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Design And Fabrication Of Grinding Wheel Attachment On Lathe Machine

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ABSTRACT: *Grinding operation is performed to obtain a fine surface finish after performing turning operation on lathe machine for cylindrical jobs. This is done to obtain required dimensions of part to be used in any assembly. Thus to perform these two operations on same machine the attachment is designed. To verify the design the attachment is fabricated. This work describes an attempt to decrease the time in loading and unloading of workpiece with desired surface finish. The report describes the selection of wheel for grinding. It also considers the rigidity of design, damping of vibration due to motor speed and stress analysis of critical part of design, which is analyzed on INVENTOR software and compared with theoretical calculations. It also lists the various operations performed to fabricate the attachment. The results are obtained in form of tolerance limits which are compared with results of individual grinding machine operation on different machine and the conclusion are stated.*

Key words: Grinding, Cylindricity, Rigidity

1. INTRODUCTION

Before the invention of CNC machines, Lathe machine was the most important machine for major operations. Previously, turning operation was carried out on lathe machine and then it was transferred to the grinding machine for surface finish. The grinding operation is done using abrasive wheel, grinder which provides fine surface finish. In this paper we have selected the required grinding wheel depending on workpiece to be used. The main aim of project is to obtain an accuracy of 20microns. Since grinding requires high surface finish thus proper motor speed is selected as required [2]. Grinding is an art and science of metal cutting operation performed by the means or rotating abrasive wheel that act as cutting tools. Basically it is the process or removing material by abrasive action of grinding wheel on the surface finish to the desired dimension.

Today latest techniques have made grinding operation practically possible on any object having complicated shapes various types of grinders are available today for various types of work. Grinding is done on jobs not just to have an aesthetic view but it has a big importance. Surface grinding and cylindrical grinding is extremely important to those parts in automobiles, which are used in I.C. engines and gear box.

Similarly it is equally important to other parts used on precision job work. Grinding is done on surface of almost all conceivable shapes and materials of all kinds. Grinding can be done by means of grinding machines.

Cylindrical grinding attachment for surface grinder is multipurpose attachment used on practically small workshop for the purpose of grinding small jobs which if grinding on large cylindrical grinders may result in heavy expenses and time consumption. The attachment is designed specifically keeping in mind the use of attachment to workshops, dimension of the job and quality of surface finish. Every attempt is made to overcome the faults and make the m/c as precise as possible. Special attention was concentrated on the rigidity of the machine which would result in improper functioning of the attachment if not considered. Beside this the important thing which was kept in mind while designing and the manufacturing the unit was that it should be capable of taking sufficient load and forces which it would face while in operation. The attachment though small in size the appearance is really a unique piece of skill and hard work.

2. LITERATURE REVIEW

Grinding can be defined as the process of removing metal by the application of abrasives. They are bonded to form a rotating wheel. The moving abrasive particles contact the work piece, they act as tiny cutting tools, each particle cutting a tiny chip from the workpiece. In cylindrical grinding, the workpiece rotates about a fixed axis and the surfaces machined are concentric to that axis of rotation. Deverakonda Harish Kumar[1] used regression analysis for achieving the accuracy and to decrease the time loss involved in the traditional grinding process.

Table 2.1 Parameters

Sr No	Units	Parameters	Level(Targets)	
			High	Low
1	m/min	Work Speed(x_1)	15	6
2	mm/rev	Feed(x_2)	0.3	0.1
3	µm	Depth of cut(x_3)	100	50

Table 2.2 Experimental Design Matrix with Surface roughness for Wet and Dry conditions

Run	X_1	X_2	X_3	Wet Ra(□m)	Dry Ra(□m)
1	15	0.3	100	0.2375	0.4375
2	15	0.3	50	0.075	0.0625
3	15	0.1	100	0.5625	0.7625
4	15	0.1	50	0.3325	0.3375
5	6	0.3	100	0.4625	0.4625
6	6	0.3	50	0.3375	0.5375
7	6	0.1	100	0.7375	0.7375
8	6	0.1	50	0.5625	0.7625

Grinding process is a abrasive cutting process where machining occurs with the help of geometrically unspecified cutting edges [2]. Grinding interface involves material removal by contact, between the grinding wheel and a random structured surface of the work piece. Surface quality is the main criterion in surface grinding and is influenced by various parameters like workpiece parameters, wheel parameters and process parameters [3]. Dhavlikar et al.[4]presented the Taguchi and response method to determine the robust condition for minimization of out of roundness error of workpieces for the centerless grinding process. Shaji and Radhakrishnan[3]elaborated the use of simultaneous optimisation of multiple quality characteristics which is the need in case of machining. Taguchi method considers the optimization of a single parameter at a time. Suresh et al.[5]used RSM and genetic algorithm(GA) for predicting the surface roughness and optimizing process parameters while machining mild steel using CNMG tools on a lathe.

