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Comparison and Analysis of Single Point Cutting Tool Under Different Rack Angles

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ABSTRACT

In this study, we investigated experimentally how the main cutting force during a turning process is influenced by the tool rake angle, depth of cut, work piece material type, and cutting tool material. When using HSS & Carbide cutting tools on Mild Steel work materials, cutting forces drop with increasing rake angle (0,4,8,12,16) and rise with increasing depth cut (0.2 to 5 mm). With an HSS cutting tool, mild steel material was turned up to a cut depth of 4 mm, and with a carbide cutting material, it was turned up to a cut depth of 5 mm.aluminium sample For minor values of cutting depth (0.2, 0.4, and 0.8 mm), the main cutting force was enhanced by raising the tool rake angle; however, for 1.5 to 5 mm cutting depth, the main cutting force was standardised and found to be essentially unchanged with HSS tool and Carbide tool. HSS and carbide cutting tools can both make cuts in aluminium that are 5 mm deep. In comparison to HSS tools, carbide tools have a higher cutting force value for the same depth of cut.

Keywords- Single point cutting tool**,** Rack Angle, Depth of cut, Cutting force.

INTRODUCTION

In order to provide the necessary surface, the work piece is often spun on the spindle as the tool is fed into it radially, axially, or concurrently in both directions. Turning, in its broadest sense, is the process of creating any cylindrical surface with a single-point cutting tool. More particular, it is frequently used only to create external cylindrical surfaces that are primarily parallel to the axis of the work piece. Facing is the process of creating surfaces that are predominantly perpendicular to the axis of the work piece.A single-point tool is a cutting tool with just one shank and one cutting element. Machine tools like lathes, turret lathes, planers, shapers, boring mills, and others regularly use them. In terms of tool geometry, the salient faces and edges of the tools are those that are present at the cutting point. The geometry and composition of the tools have a significant impact on the performance of the cutting tools in
achieving effectiveness, efficiency, and overall economy of machining.

PROBLEM STATEMENT

In order to comprehend the cutting mechanism for any particular material, machinability is a crucial criterion. It has to do with the forces created by the cutting during the machining process. As a result, it is a research topic to understand how various parameters, such as cutting speed, feed rate, cutting depth, tool angles, nose radius, tool material, and work piece material, relate to cutting force.

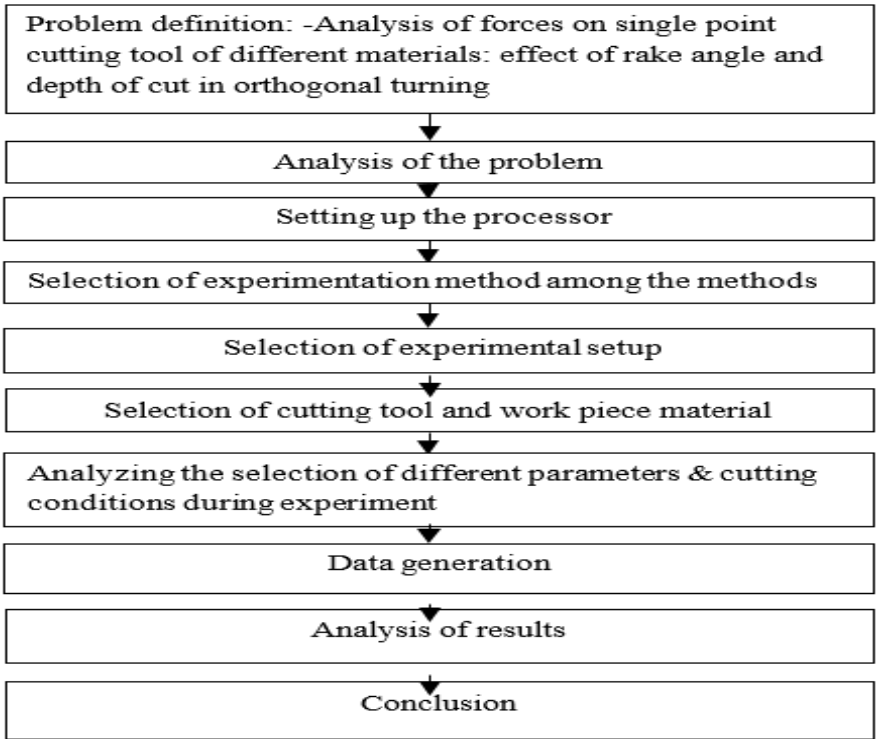
OBJECTIVES OF THE RESEARCH WORK

A characteristic called rake angle is employed in a number of cutting and machining operations. It describes the cutting face's angle in relation to the task. On cutting forces, the impact of different cut depths, work, and tool materials is also researched.
The following are the goals of the current work:

- To analyse the cutting forces for cuts with various depths and a fixed rake angle while cutting at a fixed speed.
- Analysis of cutting forces for various work materials.
- To examine cutting forces for various tool materials.

