Analysis Of Boring Bar With Magneto Rheological Damper

Vignesh M[1], Surendran R[2], Vivek Masthiraj N [3]
[1]PG Scholar, Department of Engineering Design, Government college of Technology, Coimbatore, India.
[2]Assistant Professor, Department of Mechanical Engineering, Government college of Technology, Coimbatore, India.
[3] Research Scholar, Department of Mechanical Engineering, Government college of Technology, Coimbatore, India.

Abstract- *Tool vibration is a frequent problem in the manufacturing industry, where metal cutting operation take place. It affects the surface finish of the work piece, tool life and produce noise. In order to restrain tool vibration in metal cutting, it is necessary to develop and analyses suitable methods which increases stability and improve the cutting performance. The main purpose of this work is to find out the vibration, displacement of tool during hard boring, in different direction by computational method. The present investigation aims at analyzing a boring bar along with magnet-rheological (MR) damper during hard boring operation. MR Damper has received great attention due to their ability to reversibly change from free flowing, linear viscous liquid to a semi solid in milliseconds when exposed to a magnetic field .In this project boring tool was analyzed using ANSYS software with the effect of vertical and holding damping force and without damper are carried out. The vibration can also be suppressed using magnet-rheological damper during hard boring operation. Then the amount of vibration and displacement is found out. Thus all the different condition are compared and the condition that gives less tool vibration, less tool displacement is considered.*

Keywords- magneto rheological damper, boring, tool deformation

I. INTRODUCTION

Vibration concerns the repetitive motion of an object or objects relative to a stationary frame referred to as the equilibrium of the vibration. Vibrations may be measured in terms of displacement, velocity or acceleration. Vibrations exist everywhere and may have a great impact on the surrounding environment. One general phenomenon of vibration is the ”self-oscillation” or resonance, meaning that a system exposed to even a weak force, which excites a resonance, may result in a substantial vibration level that eventually results in damage to or failure of the system. Thus, it is of great importance in engineering design to consider the properties of the system from a vibration point of view, referred to as the dynamic properties of the system. Semi–active (SA) suspension systems provide excellent vibration control for many applications in the manufacturing, automotive, aviation, and civil industries without the potentially decreased reliability and added expense of a fully active system. Magneto rheological (MR) dampers are a specific class of semi-active suspension components that use an electric current to generate a magnetic field surrounding the piston of a damper which in turn changes the local viscosity of the magnetic fluid in the shock, altering the damping characteristics. MR Dampers also have the additional benefits of very low power consumption while maintaining the ability to generate large forces, minimal complexity, and the inherent ability to function as a passive damper during a failure mode (complete loss of power).

1.1 HARD BORING

Hard boring is a method of making internal profiles on a hole completed by drilling or other method. It uses single point cutting tool called a boring bar. In boring, the boring bar can be rotated, or the operational part can be rotated. Machine gears which rotate the boring bar against a stationary work piece are called boring machineries. Boring can be skilled on a turning machine with a stationary boring bar placed in the tool post and rotating work piece seized in the lathe chuck as illustrated in the figure.1

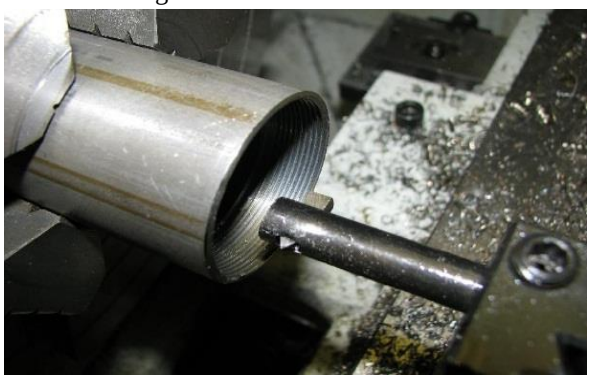

Fig 1 Hard Boring

1.2 CUTTING CONDITIONS IN BORING

Since is an operation quite similar to boring, the same type of cutting conditions could be considered