3. METHODOLOGY

To obtain our project's aim and obbjective we would be adapting the following methodology:

3.1. Selection of Grinding Wheel

While selecting the grinding whee l we will be checking certain parameters which would be appropriate for our application and won't fail. Th e parameters which we will be considering are:

- Abrasives
- Grit
- Grade
- Structure
- Bond

Wheel selected is A-60PV
Outer Diameter and Inner diameter-150mm and 20mm respectively
Thickness- 12.7mm

Figuree 1 shows Grinding wheel used in the Attachment

3.2. Selection of Motor

Grinding generally requires high rpm for fine surface finish. Depending on diameter of grinding wheel and peripheral speed of work piece, the wheel speed is selected.

AC motor, RPM-2950, Power 1 H.P., Frequency-50Hz, Voltage-415 V, current 1.8 Amps

Figure 2 shows Motor used in the attachment

3.3. Selection of Shaft

Standard shaft diameter and leng th is manufactured using lathe by turning operation .Collar of certain diameter and thickness is provide d to hold wheel firmly and to rotate it and resstrict its motion. The shaft is so designed that it should not vibrate.

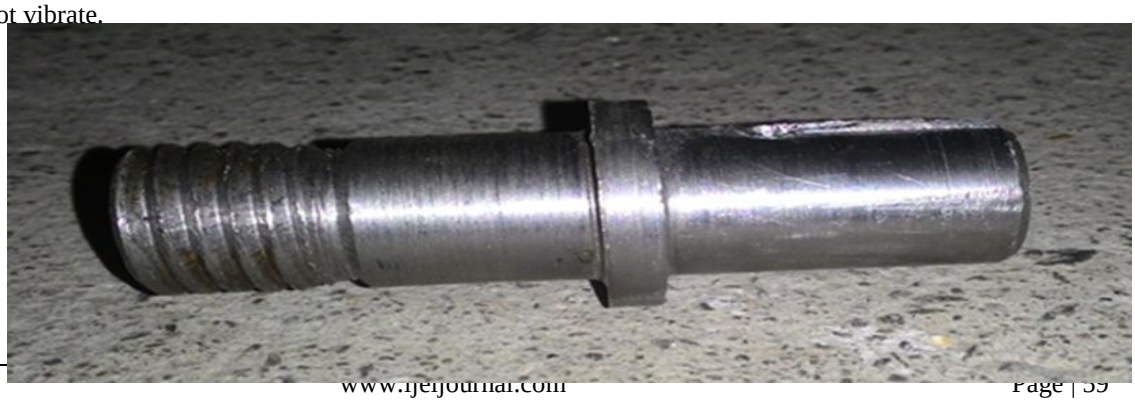


Figure 3 shows shaft used in the attachment

3.4. Base plate and Frame

This serves as the foundation for the machine or attachment. It should be string rigid and should be accurate and precise in dimensio ns. The material selected is Mild Steel. The base plate is welded on the Frame.

Figure 4 shows Base plate and Frame used in the attachment

Dimensions of Base plate and Frame are:
Thickness of the Frame: 2 cm
Total length of Frame: 52 cm
Thickness of Base plate: 0.5 cm
Height of Base plate: 15.75 cm
Length of Base Plate: 17.5 cm

3.5. Sleeve

The sleeves are made of mild steel. They are 1 in number. This should be accurate and precise in dimensions. They are turned on lathe and drilled.

Figure 5 shows sleeve used in the attachment

3.6. Damper

The damper is placed between baseplate and motor to absorb vibration. The damper which we will be selecting depends upon the static deflection and the damping ratio (ξ). Rubber corresponds to value of $\xi = 0.05$. Thus we are selecting rubber as a damper with thickness 5mm. This helps in absorbing high vibrations from the motor**.**

Figure 6 shows Damper used in the attachment

3.7. Final Layout

The layout is very compact and it can easily mount on lathe by removingg check post. The motor is mounted on the attachment, fitted on the cross slide. The final layout is shown below.

Figure 7 shows Final Layout

3.8. Design Calculations

To achieve the objective of this project some important issues need to be focused, which will guarantee the accuracy of 20 microns and fine surface finish. This information must be takken into consideration while designing the attachment.

