INFLUENCE OF DRILL GEOMETRY ON BURR FORMATION CHARACTERIZATION

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Thesis submitted accordance with the requirements of the National Technical University College of Malaysia for the Degree of Bachelor of Engineering Manufacturing (Honours) (Manufacturing Design)

By

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

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. The members of the supervisory committee are as follows:

…………………………………………

Mr.Sivarao

Supervisor

Faculty of Manufacturing Engineering

DECLARATION

I hereby, declare this thesis entitled "Influence of Drill Geometry on Burr Formation Characterization" is the results of my own research except as cited in the reference.

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ABSTRACT

This report describe about "Influence of Drill Geometry on Burr Formation Characterization". In this study the entrance and exit burr will be investigate by using a different of drill bit with coated TiN and TiAlN. The selection of cutting tool is coated to investigate the burr formation, tool wear and surface roughness. The selected point angles of drill bit are 120º to compare of burr formation characterization, surfaces roughness, and tool wear and the effect of speed and feed rate to the work piece will be discuss. In this study the burr will be measure by using of Horizontal Optical Comparator, the tool wear was measure by Tool Maker Microscope and surface roughness was measure by Portable Surface Roughness SJ-301. The diameter of cap burr formation will be measured at the exit burr. The appropriate material that used in this study is stainless steel 300 series. The burr formation will be investigated on this material. The experiment was run by using CNC Milling Machine. This experiment called hard drilling because coolant not use for this experiment and used high speed and feed rate for drilling operation.

ABSTRAK

Laporan ini membincangkan tentang pengaruh geometri mata gerudi dalam kewujudan burr. Dalam kajian ini burr pada permukaan atas dan bawah akan dikaji dengan menggunakan mata gerudi yang yang berbeza dan disalut dengan TiN dan TiAlN. Pemilihan mata gerudi jenis bersalut adalah untuk mengkaji kewujudan burr, kehausan mata gerudi dan kekasaran permukaan. Sudut mata gerudi yang dipilih ialah 120º untuk membandingkan kewujudan burr, kekasaran permukaan dan kehausan mata gerudi serta membincangkan kesan kelajuan gelendong dan kadar suapan pada bendakerja. Dalam kajian ini kewujudan burr akan diukur dengan menggunakan 'Horizantal Optical Comparator' kehausan mata gerudi akan diukur dengan menggunakan 'Tool Maker Microscope' dan kekasaran permukaan akan diukur dengan menggunakan Portable Surface Roughness SJ-301. dalam kajian ini, bendakerja yang akan digunakan ialah 'Stainless Steel siri 300' dan kewujudan burr akan dikaji pada bendakerja ini. Eksperimen ini dijalankan dengan menggunakan 'CNC Milling Machine'. Eksperimen ini dipanggil menggerudi keras kerana bahan penyejik todak digunakan dan menggunakan kelajuan gelendong dan kadar suapan yang tinggi semasa eksperimen dijalankan.

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DEDICATION

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CHAPTER 1

1.0 INTRODUCTION

1.1 Introduction

In every machining burr are formed as a result at plastic deformation. In drilling operations usually produce burrs on both the entrance and the exit surfaces of the work piece. The entrance burr forms on the entrance surface as material near the drill undergoes plastic flow. The exit burr is a part of the material extending off the exit surface of the work piece. Most burr-related problems in drilling are caused by the exit burr because the exit burr is much larger than the entrance burr. Burrs are a source of dimensional errors, jamming and misalignment when do the assembly process. They may cause short circuits in electrical components and may reduce the fatigue life of components. Furthermore, burrs can be a safety hazard to personnel because they are usually sharp. The existence of burrs on a work piece is source of the dimensional errors. The burr may reduce the fatigue life of the parts since the hardened and brittle burr material can act as a crack initiation point. Debris of the burrs can cause serious damage on the moving parts. This is why we try to avoid the formation of a drilling burr or at least to minimize it, or sometimes, to control the type of the burr.

The formation of the drilling burr depends on many parameters such as characteristics of work pieces (material properties, geometries, surface roughness), drills (material

properties, geometries, tool wear, temperature, chip formations), and process parameters (cutting speed, feed rate, usage of coolant, rigidity of machine, temperature).
In burr formation there are many type of burr such as crown burr, crown burr with inner cap fragment attached, petal burr, uniform burr, uniform burr with a drill cap, uniform burr without cap and transient burr. All these type of burr depend on cutting parameter, speed and feed, and material. A uniform burr that has a relatively uniform burr height and thickness along the hole periphery, and triangular cross-section, is the most common type of drilling burr.

The influence of drill geometry is a one thing to make a burr perform in drilling process. So, in this study the selection of drill bit must be exactly for minimize the burr formation. The selection of point angle is important thing to minimize burr formation, so in this study the point angle of drill bit was selected is 120º to investigate the burr formation on drilling. And lastly the entrance and exit burr was measure by using Horizontal Optical Comparator. The burr will measure at diameter of cap burr formation on drilling.

