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COMPARATIVE EXPERIMENTAL WORK FOR DIFFERENT CARBIDE TOOLS TO IMPROVING QUALITY

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Abstract:
Metal cutting is one of the most critical manufacturing processes in the area of material removal. Black defined metal cutting as removing metal chips from a workpiece to obtaining finished products with desired attributes of size, shape, and surface roughness.

The science of metal cutting's imperative objective is practical problems associated with the efficient and precise removal of metal from the workpiece. It had recognized that the reliable quantitative predictions of the various technological performance measures, preferably in the form of equations, are essential to developing optimization strategies for selecting cutting conditions in process planning.

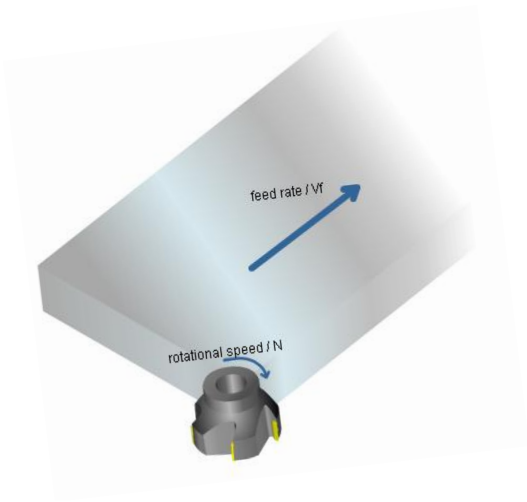
In this thesis, experiments are conducting to improve the surface finish quality of a workpiece using carbide tips. The type is bullnose tip. A series of experiments varied the milling parameters, spindle speed, feed rate, and cut depth.

INTRODUCTION

Milling is machining using rotary cutters to remove material by advancing an edge into a workpiece. Milling may be doing in varying directions on one or several axes, cutter
head, speed, and pressure.

CUTTING AND FEED MOVEMENTS

Milling is a forming operation whereby chips removed using a cutting tool known as a "milling cutter." It has several cutting edges laid out around its axis of rotation and subjected to a feed motion rotational movement.



CUTTING PARAMETERS

The following parameters characterize a milling operation:

a_p: Axial engagement of the tool, also known as the axial pass depth in mm.

A_e: Radial engagement of the tool in mm.

N: Rotational speed in rev min^{-1}.

V_c: Cutting speed in m min^{-1}.

F_z: Feed per tooth in mm $tooth^{-1}$.

V_f: Feed rate in mm min^{-1}.

Q: Material removal rate in cm^3 min^{-1}

INTRODUCTION TO CUTTING TOOLS

Cutting is the separation of a physical object, or a portion of a physical object, into two parts, through the application of an acutely directed force. An implement commonly used for cutting is the knife or, in medical cases, the scalpel. However, any sufficiently sharp object can cut if it has a hardness enough more extensive than the item is missed and applied with sufficient force. Cutting also describes the action of a saw, which removes material in the process of cutting.

Cutting is a compressive and shearing phenomenon and occurs only when the total stress generated by the cutting implement exceeds the ultimate strength of the object's material cutting. The most straightforward applicable equation is stress = force/area: The pressure generated by a cutting implement is directly proportional to the force with which it is applying and inversely proportional to the contact size. Hence, the smaller the area, the less power is needed to cut something.

"Cutting" may also refer to a method used in plant propagation. It involves cutting a part of the plant - typically a healthy shoot - with any sharp and sterile device and then placing the removed part in water, where it grows roots before transplanting into potting soil. Some cuttings do not require water but can grow immediately in vermiculite or potting soil.

CUTTING TOOLS

A **cutting tool** (or **cutter**) is using to remove material from the workpiece utilizing shear deformation. Cutting may be accomplished by single-point or multipoint mechanisms. Single-point devices are operating in turning, shaping, plaining and similar operations and removing material through the cutting edge. Milling and drilling tools are often multipoint tools. Grinding tools are also multipoint tools. Each grain of abrasive functions as a microscopic single-point cutting edge (although of high negative rake angle) and shears a tiny chip.

Cutting tools must be made of a material harder than the fabric, cutting the device to withstand the heat generated in the metal-cutting process. The agency must also have a specific geometry, with clearance angles designed so that the cutting edge can contact the workpiece without the rest of the device dragging on the workpiece surface. The cutting face tip is also essential, as is the flute width, number of flutes or teeth, and margin size. All are optimized to have a long working life, plus the speeds and feeds the tool is running.

TYPES

Linear cutting tools include tool bits (single-point cutting tools) and broaches. Rotary cutting tools include drill bits, countersinks and counterbores, taps and dies, milling cutters, and reamers. Other cutting tools, such as bandsaw blades and fly cutters,

CUTTING TOOL INSERTS

Cutting tools are designing with inserts or replaceable tips (tipped tools). In these, the cutting edge consists of a separate piece of material, either brazed, welded, or clamped on to the tool body. Common materials for tips include tungsten carbide, polycrystalline diamond, and cubic boron nitride. Tools using inserts include milling cutters (end mills, fly cutters), tool bits, and saw blades.

