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# Optimization of Speed and Feed Rate for a Low Vibration and Better Surface Finish in Mild Steel on Lathe

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***Abstract***

Machining is a complex process in which many variables can deleterious the desired results. Among them, cutting tool vibration is the most critical phenomenon which influences dimensional precision of the components machined, functional behavior of the machine tools and life of the cutting tool. In a machining operation, the cutting tool vibrations are mainly influenced by cutting parameters like cutting speed, depth of cut and tool feed rate. The cutting tool vibration signals have been collected through a data acquisition system supported by RS-232 software. On mild steel, the collecting data at various parameters like depth of cut, speed, feed rate etc. A number of data have been recorded by varying the above parameters. On the completion of experimental work MATLAB has been used to analyze the result for vibration in metal cutting tool and also to predict the optimum behavior of the system under any cutting condition within the operating range.

**Keywords:** *Vibration*, *RS-232 software*, Vibration measuring systems; Lathes

## Introduction

Vibration is a repetitive, periodic, or oscillatory response of a mechanical system. The rate of the vibration cycles is termed "frequency." Repetitive motions that are somewhat clean and regular, and that occur at relatively low frequencies, are commonly called oscillations, while any repetitive motion, even at high frequencies, with low amplitudes, and having irregular and random behavior falls into the general class of vibration.

With the modern trend of machine tool development, accuracy and reliability are gradually become more prominent feature. To achieve higher accuracy and productivity it is not enough to design the machine tools from static consideration without considering the dynamic instability of the machine tools. If there be any relative vibratory motion present between the cutting tool and the job, it is obvious that the performance of the machine tool not be satisfactory. Moreover machine tool vibration has detrimental effect on the tool life, which in turn, lowers down the productivity and increase cost of production.

**Mild Steel**

Mild steel is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications relatively low tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing

It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7.85 g/cm$^3$ (0.284 lb/in$^3$) and the Young's modulus is 210,000 M Pa. Low carbon steels suffer from yield-point run out where the material has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If low carbon steel is only stressed to some point between the upper and lower yield point then the surface may develop.

Mild steel has a density of .248 pounds per cubic inch. Mild steel is very strong due to the low amount of carbon it contains. In materials science, strength is a complicated term. Mild steel has a high resistance to breakage. Mild steel, as opposed to higher carbon steels, is quite malleable, even when cold. This means it has Low carbon steel contains approximately 0.05–0.15% carbon and mild steel contains 0.16–0.29% carbon, therefore it is neither brittle nor ductile. Mild steel has a range from 150 to 190. For all structural steels, the modulus of elasticity can be taken as 205,000 MPa.

**Experimental Set up**

We measure and analyze the vibrations produced in the machine tool at different cutting speed, depth of cut, feed rate etc. during the cutting operations on the machine tool on three different materials. The different parameters like speed, depth of cut, feed rate give the different results for the vibration in the tool. We measure high tensile and impact strength. Higher carbon steels usually shatter or crack under stress, while mild steel bends or deforms. Both the BHN and VHN for steel the frequency, amplitude of the vibration in the tool. For measurement of the vibration following elements were used

1. Machine tool
2. Vibration meter
3. RS-232 data cable
4. Software
5. Computer
6. Material for Turning on machine

**Figure 3.1: Vibration sensor mounted on tool post**

## 4.0 Results and Discussion

During machining of mild steel following data was recorded with the help of vibration meter