METHODOLOGY

This study will experimentally evaluate cutting forces in relation to rake angle and depth of cut in an orthogonal turning process. Three cylinders will be turned using HSS (Miranda) and carbide tools at varied rake angles. The materials for the cylinders include EN 31, MS, and aluminium (0, 4, 8, 12, 16 degree). Nine various depth cuts (0.2, 0.5, 0.8, 1.2, 1.5, 2, 3, 4,5 mm) will be tested for each rake angle while keeping the cutting speed constant (550 rpm). During the experiment, dynamometers will be used to measure the forces.



RESULT AND ANALYSIS

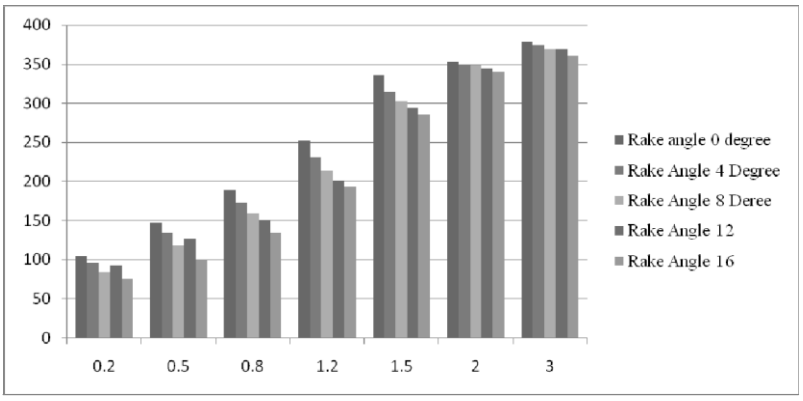


Figure5.1 Cutting force on EN 31 at various Rake angles.

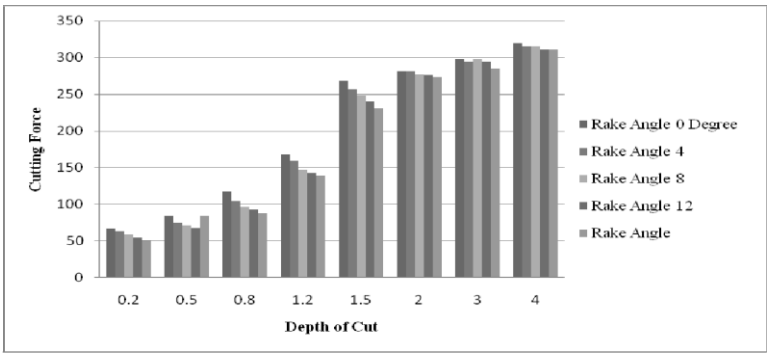


Figure5.2 Cutting force on MS at various Rake angles.

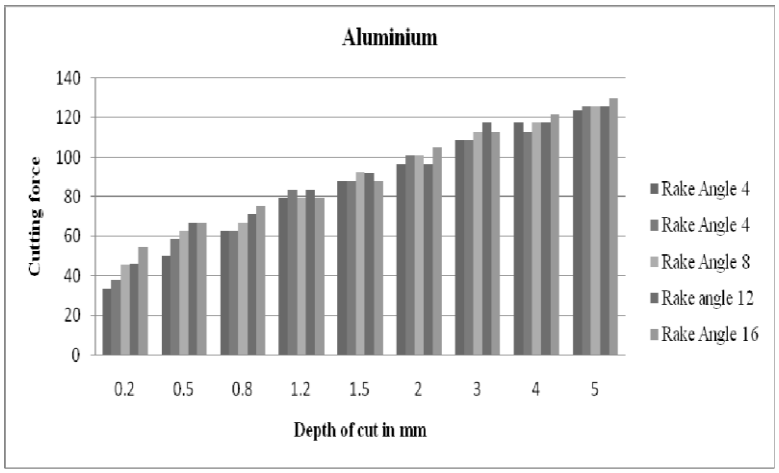


Figure5.3Cutting force on AL at various Rake angles.

Cutting pressures on EN 31, MS drop as rake angle increases, but rise for shallow cuts on aluminium and stay the same for (1.5 mm to 5 mm). Compared to HSS tools, carbide tools offer a higher cutting force value per unit of cut depth.

CONCLUSION

The research project's conclusions include the following:

For EN 31 and mild steel specimens, there is a decreasing trend in the main cutting force as the tool rakes angle increases from 00 to 160. However, for cutting depths between 1.5 mm and 5 mm, the main cutting force is normalised and essentially held constant with HSS tool and Carbide tool. On the other hand, for small cutting depth values (0.2 and 0.8 mm), the main cutting force increases as the tool rake angle increases. The ease of slicing materials is determined by the rake angle. In practical use, it has been seen that increasing the rake angle decreases tool forces and lengthens tool life.

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