MATERIALS

Generate quality tools. A cutting tool must have three characteristics:

- Hardness,
- Toughness
- , Wear resistance.

Cutting tool materials can be dividing into two main categories: stable and unstable.

Hazardous materials (usual steels) are substances that start at a relatively low hardness point and are then heat-treated to promote hard particles' growth (usual carbides) inside the original matrix, increasing the overall hardness of the material at the expense of some of its actual toughness. Since heat is the mechanism to alter the structure of the substance and at the same time the cutting action produces a lot of heat, such substances are inherently unstable under machining conditions.

Durable materials (usually tungsten carbide) are substances that remain relatively stable under the heat produced by most machining conditions, as they don't attain their hardness through heat. They wear down due to abrasion but generally don't change their properties much during use.

Most stable materials are hard enough to break before flexing, which makes them very fragile. To avoid chipping at the cutting edge, most tools made of such materials are finishing with a sightly blunt edge, which results in higher cutting forces due to a high shear area. Fragility combined with high cutting forces results in most durable materials being unsuitable for use in anything but large, heavy, and stiff machinery.

Hazardous materials, being generally softer and thus tougher, naturally can stand a bit of flexing without breaking, making them much more suitable for unfavorable machining conditions, such as those encountered in hand tools and light machinery.

LITERATURE SURVEY

Modeling of the Influence of Cutting Parameters on the Surface Roughness, Tool Wear and Cutting Force in Face Milling in Off-Line Process Control by Dražen Bajić* – Luka Celent – Sonja Jozić**,** This paper examines the influence of three cutting parameters on surface roughness, tool wear and cutting force components in face milling as part of the off-line process control. The experiments are carrying out to define a model for process planning. Cutting speed, feed per tooth, and depth of cut were taking as influential factors.

Optimization of surface roughness in face turning operation in the machining of en-8 by K. Adarsh Kumar, Ch. Ratnam, BSN Murthy, B.Satish Ben, K. Raghu Ram Mohan Reddy This present paper presents an experimental study to investigate the effects of cutting parameters like spindle speed, feed and depth of cut on the surface finish on EN-8. A multiple regression analysis (RA) using variance analysis is conducting to determine the performance of experimental measurements and to show the effect of cutting parameters on the surface roughness.

Effect of machining conditions on MRR and surface roughness during CNC Turning of different Materials Using TiN Coated Cutting Tools – A Taguchi approach by H. K. Dave, L. S. Patel, H. K. Raval This paper presents an experimental investigation of the machining characteristics of different grades of EN materials in CNC turning process using TiN coated cutting tools. In a machining operation, the quality of surface finish is an essential requirement for many turned workpieces. Thus, the choice of optimized cutting parameters is significant for controlling the required surface quality.

EXPERIMENTAL PROCEDURE

This experiment employed a CNC vertical milling machine. A Carbide cutting tool is using. The experiment has been done under conditions of feed rate 700mm/min, 980mm/min, 1400 mm/min, 1900 mm/min and 2600 mm/min. For EN24, Spindle speeds are2000rpm, 1800rpm, 2100rpm, and depth of cut 0.25mm, And for EN31, spindle speeds are 2100rpm, 2200rpm, 2300rpm, 2400rpm, and 2500rpm.

Three square pieces of EN 24 material and three round pieces of EN8 fabric are taking for machining.

Fig 2: Parameters given for an operation

Fig 3: Experimental procedure with the clamping workpiece

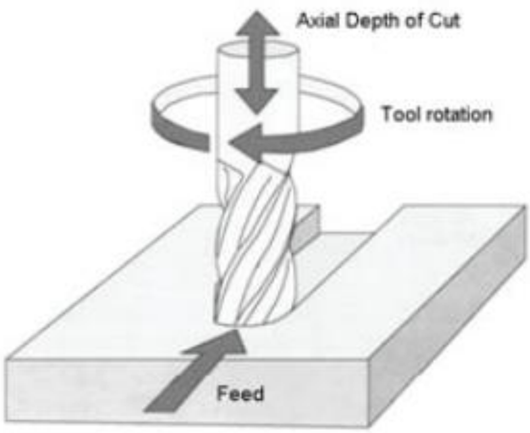


Fig 1: Tool Geometry figure

S.NO.	FEED	RPM	DEPTH OF CUT	Surface finish (R_a) µm
1.	700	2000	0.25	4.76+3.1/2=3.93
2.	980	1800	0.25	4.41+3.1/2=3.755
3.	1400	2100	0.25	1.32+3.86/2=3.25
4.	1900	2000	0.25	1.53+1.71/2=1.62
5.	2600	2000	0.25	1.3+1.56/2=1.96

