# TOOL WEAR AND SURFACE FINISH INVESTIGATION OF HARD TURNING USING TOOL IMAGING

**A. V. N. L. Sharma[1], K. V. G. Rama Seshu [2], A. Gopichand[3], K. V. Subbaiah[4]**

***avnls277522@gmail.com, karriseshu@gmail.com, allkagopichand@gmail.com***

## Abstract

*Surface roughness and tool wear is one of the most specified customer requirements in a machining process. To predict the surface roughness and tool wear, Genetic Algorithm& Image processing model was designed through MATLAB 7.1 software for the data obtained.*

***Keywords**: Tool wear, Profile projector, GA.*

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## 1. INTRODUCTION

The technology of metal cutting is a permanent evolution and is a field of much interest in terms of computer applications. Cutting tool wear detection is a fundamental aspect in the evolution of production techniques. As the quality of the cutting tool is directly related to the quality of the product, the level of tool wear should be kept under control during machining operations. The recognition of the general conditions of a cutting tool has a major role in the optimization of machining processes, since the accurate prediction of the exact moment for tool change results in many cases in an effective economy: a longer cutting tool life can be achieved, tolerances can be under control and rejection of pieces by deterioration of the tool conditions can be prevented.

In metal cutting, tool wear on the tool–chip and tool–work piece interfaces (i.e. flank wear and crater wear) is strongly influenced by the cutting temperature, contact stresses, and relative sliding velocity at the interface. These process variables depend on tool and work piece materials, tool geometry and coatings, cutting conditions, and use of coolant for the given application.

In this study, profile projector and digital image processing methods are used for measurement of the tool geometry and tool wear.

## 1.1 EXPERIMENTAL PROCEDURE

### Experimental details and specifications

| | |
|---|---|
| Machine tool: | Lathe machine |
| Work material: | EN8 steel |
| Cutting tool: | High speed steel |

## 1.2Process parameters and their levels:

| Level | Speed (v) (rpm) | Feed rate(f) (mm/rev) | Depth of cut(d) (mm) |
|---|---|---|---|
| 1 | 228 | 0.06 | 0.4 |
| 2 | 450 | 0.08 | 0.6 |

## 1.3Available Cutting Parameters & Ranges

| | |
|---|---|
| Speed, V (rpm) | 228, 250, 360, 450, 580, 740 |
| Feed rate, f (mm/rev) | 0.05, 0.06, 0.07, 0.08, 0.1 |
| Depth of cut, d (mm) | 0.4, 0.5, 0.6, 0.7, 0.9, 1 |

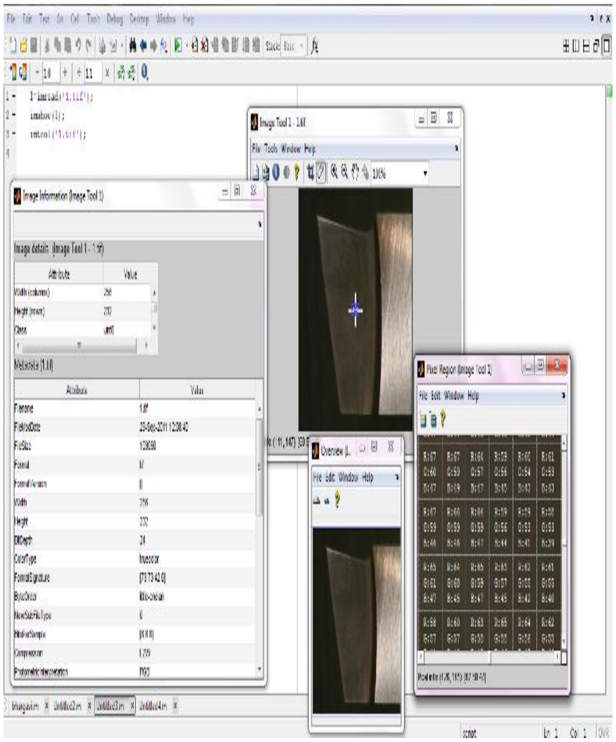
## 2. SPECIFICATION FOR THE WORK PIECE MATERIAL

Size of the material is : Ø34×1500mm

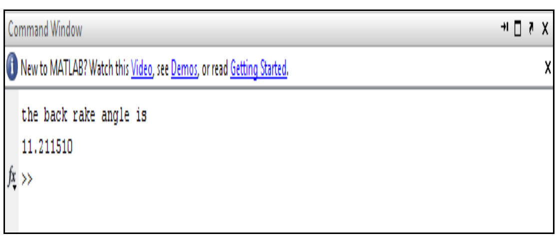
## 2.1 Chemical composition for the EN8 steel:

