with out nano material ordinary coolant and with one nano material (TiO_2) included coolant for L27 method.

Surasit Rawangwonga, Jaknarin Chatthonga, [18] Worapong Boonchouytana, and Romadorn Burapaa investigated the effect of the main factors of the surface roughness in aluminum semi-solid 2024 face milling. The results of the research could be applied in the manufacture of automotive components and mold industries. This study was conducted by using computer numerical controlled milling machine with 63 millimeter diameters fine type carbide tool with twin cutting edge. The controlled factors were the speed, the feed rate and the depth of cut which the depth of cut was not over 1 mm. For this experiment, we used factorial designs and the result showed that the factors effected of surface roughness was the feed rate and the speed while the depth of cut did not affect with the surface roughness. Furthermore, the surface roughness was likely to reduce when the speed was 3,600 rpm and the feed rates was 1,000 mm/min. The result of the research led to the linear equation measurement value which was Ra = 0.205 - 0.000022 Speed + 0.000031 Feed rate. The equation formula should be used with the speed in the range of 2,400 - 3,600 rpm, feed rate in the range of 1,000 - 1,500 mm/min and the depth of cut not over 1 mm. The equation was used to confirm the research results, it was found that the mean absolute percentage error (MAPE) of the surface roughness obtained from the predictive comparing to the value of the experiment was 3.48%, which was less than the specified error and it was acceptable.

IV Research Methodology

Here materials as well as the tools can be changed and examine the different results that will be obtained on machining them. All materials have different properties. Due to the difference in their properties and way of working, they react differently with all materials. Different materials give different surface finish on machining with different tools.

V Research Methodology Tool

Carbide tool, Hss tool, Mild steel, cast iron, and Aluminum work piece. Experimental work is to be carried out using carbide and HSS milling tools subjected to surface finish of different materials like MS, AL, and CI.

- All the materials will be subjected to each and every type of milling tool.
- Analysis will be carried out on each and every result and the best suitable tool will be found.
- At the end all the result will be compared and the best tool for machining different materials will be found.

VII Conclusion

By studying above research papers we come to the conclusion

- That most of the people have used milling cutters to mill a single work piece by keeping the cutting parameters constant.
- Also they have done analysis by changing any one parameter and keeping the rest of the parameters constant.
- They have also measured surface roughness & wear of tool.
- So from this study we get an idea that we can subject different work pieces to the single tool and by keeping the parameters constant we can record and compare the results.
- We can also record the results by changing different parameters one at a time and record the readings.
- So from the proposed idea one will be able to find out which cutting tool gives best results at which
- Parameters. Also we can find out the tool wear and the accuracy at which the tools are best suited for surface finish of a particular material.

References

[1] High-speed machining of cast iron and alloy steels for die and mold manufacturing P.FallboÈhmer, C.A. RodrõÂguez, T. OÈ zel, T. Altan,Engineering Research Center for Net Shape Manufacturing, The Ohio State University, 339 Baker Systems Building, 1971 Neil Avenue, Columbus, OH 43210-1271 USA