Fig 4: Resultant values while experimentation

EXPERIMENTAL WORK

EN-24 MATERIAL

SECTION-A

S.NO.	FEED	RPM	DEPTH OF CUT	Surface finish (R_a) µm
1.	700	2000	0.25	4.36+2.78/2=3.57
2.	980	1800	0.25	4.1+2.85/2=3.475
3.	1400	2100	0.25	1.16+3.76/2=2.46
4.	1900	2000	0.25	1.34+1.30/2=1.32
5.	2600	2000	0.25	1.2+1.24/2=1.22

SECTION-B

S.NO.	FEED	RPM	DEPTH OF CUT	Surface finish (R_a) µm
1.	700	2100	0.25	4.23+2.90/2=3.63
2.	980	2200	0.25	4.6+2.97/2=3.785
3.	1400	2300	0.25	1.45+3.92/2=2.685
4.	1900	2400	0.25	2.13+1.72/2=2.785
5.	2600	2500	0.25	1.61+1.4/2=2.31

EN-31 MATERIAL

SECTION-A

SECTION-B

S.NO.	FEED	RPM	DEPTH OF CUT	Surface finish (R_a) µm
1.	700	2100	0.25	4.86+3.31/2=4.085
2.	980	2200	0.25	4.92+3.42/2=4.17
3.	1400	2300	0.25	1.61+3.92/2=2.765
4.	1900	2400	0.25	2.42+2.1/2=2.26
5.	2600	2500	0.25	1.71+1.52/2=1.615

CONCLUSION

In this thesis, experiments

done to improve the surface finish quality of a workpiece using carbide tips. The type of information is bullnose tip. A series of experiments are conducting by varying the milling parameters, spindle speed, feed rate. The experiments are operating on a vertical milling machine of make Chenho. The workpiece materials are alloy steel EN24 and EN31.

Two sets of each workpiece material are machining by specifying the following parameters:

Feed rates of 700mm/min, 980mm/min, 1400mm/min, 1900mm/min and

2600mm/min, Spindle speeds of 2000rpm, 1800rpm, 2100rpm, and 2000rpm. Observing the experimental results for EN24 material machining at 2600mm/min feed rate and a spindle speed of 2000rpm yields better results as the surface finish is good.

For material EN31, machining at 1900mm/min and 2000rpm yields better results as the surface finish are good.

REFERENCES

1. *Modeling of the Influence of Cutting Parameters on the Surface Roughness, Tool Wear and Cutting Force in Face Milling in Off-Line Process Control by Bajić, D, – Celent, L. – Jozić, S. Dražen Bajić* – Luka Celent – Sonja Jozić, Journal of Mechanical Engineering 58(2012)11, 673-682*
2. *Optimization of surface roughness in face turning operation in the machining of EN-8 by K. Adarsh Kumar, Ch. Ratnam, BSN Murthy, B.Satish Ben, K. Raghu Ram Mohan Reddy, International journal of engineering science & advanced technology Volume-2, Issue-4, 807 – 812*
3. *Effect of machining conditions on MRR and surface roughness during CNC Turning of different Materials Using TiN Coated Cutting Tools – A Taguchi approach by H. K. Dave, L. S. Patel, H. K. Raval, International Journal of Industrial Engineering Computations*
4. *Optimization of surface roughness in CNC ends milling using response surface methodology and genetic algorithm by B. Sidda Reddy, J. Suresh Kumar, and K. Vijaya Kumar Reddy, International Journal Engineering, Science and Technology.*
5. *Prediction of surface roughness in end milling with gene expression programming by Yang Yang, Xinyu Li, Ping Jiang, Liping Zhang, Proceedings of the 41st International Conference on Computers & Industrial Engineering*
6. *Furness, R.J., Ulsoy, A.G., Wu, C.L. (1996). Feed, speed, and torque controllers for drilling. ASME Journal for Manufacturing Scientists and Engineers, vol. 118, p. 2–9.*
7. *Landers, R.G., Usloy, A.G., Furness, R.J. (2002). Process monitoring and control of machining operations. Mechanical Systems Design Handbook. CRC Press LLC, p. 85-119.*
8. *Lu, C. (2008). Study on prediction of surface quality in the machining process. Journal of Materials Processing Technology, vol. 205, no. 1-3, p. 439-450*
9. *Bajić, D., Belaić, A. (2006). Mathematical modeling of surface roughness in the milling process. Proceedings of the 1st International Scientific Conference on Production Engineering (ISC), p. 109-115.*
10. *Oktem, H., Erzurumlu, T., Kurtaran, H. (2005). Application of response surface methodology in the optimization of cutting conditions for surface roughness. Journal of Materials Processing Technology, vol. 170, p. 11-16*