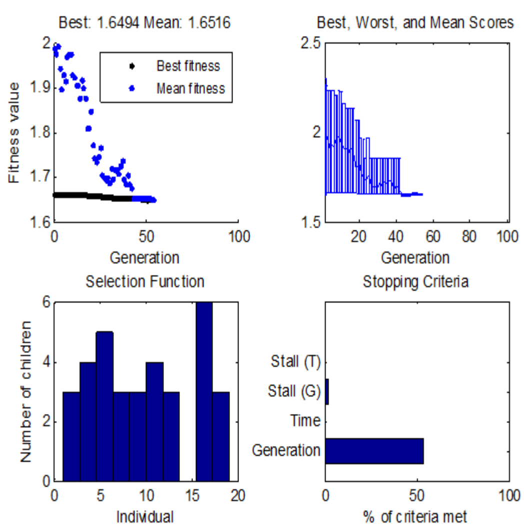
| C. | Si. | Mn. | S. | P. |
|---|---|---|---|---|
| 0.40% | 0.25% | 0.80% | 0.015% | 0.015% |

### 2.2 IMAGE Tool Overview

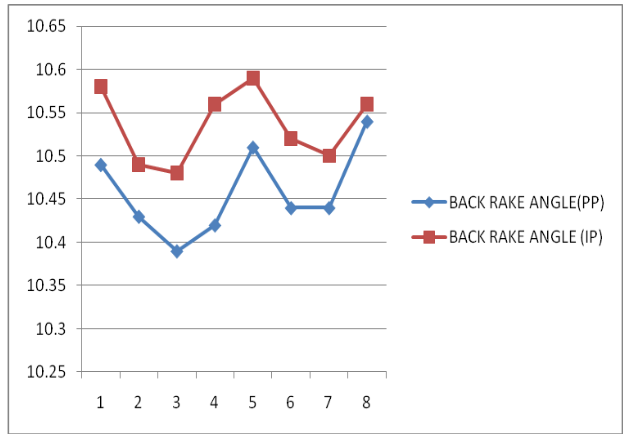


### 2.3 Displaying result

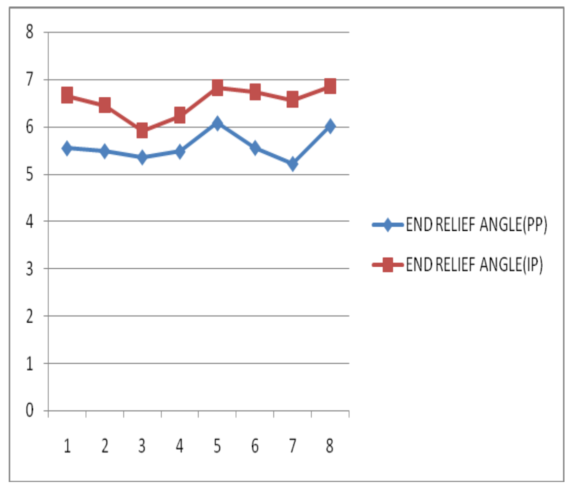


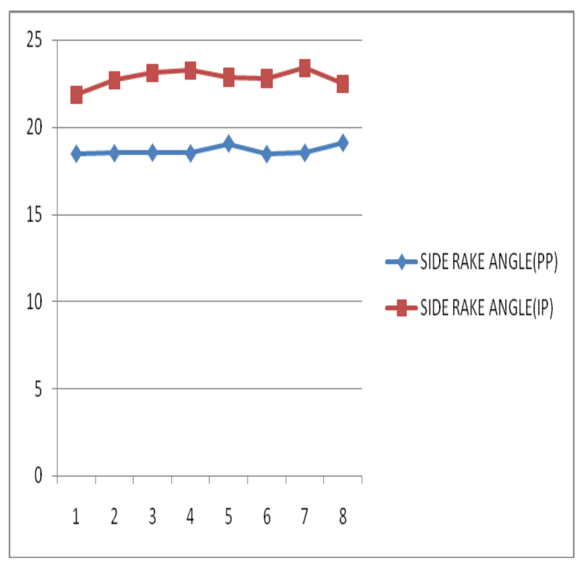

**Different graphs of GA Output function**



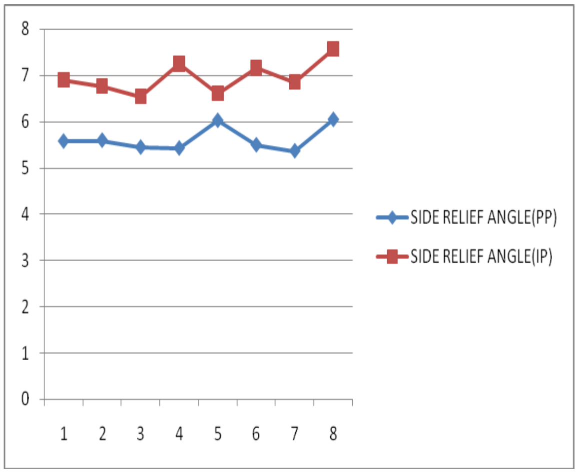

**Graph-a** Comparision of Back rake angle values of HSS tool




**Graph .b**Comparision of End relief angle values of HSS tool

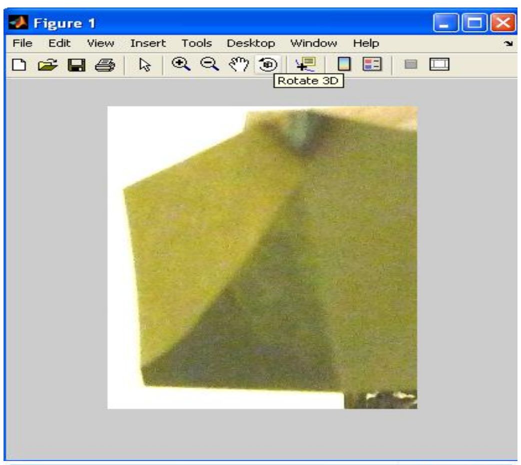


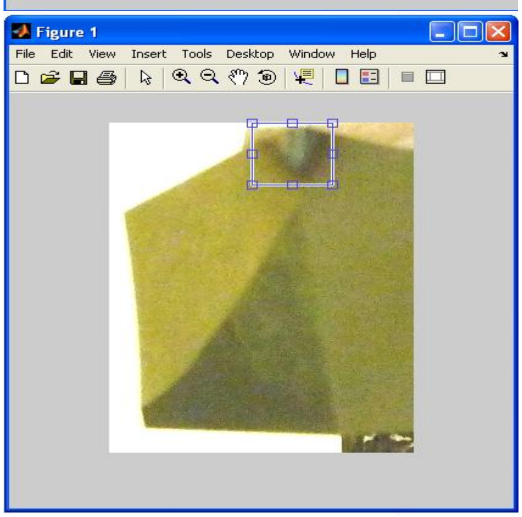

**Graph .C** Ccmparision of Side rake angle values of HSS tool




**Graph -**Comparision of Side relief angle values of HSS tool

### 2.4Finding tool wear area through image analysis



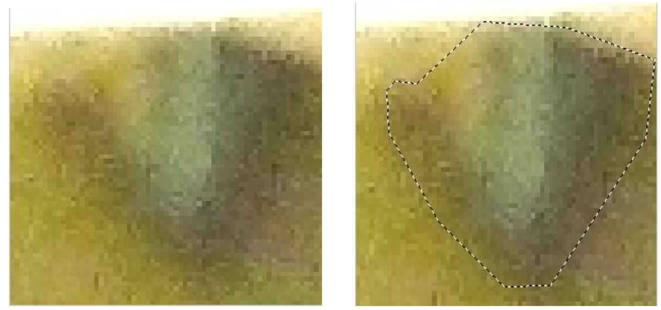
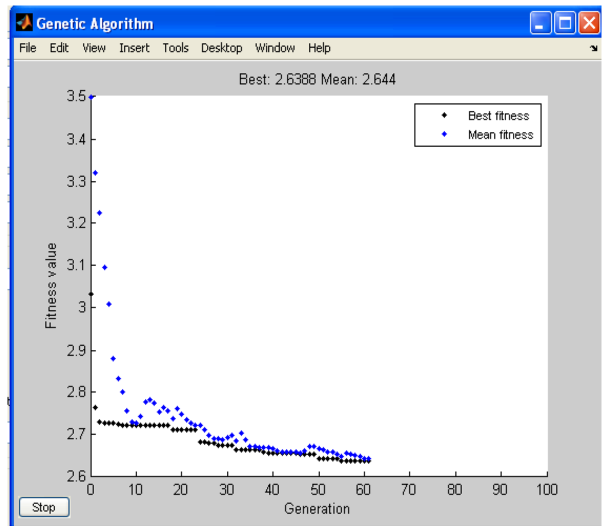



**Figure.a** Images for finding wear area of the first HSS tool




**Fitness value vs. Generation**

## RESULTS & CONCLUSION:

The contact phenomena on the tool flank surface are of interest because understanding them allows the explanation of tool flank wear and the formation of surface integrity of machined surfaces on work pieces. Flank wear of cutting tools is often selected as tool life criterion because it determines the dimensional accuracy of machining, its stability and reliability. An attempt is made to determine the flank wear from image processing method for EN8 material with HSS tool and the following conclusions has been drawn.

- A new technique is implemented in determining flank wear area i.e image processing. The deviation of results between the two methods is explained below:
- At speed= 450 rpm, feed= 0.08mm/rev and depth of cut=0.6 maximum tool wear area is obtained by image processing. The deviation with conventional method is 15.328%.
- At speed= 450 rpm, feed= 0.06mm/rev and depth of cut=0.6 minimum tool wear area is obtained by image processing. The deviation with conventional method is 17.526%.

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