[2] High Performance Milling of Nickel-Base Alloys, Barstad, Terje Juul (Norwegian University of Science and Technology, Faculty of Engineering Science and Technology, Department of Productions and Quality Engineering
[3] Analyze of insert geometries, wear types and insert life in milling- Per Wiklund, Sandvik CoromantAB Ragnar Larsson Chalmers University of Technology
[4] Analysis of the surface roughness of tangential turn-milling for machining with end milling cutter- Vedat Savas ,Cetin Ozay University of Firat, Faculty of Technical Education, Department of Machine Education, 23119 Elazig, Turkey.
[5] Optimization of the tool life in Milling.,Bin Masral University Malaysia Pahang.
[6] Wear characteristics and performance of multi-layer CVD-coated alloyed carbide tool in dry end milling of titanium alloy, M. Nouari, A. Ginting
[7] An experimental investigation of chatter effects on tool life. M Kayhan and E Budak,Faculty of Engineering and Natural Sciences, Sabanci University, Tuzla, Turkey
[8] An Investigation of Optimum Cutting Conditions in Face Milling Nodular Cast Iron FCD 400 Using Carbide Tool International Journal of Materials, Mechanics and Manufacturing,Vol.No.4,November2013,Surasit,Rawangwong,Jaknarin,Chatthong,Julaluk,Rodjananugoon,Romadn Burapa, and Worapong Boonchouytan
[9] Performance of multilayer coated carbide tools when turning cast iron- Recep YIGIT, Fehim FINDIK, Erdal CELIK
[10] Analyses of roughness, forces and wear in turning gray cast iron, S. Thamizhmanii, S. Hasan
[11] An Experimental and Theoretical Investigation for the Machining of Hardened Alloy Steels Tae-Hong Lee ,M.E. Mechanical Design & Production, KonKuk University, South Korea
[12] Machining behaviour of Ti-6Al-4V and Ti-5553 alloys in interrupted cutting with PVD coated cemented carbide -Asier Ugartea, b, Rachid M'Saoubia, Ainhara Garay b, P.J. Arrazolab
[13] Machinability Study of AISI 316 Grade Austenitic Stainless Steel Using P 30 Grade Cemented Carbide Insert - Sanjib kumar Hansda
[14] Performance Assessment of Coated Cemented Carbide Tools in Turning Aisi 1018 steel- Mohamad Nouilati B.S. Louisiana State University
[15] Analysis of the surface roughness of tangential turn-milling for machining with end milling cutter. Vedat Savas, Cetin Ozay University of Fırat, Faculty of Technical Education, Department of Machine Education, 23119 Elaz, Turkey
[16] Optimization of Tool life in Milling - Mohd Ezuwanizam Bin Masral
[17] Evalution of Surface Finish on Machining Of Mild Steel Using High Speed Steel Tool in Lathe with Normal Coolant (Or) Nano Material Added CoolantT.SenthilKumar,G.Mahadevan, T.R.Vikraman ,Head Of Department, Department of Mechanical Engineering, BIT Campus, Anna University, Trichy, Tamilnadu , India.
[18] An Investigation of Optimum Cutting Conditions in Face Milling Aluminum Semi Solid 2024 Using Carbide Tool Surasit Rawangwonga, Jaknarin Chatthonga, Worapong Boonchouytana, Department of Industrial Engineering, Faculty of Engineering, Rajamangala University of Technology Srivijaya, Muang, Songkhla 90000, Thailand and Romadorn Burapaa
[19] Effect of tool cutter immersion on Al-Si bi-metallic materials in High-Speed-Milling- J.H. Sokołowski a, D. Szablewski W. Kasprzak E.G. Ng, M. Dumitrescu Mechanical, Automotive, Materials Engineering, University of Windsor, Canada.
[20] Freeform surface region optimization for 3-axis and 5-axis milling -Gershon Elber Department of Computer Science, Technion, Israel Institute of Technology, Haifa 32000, Israel
[21] Wear characteristics and performance of multi-layer CVD-coated alloyed carbide tool in dry end milling of titanium alloy-M. Nouari A. Ginting ,Department of Mechanical Engineering, Faculty of Engineering, University of Sumatera Utara Jalan Almamater, 20155 Medan, North Sumatera, Indonesia