1.2 Drilling Machine

One of the most important and essential tools in any metalworking shop is the drilling machine or drill press. Although the drilling machine is used primarily for drilling holes, it is often used for reaming, boring, tapping, counterboring, countersinking, and spotfacing. All drilling machines operate on the same basic principle. The spindle turns the cutting tool, which is advanced either by hand or automatically into a workpiece that is mounted on the table or held in a drill press vise. Successful operation of any drilling machine requires a good knowledge of the machine, proper set-up of the work, correct speed and feed, and proper use of cutting fluids applied to the cutting tool and work. Many types and sizes of drilling machines are used in manufacturing. They range in size from a simple bench mounted sensitive drill press to the large multiple-spindle machines able to drive many drills at the same time. Figure 1 shows a schematic diagram of a standard vertical drill press as well as a schematic diagram of a turret-drilling machine. Described below are these and other types of drill presses such as sensitive and radial drills. Drilling is the process most commonly associated with producing machined holes. Although many other processes contribute to the production of holes, including boring, reaming, broaching, and internal grinding, and drilling accounts for the majority of holes produced in the machine shop. This is because drilling is a simple, quick, and economical method of hole production. The other methods are used principally for more accurate, smoother, larger holes. They are often used after a drill has already made the pilot hole.

Drilling is one of the most complex machining processes. The chief characteristic that distinguishes it from other machining operations is the combined cutting and extrusion of metal at the chisel edge in the center of the drill. The high thrust force caused by the feeding motion first extrudes metal under the chisel edge. Then it tends to shear under the action of a negative rake angle tool.

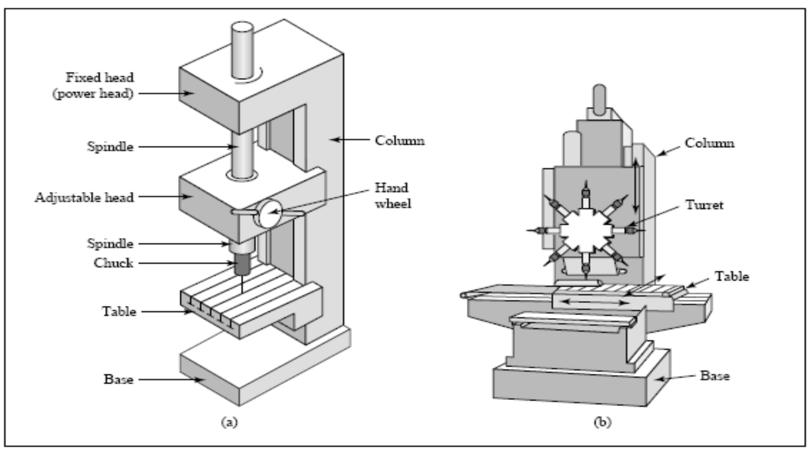

Figure 1-1: Schematic illustration of (a) vertical drill press, (b) CNC turret drilling machine.

1.2.1 Drill bit

A drill is an end-cutting tool for producing holes. It has one or more cutting edges, and flutes to allow fluids to enter and chips to be ejected. The drill is composed of a shank, body, and point.

Table 1-1: Part at drill bit

Shank	The shank is the part of the drill that is held and driven. It may be straight or tapered. Smaller diameter drills normally have straight shanks. Larger drills have shanks ground with a taper and a tang to insure accurate alignment and positive drive.
Body	The body of the drill extends from the shank to the point, and contains the flutes. During sharpening, it is the body of the drill that is partially ground away.
Point	The point is the cutting end of the drill.
Flutes	Flutes are grooves that are cut or formed in the body of the drill to allow fluids to reach the point and chips to reach the workpiece surface. Although straight flutes are used in some cases, they are normally helical.
Margin	The margin is a short portion of the land not cut away for clearance. It preserves the full drill diameter.
Chisel Edge.	The edge ground on the tool point along the web is called the chisel edge. It connects the cutting lips
Lips	The lips are the primary cutting edges of the drill. They extend from the chisel point to the periphery of the drill.
Axis	The axis of the drill is the centerline of the tool. It runs through the web and is perpendicular to the diameter.
Length	Along with its outside diameter, the axial length of a drill is listed when the drill size is given. In addition, shank length, flute length, and neck length are often used.
Body Diameter Clearance	The height of the step from the margin to the land is called the body diameter clearance.
Helix Angle.	The angle that the leading edge of the land makes with the drill axis is called the helix angle. Drills with various helix angles are available for different operational requirements
Point Angle	The included angle between the drill lips is called the point angle. It is varied for different workpiece materials.
Lip Relief Angle	Corresponding to the usual relief angles found on other tools is the lip relief angle. It is measured at the periphery.
Chisel Edge Angle	The chisel edge angle is the angle between the lip and the chisel edge, as seen from the end of the drill. It is apparent from these partial lists of terms that many different drill geometries are possible.