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## EFFECT ON SURFACE FINISH BY USE OF DAMPERS IN BORING OPERATION

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**Abstract**-Many of the small -scale industries are facing problems of vibration while doing boring operation on lathe. Boring tool is used to enlarge the drilled hole. Vibratory motion between tool and work piece can lead to reduce performance. Vibration in boring operation causes tool damage, improper surface finish and other effects.

During an internal turning operation, the cutting tool and the boring bar are subjected to cutting forces due to the relative motion between the tool and work piece in the cutting speed direction and in the feed direction. Therefore, a variable cutting force during boring operations causes the tool to deflect and leave behind a wavy surface. When the cutting edge encounters this wavy surface in the next revolution, the relative phasing can lead to increased force and deflection through regenerative chatter and creates vibration to reduce these vibrations different dampers used of different material is used to reduce vibrations.

**Keywords:** Boring operation. Vibration, Ra values, dampers used of different materials.

**Introduction**-It is important to limit vibrations of the machine tool structure as their presence results in poor surface finish, cutting-edge damage, and irritating noise. The causes and control of free and forced vibrations are generally well understood and the sources of vibration can be removed or avoided during operation of the machine. Chatter vibrations are less easily controlled, and metal removal rates are frequently limited because the operator must stop the machine to change the cutting conditions, which often means reducing the depth of cut or feed rate. The causes of machine tool chatter are generally well understood, and the vibrations occur because of the basic interaction between the cutting process and the machine tool structure In industry where metal cutting operations such as turning, milling, boring and grinding take place, degrading vibrations are a common problem. In internal turning operations vibration is a pronounced problem, as long and slender boring bars are usually required to perform the internal machining of workpieces. Tool vibration in internal turning frequently has a degrading influence on surface quality, tool life and production efficiency, whilst also resulting in severe environmental issues such as high noise levels. For boring bars that have L/D ratio of  $< 5:1$ , then relatively stable cutting conditions with controllable vibration influences can be tolerated. However, if L/D ratios utilized are larger than this limiting value, then potentially disastrous vibration tendencies could occur, leading to a variety of unwanted machining and workpiece characteristics, these include: • Limited tool life – caused



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by forced and self-excited vibrations, restricting both cutting efficiency and tool life, • Unacceptable machined surface texture – vibrations in the form of work piece surface chatter, can be the cause for component rejection, • Substandard machined roundness – vibration/chatter affects creating high frequency

### Objectives:

The proposed work is to see the feasibility of passive damping technique in boring bar and develop a damper which can minimize the effects of vibration.

- 1.To measure the vibrations occurred during boring operation
2. To Design Damper for boring tool
- 3.Measure the vibrations occurred using boring tool with dampers.
4. Check the Ra values of work pieces in cases 1 and 3.

### Design Parameters:

- 1.L/D ratio of boring tool is the main cause of vibration occurred in boring operation.
- 2.Select the proper L/D ratio as per need for boring operation.
3. To Design passive vibration damper for minimising the effect of boring operation
4. Find out correlation between Ra values for with and without damper for boring operation.



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## Dimensional Analysis

Parameters affecting response of a damped single degree of freedom system under harmonic excitation are selected based on its equation of motion. Equation of motion of a single degree of freedom system under harmonic excitation is given by,

$$x = f(m, k, C, F_0, \omega)$$

$$f_1(x, m, k, C, F_0, \omega)$$

these variables may be completely described by fundamental dimensions of  $M - L - T$  systems. Hence the number of fundamental quantities,  $m = 3$ . Therefore, there are  $(n - m) = 3$  independent dimensionless  $\pi$ -terms, say  $\pi_1, \pi_2, \pi_3$  and  $\pi_4$ .  $f_2(\pi_1, \pi_2, \pi_3) = c_1$  (4.10) In order to form these  $\pi$ -terms, one has to choose 3 repeating variables, since in this case  $m = 3$ . As stated earlier, these variables should be such that they, among them, contain all the three fundamental dimensions and they themselves do not form a dimensionless parameter. Hence  $x(L)$ ,  $m(M)$  and  $k(MT^{-2})$

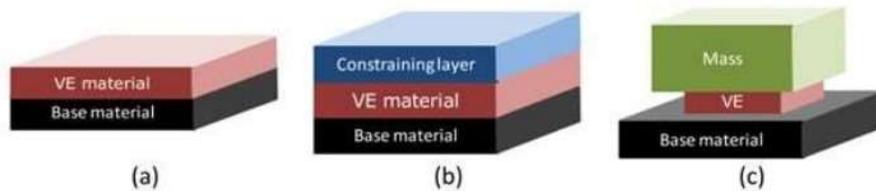
### Materials for dampers

In machining the input energy is difficult to control since it depends on the operational conditions. A reduction of the input energy will affect, in most cases, the productivity of that particular machining operation. High stiffness and damping are both necessary, but not individually sufficient requirements for a machining operation. In recent years it has been observed that the trend in machine tool design is going towards lightweight structures. This means that vibrations are transmitted with higher intensity. However, low mass can help to increase the controllable bandwidth, but, on the other hand, high mass does diminish high-frequency vibration. Increasing stiffness would cause a mode to shift upwards in frequency; however, given the random excitation of machine tool structures due to the dynamic cutting force, this solution would not secure a vibration-free machining. The major restrictions on the implementation of the damping treatment are; i Weight ii The treatment has to be applied without disassembly of the components. The benefits of passive damping for vibration suppression are well established in various fields of mechanical engineering applications. Engineered passive damping for structures is usually based on one of four damping technologies