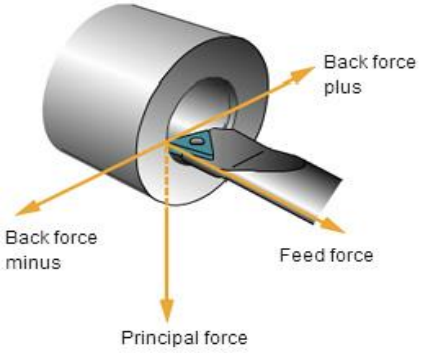

Fig 2 cutting conditions in boring

1.3 CUTTING TOOL

Once boring through a rotating tool, size stands controlled by altering the radial position of the tool slide, which hold the boring bar, with respect to the spindle axis of rotation. For final machining process, the boring bar is furthermore attached in an variable boring head for extra precise control of the bar in a radial position

Fig 3 cutting tool

II. MODELLING

III.

The model of the boring bar is made using SOLIDWORKS 2013.

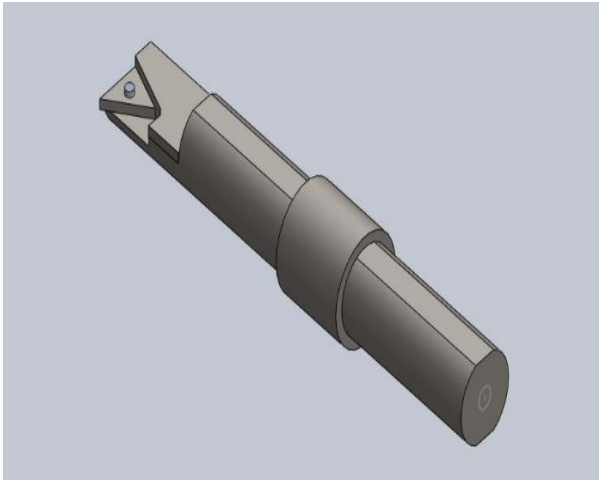

Fig 4 MODELLING OF BORING BAR

IV. STATIC ANALYSIS

3.1 ANALSYS OF BORED TOOL WITH DAMPER IN 150MM HOLDING FORCES

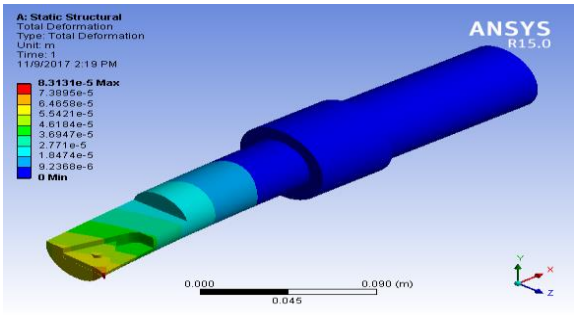

Fig 5 Deformation of tool 150mm

The figure shows the deformation of the holding force applied on the boring bar to length of 150mm.

3.2 ANALSYS OF BORED TOOL WITH DAMPER IN 175MM HOLDING FORCES

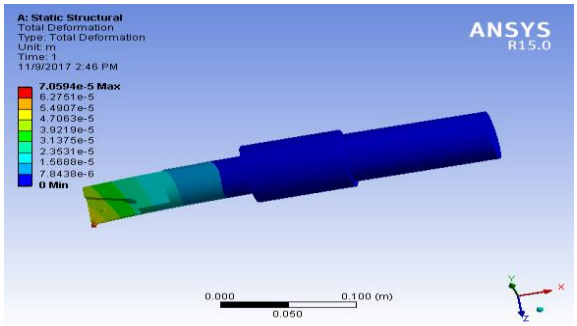

Fig 6 Deformation of tool 175mm

The figure shows the deformation of the holding force applied on the boring bar to length of 175mm.

3.3 ANALSYS OF BORED TOOL WITH DAMPER IN 200MM HOLDING FORCES

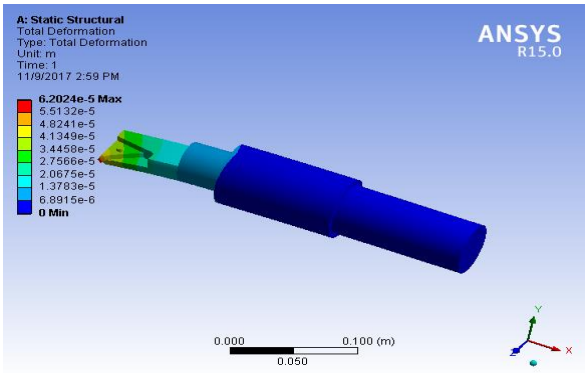

Fig 7 Deformation of tool 200mm

The figure shows the deformation of the holding force applied on the boring bar to length of 200mm.