We considered the following points during design calculations:

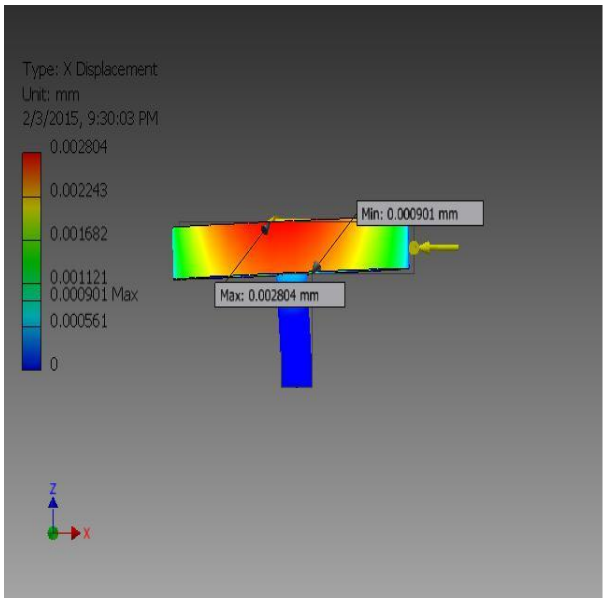
- Absorption of vibration
- Rigidity of attachment.
- Cylindricity of workpeice.
- Theoretical Deflection of shaft
- Analysis of Shaft on software

- Check for safe working of bolts

3.9.Software Analysis

The shaft along with the grinding wheel attached to it have been analyzed using inventor software. The shaft has been analyzed for displacement, maximum stress induced in it under same values of forces acting on it.

Result of analysis for displacement on inventor software. It can be seen that the maximum displacement of 2.8 microns takes place due to horizontal and 1.8 microns due to vertical forces. It is within tolerance limit of required value.



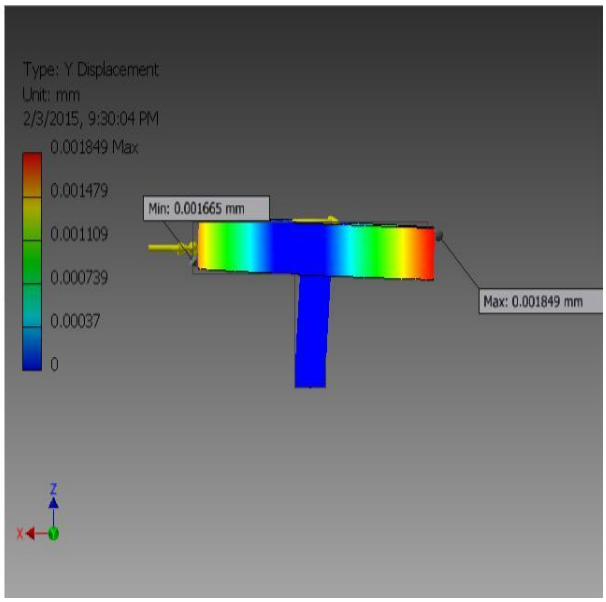


Figure 8 shows X & Y dsplacement of shaft on Software

Table 3.1 Comparison of theoretic and practical values of displacement

Displacement	**Theoretical values**	**Analytical values**
Vertical displacement	0.58 microns	1.8 microns
Horizontal displacement	5 microns	3 microns

4. RESULT AND CONCLUSION

As discussed above the Grinding Wheel Attachment on Lathe this process has easy setup on lathe machine. If we consider manual grinding and attachment og grinding machine on lathe there is various parameters have to be consider.

Time

Time is the most important factor affecting every manufacturing process Manual grinding machines are mounted at specific location and we have to take job at that location and have to done grinding process. It consumes time as compared to grinding wheel attachment has easy setup it has to remove check post of lathe it consumes less time than manual grinding process.

Accuracy

For attaining highest surface accuracy upto 20 microns if we compare manual grinding process with our attachment of grinding wheel on lathe for manual grinding process we have to remove job from chuck of lathe and have to be take upto that grinding machine which is mounted at specific location in workshop it affects the accuracy of final product because of human errors. And our grinding wheel attachment is mounted on lathe with use of frame

and with this there is no errors because we are not removing job from lathe. So there is more accuracy can be achieved as compared to manual grinding process. Finally from this above two factors our grinding wheel attachment has advantages over manual grinding process.

Surface finish is good in production type of grinding wheels than in the conventional ones. Using coolent of 1:20 mineral oil to water concentration ratio surface roughness is achieved from 0.14 to 0.45 in dry grinding and 0.26 to 0.8 in wet grinding when using production type grinding wheel.

The scope of this project is limited only for cylindrical work pieces on tiger lathe machine tool. The grinding is restricted only to external surface no internal grinding. Grinding is constrained only to mild steel work pieces. The design is also constrained due to space available on the lathe cross slide therefore dimensions of attachment and grinding wheel are fixed to some extent.

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