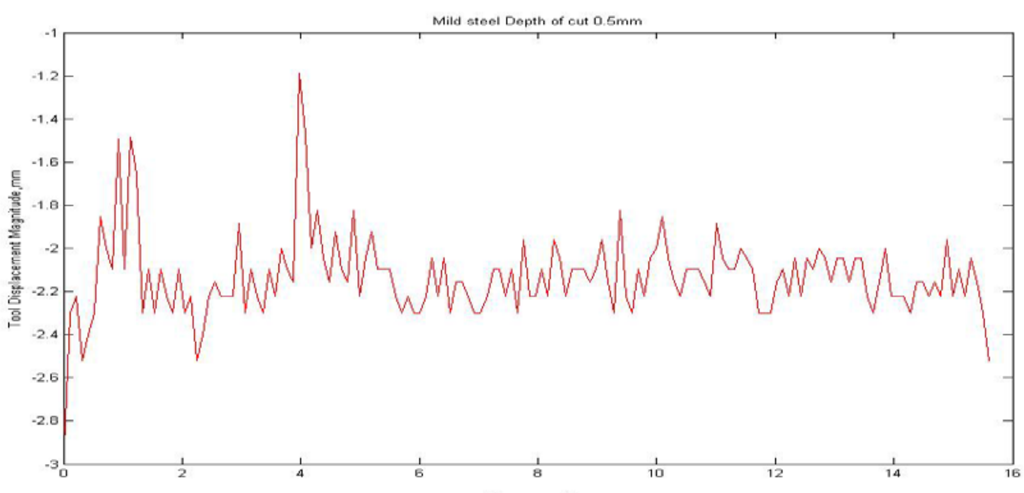


**Figure 4.1: Mild Steel graph of Freq. vs. Magnitude with depth of cut 0.5 mm and speed 750 rpm**

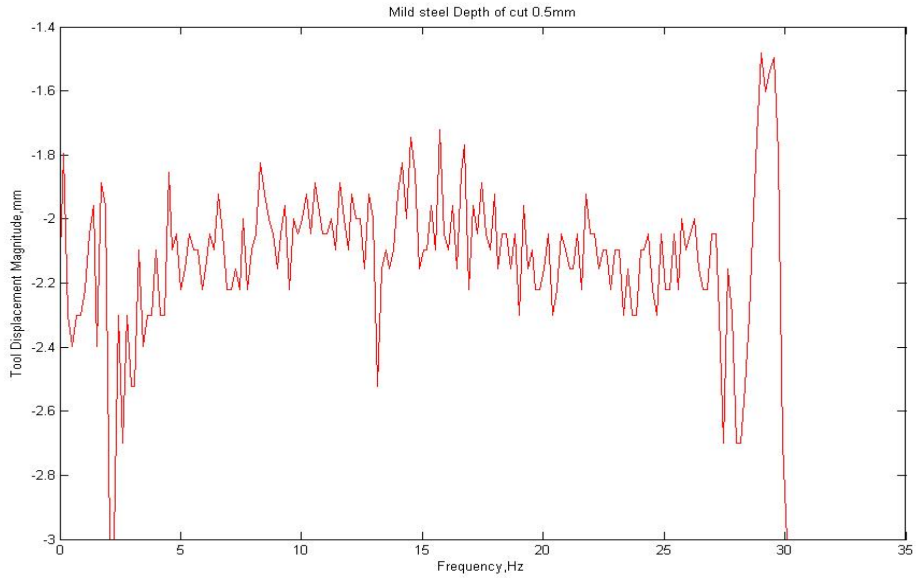


**Figure 4.2: Mild Steel graph of Freq. v/s Magnitude with depth of cut 0.5 mm and speed 1250 rpm**

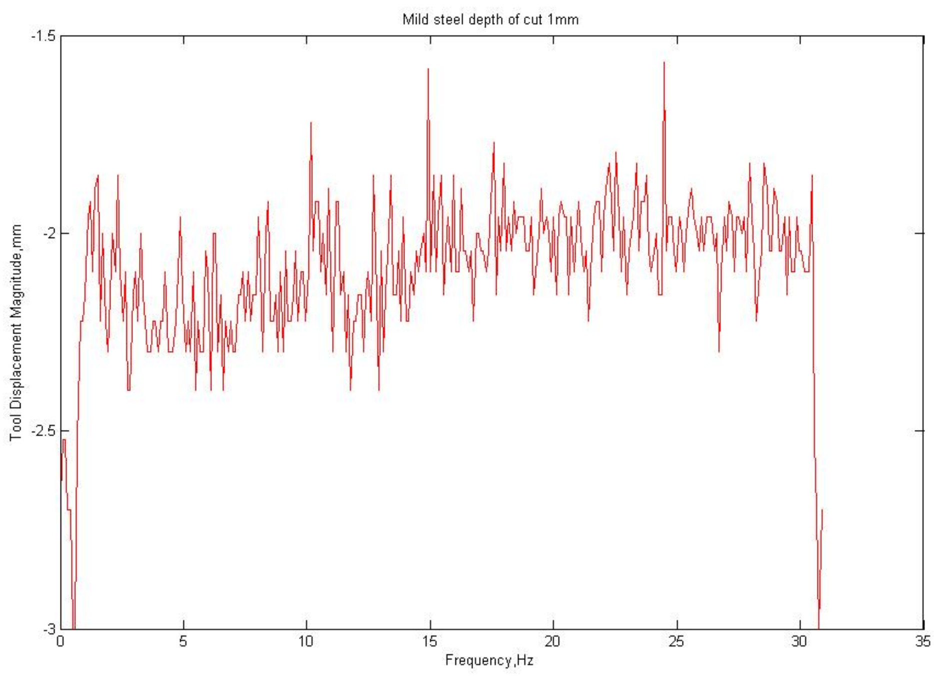


**Figure 4.3: Mild Steel graph of Freq. vs Magnitude with depth of cut 0.5 mm and speed 1250 rpm**

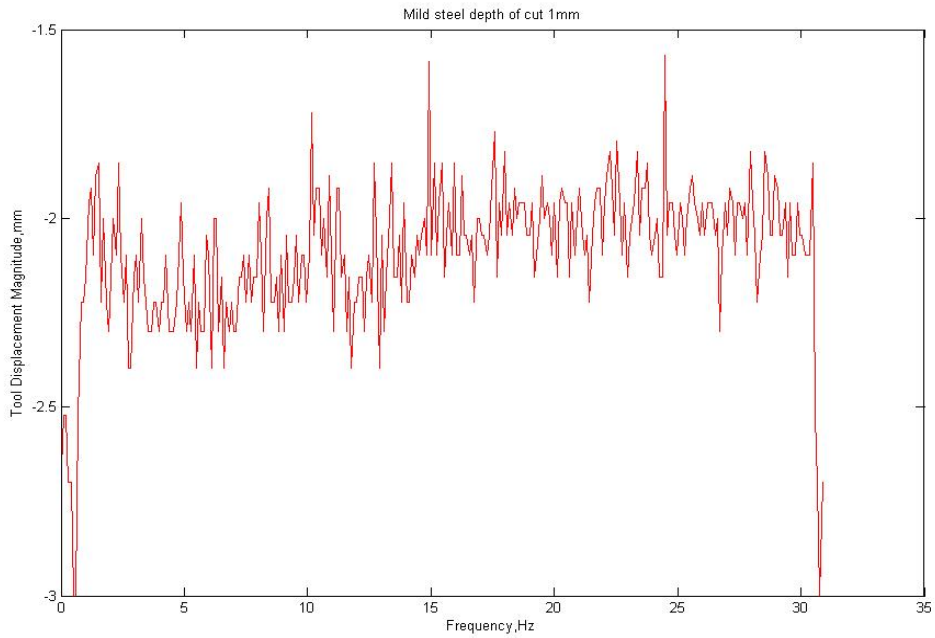


**Figure 4.4: Mild Steel graph of Freq. vs Magnitude with depth of cut 1 mm and speed 750 rpm**

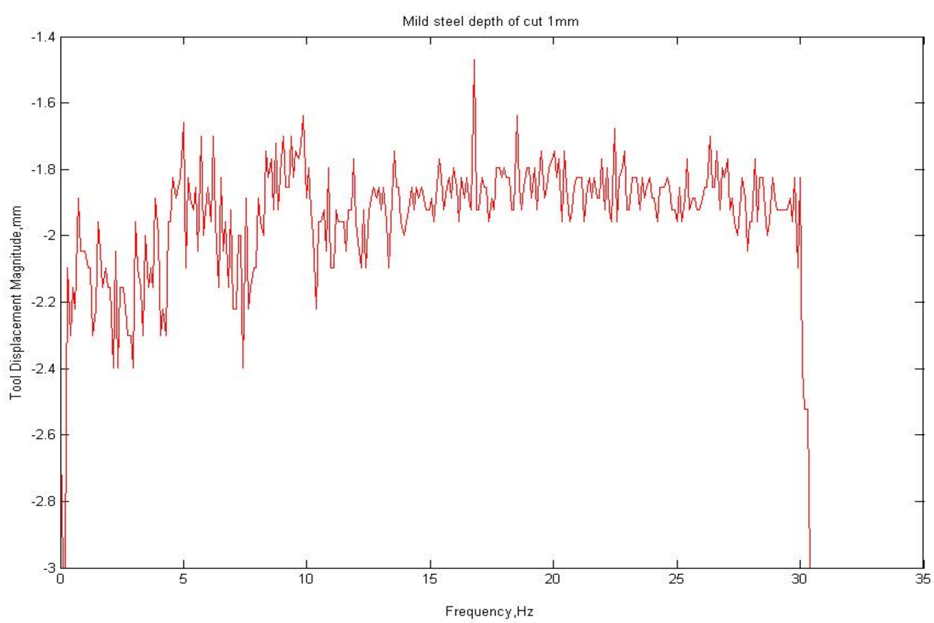


**Figure 4.5: Mild Steel graph of Freq. vs Magnitude with depth of cut 1 mm and speed 1250 rpm**

**Table 1.1: After analysis and calculation following data was obtained**

| Sr. no. | Depth of cut (mm) | Speed (rpm) | Avg. Magnitude (mm) | Max Magnitude (mm) | $Log_{10}$ |
|---|---|---|---|---|---|
| 1 | 0.5 | 250 | .0083 | .065 | -1.187 |
| 2 | 0.5 | 750 | .0071 | .028 | -1.553 |
| 3 | 0.5 | 1250 | .0099 | .022 | -1.657 |
| 4 | 1 | 750 | .0087 | .015 | -1.824 |
| 5 | 1 | 1250 | .0122 | .023 | -1.638 |

## Result

Best method for machining mild steel

- Depth of cut: - 1mm
- Speed:-750 rpm
- Feed:-125 mm/min.

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