V. COMPARSION OF RESULT

Table 1 Deformation of boring bar

S. no	location of damper (mm)	Tool vibration for damper movement in vertical direction (m)	Tool vibration for damper movement in holding direction (m)	Tool vibration without damping (m)
1	150	0.19187	8.3131e-5	201.35
2	175	0.18818	7.0594e-5	201.35
3	200	0.18382	6.2024e-5	201.35

The above table 1 shows that deformation of boring bar.

Table 2 Computational Approach in Directions of Force

S.no	Deflection of the holder with MR damper in vertical direction(mm)	Deflection of the holder with MR damper in holding direction(mm)
1	1.9187e5	0.083131

The above table 2 shows that deformation of boring bar in vertical and holding direction in mm.

4.1 COMPARSION OF DEFLECTION IN DIFFERENT FORCE DIRECTION

The vertical and holding force are compared and values are shows in figures

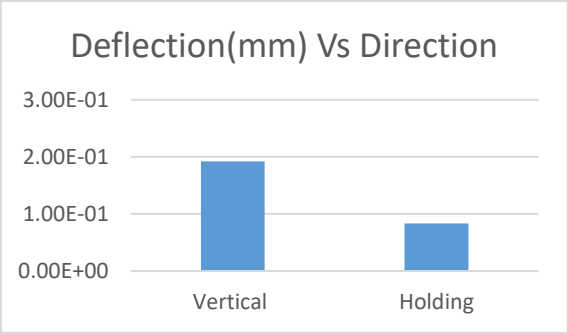

Fig 8 Deflection vs Direction

4.2 COMPARISON OF DEFLECTION BETWEEN WITH (HOLDING DIRECTION) AND WITHOUT DAMPER

The graph drawn between deflection and direction the result shows the reducing the deflection while using holding damping force

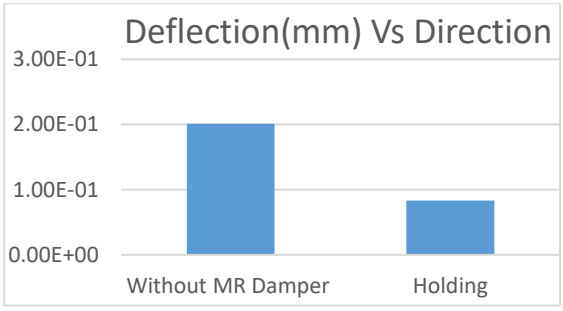

Fig 9 Deflection vs Direction

4.3 COMPARISON OF DEFLECTION BETWEEN WITH (VERTICAL DIRECTION) AND WITHOUT DAMPER

The graph drawn between deflection and direction the result shows the reducing the deflection while using vertical damping force

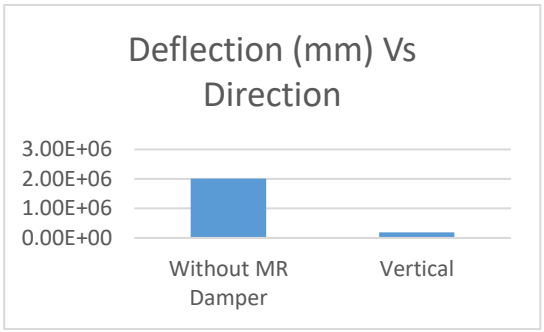

Fig 10 Deflection vs Direction

VI. CONCLUSION

In this paper, ANSYS software was used to study the effect of magneto rheological damper on tool vibration during hard boring. Tool holder with insert and shim was modelled in ANSYS. Damping force obtained for optimum parameter, main cutting force are given as force constraints along with fixed boundary condition. The result obtained from computational method were compared with the different direction (vertical and holding) where MR damper can be applied. From the present study, it was observed that, using magneto rheological fluid damper can suppress tool vibration effectively in holding direction. From the result of first phase make a holder to reduce the vibration level. Experimental test will conduct and its compare with analytical values in forth coming.

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