[22] Analysis of the surface roughness of tangential turn-milling for machining with end milling cutter -Vedat Savas, Cetin Ozay University of Firat, Faculty of Technical Education, Department of Machine Education, 23119 Elaz, Turkey
[23] optimization of variable helix end milling tools -Ahmad Razlan Yusoff
[24] Performance evaluation of uncoated and coated carbide tools when end milling of titanium alloy using response surface methodology-Amrifan Aaladin Mohruni, University Technology Malaysia
[25] Deformations of selected milling cutters while milling ti6al4v alloy on a cnc machine tool, experimental tests and fem modeling-Andrzej Kawalec, Marek Magdziak, Department of Manufacturing Techniques and Automation, Rzeszów University of Technology,Poland
[26] Effect of tool cutter immersion on Al-Si bi-metallic materials in High-Speed-Milling- J.H. Sokołowski a, D. Szablewski W. Kasprzak E.G. Ng, M. Dumitrescu Mechanical, Automotive, Materials Engineering, University of Windsor, Canada.
[27] Investigations of Machining Parameters on Surface Roughness in CNC Milling using Taguchi Technique-Mandeep Chahal Assistant Professor, Department of Mechanical Engineering,H.C.T.M Kaithal, Haryana.
[28] Investigating Effect of Machining Parameters of CNC Milling on Surface Finish by Taguchi Method- Amit Joshi & Pradeep Kothiyal Mechanical Engg. Deptt., G.B.Pant Engineering College, Pauri Garhwal, India
[29] Rotating Tools,Sweden: Elanders ,AB Sandvik Coromant (2010), C-2900:10 ENG/01
[30] AB Sandvik Coromant (2007) Design of experiments, Principles and Applications,Umea Umetrics AB L. Eriksson, E. Johansson (2008):
[31] Sandvik Coromant (1994) Modern Metal Cutting,Kullavik: Tofters Tryckeri.
[33] Arumugam, P. U., Malshe, A. P., and Batzer, S. A., Bhat, D. G., 2002. Study of airborne dust emission and process performance during dry machining of aluminum-silicon alloy with PCD and CVD diamond coated tools NAMRC, ID. Society of Manufacturing Engineers. MR02 153, pp 1-8, May 21-24 2002 West Lafayette
[34] Demir H, Gündüz S. (2008). The effects of aging on machinability of 6061 aluminium alloy,Journal of Material and Design, doi:10.1016/j.matdes.2008.08.007
[35] Konig, W, Erinski D., 1983, Machining and Machinability of Aluminium Cast Alloys, Annals*of the ClRP*, Vol 32, N 2 Khettabi, R., Songmene, V and
[36] H.A. Kishawy, M. Dumitrescu, E.G. Ng, M.A. Elbestawi, Effect of coolant strategy on tool performance, chip morphology, and surface quality during high-speed machining of A356 aluminum alloy, International Journal of Machine Tools & Manufacture, v. 45, 2005, p. 219-227.
[37] Orrego, D.A.F.,Jimenez, L.B.V., Atehortua, J.D.E.,Ochoa, D.A.F., Effect of the variation of cutting parameters in surface integrity in turning processing of an AISI 304 austenitic stainless steel; 24-26 November 2010; Capacabana, Rio de Janeiro, Brazil
[38] Tekiner ,Z.,Yesilyur,S., Investigation of the cutting parameters depending on process sound during turning of AISI 304 austenitic stainless steel; Material and Design 25 (2004) 507-513
[39] Astakhov, V.P., Effects of the cutting feed, depth of cut, and work piece diameter on the tool wear rate; Springer-Verlag London Limited 2006

[40] Agarwal,S., Chakrabarti,A.K.,Chattopadhyay, A.B., A study of the machining of cast austenitic stainless-steels with carbide tools; Material Processing Technology 52 (1995) 610-620
[41] Rapid Traverse: More Teeth Per Flute
[42] J.Ramsey, "Max Diameter for a Flycutter", PracticalMachinist.com discussion board, retrieved 2011-06-05.

AUTHOR’S PROFILE

Sonal C Yogi *Research Scholar, Department of Mechanical Engineering, Rai University, Ahmedabad (Guj.), India*

Rahul Kumaer Sen,. *Assistant Professor Tatva Institute of Technological Studies, Modasa*

Mayank kumar Madia, *Assistant Professor Tatva Institute of Technological Studies, Modasa*

Pragnesh K Brahmbhatt *Guide & Associate Professor ,Govt .Engineering College Modasa,Department of Mechanical Department*