- i Viscoelastic polymers,
- ii Viscous fluids,
- iii Magnetic and
- iv Passive piezoelectric.



All passive damping treatments work by absorbing significant amounts of strain energy from the vibration modes of interest and dissipating this energy through mechanism. The principle of passive damping is to enhance the damping ability of the tool without actively compensating for the upcoming vibrations. A common way to achieve passive damping is by using viscoelastic materials to dissipate the energy that causes vibration. Viscoelastic polymers provide high energy dissipation. Viscoelastically damped structures have been successfully applied in many engineering fields. Generally employing the VE polymer in three different ways; i as free-layer dampers (FLD), ii as constrained-layer dampers (CLD), iii in tuned viscoelastic dampers (TVD). FLDs are defined as those dampers composed by a single layer of damping material positioned on top of the base material by gluing or other bonding techniques. CLDs consist of a sandwich structure where the damping material is constrained between two layers of elastic material. TVDs consist of a mass residing on a damping layer bonded to the base material. Figure 5.1: (a) Free layer damper, (b) Constrained-layer damper, (c) Tuned Viscoelastic damper

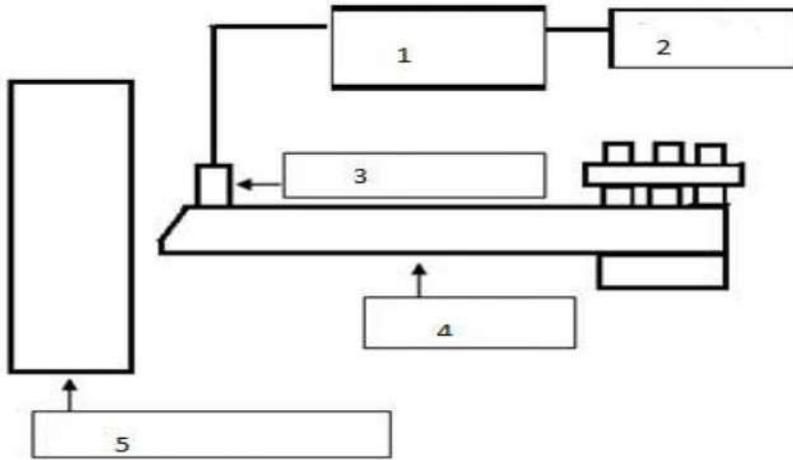
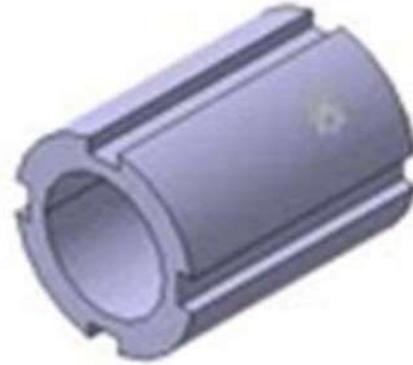
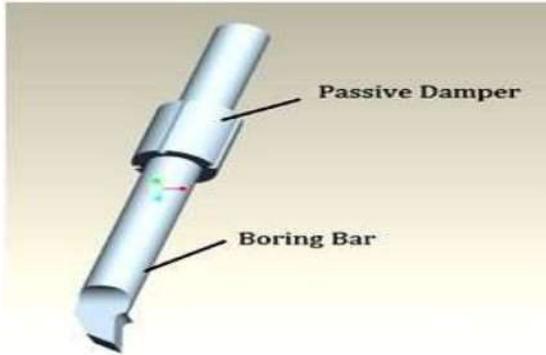


### Design for Customised boring bar(With different material damper)

Length of the damper depends upon the relationship of boring bar overhang; i.e. 30 percent and 60 percent of the boring bar overhang. For experiment purpose the boring bar overhang is taken as 100 mm and 120 mm .I.D=0.016L and O.D=0.038L and slot dimensions-0.004.



∴ Length (l) = 0.03m, 0.036m, 0.06m, and 0.072m



### Experimental Setup

1. FFT Analyser
2. Computer
3. Accelerometer
4. Boring Tool
5. Cylindrical work piece

**Conclusion**-By using passive damping technique can reduce vibration and can visualize effect on surface finish.