Design and Development on Conventional Lathe Machine

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Abstract-

The advancement of current advances in PC programming, equipment, and firmware and in addition the combination of these advances in the modern lines has demonstrated better and more effective preparations can be machined. The retrofitting procedure of the regular machine machines into self-loader control machine, requests two key components, to be specific, mechanical and hardware parts. In the mechanical section, an outline is made to encourage the stepper engine to the lead screw. Then again, in the gadgets section, an electronic circuit containing the engine driver circuit is outlined with a specific end goal to control the engine development.

I. INTRODUCTION

The conventional manual machines are very time consuming and tedious, has the manufacturer to think and implement new methods to automate machines, by developing devices with digital control system after World War II.

Retrofitting is the process of replacing the CNC, servo and spindle systems on an otherwise mechanically sound machine tool to extend its useful life. Rebuilding and remanufacturing typically include a CNC retrofit. The anticipated benefits include a lower cost investment than purchasing a new machine and an improvement in uptime and availability.

The retrofit investment is similar to any other kind of investment. Considering all the financial costs and benefits allows you to calculate an ROI for a comCNC retrofitting is typically the lowest cost solution to improve the overall performance of an older machine tool. Though some electrical subassembly is often performed at the retrofitter's business location, most of the work can be completed at the machine site, avoiding costly machine rigging and transportation costs, and minimizing the time that the machine is out of commission. The main objective of the retrofitting in lathe machine is to improve the existing conventional lathe machine to provide it features of SEMI-AUTOMATIC LATHE MACHINE with very lower cost than the new SEMI AUTOMATIC LATHE MACHINE.

Rather than above main objective there also several objectives of the retrofitting which is given below

- To Increased productivity and improved control of machine.
- Far superior repeatability.
- To reduced machine downtime.
- Fast machining cycles.
- High accuracy, high feed-rate.
- To increased accuracy and part finished due to controller.
- Eliminate additional tooling cost.
- The Up-gradation Package is less expensive and more readily justifiable.

II. AIMS AND OBJECTIVES

The aim of the research project is to convert the conventional lathe machine into the semi-automatic CNC lathe machine. Thus eventually will improve the flexibility of a traditional lathe machine where previously depends on the skill of experience operators. Therefore the research project has two objectives, first to introduce the necessary amendments to the traditional lathes to be controlled by computer, through the feed lead screw movement which is controlled by the computer by a step motor, and the separation of the mechanical system that feed the first place to make the lead screw moving by a step motor, which can be controlled by computer. Second to design and analyze the step motor for CNC lathe machine, the relative components and the working principle of components of machine under consideration.

III. LITERATURE REVIEW

In 1984, Department of Mechanical Engineering, IIT, New Delhi [1], has taken a research topic named as “Machine tool failure data analysis for condition monitoring application”. With the development of modern manufacturing technology, Flexible Manufacturing Systems have become key equipment in factory automation. Machine tool is heart of the Flexible Manufacturing Systems. Ex example Lathe machine is the general type of machine tool used by almost all the FMSs. During the operation of this machine tool, different kinds of failures are faced by the industry. A systematic study of such failures can help in identifying the critical sub-system of these machine tools. This will be useful for identifying the condition monitoring needs of the machine tools. This deals with the identification of critical sub-system based on the failure data analysis for different type of machine tools.

Initially lathe has been classified into various sub-systems as shown in Figure. In the frequency of failures for each sub-system and failure modes have been considered for finding out the weakest sub-system. In analysis, failure frequency and downtime have been taken into consideration for deciding critical sub-systems of machine tools. It can be observed that the maximum failures took place in headstock and carriage sub-systems. These sub-systems face failures in components like gear, gearbox bearing, spindle bearing, clutch and cross-slide jib. Here it could be observed that the bearing failures cause longer downtime.

In 2012, Institute of Mechanical Technology, Poland [2] has taken a research in cone worm gear drive with conical worm on CNC milling machine. It gives the ides about cutting of a cone-gear with specified parameters.

In 2012, school of engineering, china [3] has taken research in "CNC Milling Machine Spindle Characteristics Analysis by FEM". As an important component of milling machine, the stiffness and vibratory model of spindle need to be analysedin the process of design.

In 2010, 8th IEEE International Conference on control and Automation [4] published "Mechatronic Modelling andControl of a Lathe Machine Equipped with a MR Damper for Chatter Suppression". The obtained results show that theproposed method has been successful in reducing the chatter conditions and improving the stability of turning operationwith very low energy consumption.

In 2008, International Conference on Smart Application, Korea [5] has taken research in "Development of a Miniature

Vertical Milling Machine for Automation Used in a Microfactory"With the development of many benefits for saving resources, energy and coast. For the automated process, the VMC wasselected and optimal configuration of the structure was examined to maximize loop stiffness between spindle and feed table.

In 2008, World Academy of Science, Engineering and Technology [6] has Taken Research in "Design of HydraulicCircuit for CNC Lathe Machine Form Conventional Lathe Machine ", the design of hydraulic circuit is dramatically needed. These consist of changing the tool, working the machining processes and locating the tool in turret.

In 2006,School of Mechanical and Manufacturing Engineering, Australia[7], has Taken Research in "Very Low Compliance force Control On a CNC Lathe Machine" with demonstrates how to carry out contact operation in a very stiff contact situation. The experimental set up used is a CNC machine that carries out metals spinning. The controlled forces are the metal forming process. The designed controller operates in a dynamic environment.

IV. AXIS MOVEMENT

The machine has just two pivot x and z. Since z hub is constantly parallel to the shaft, longitudinal(carriage) travel is assigned z.The cross slide development is assigned X, since it is essential hub opposite to Z. On the off chance that it were conceivable to move the carriage climb and down, that pivot would be Y. There is, however a potential issue in with this course of action. There give off an impression of being two Z tomahawks the carriage development and the tail stock development. Hub developments are appeared in beneath figure 1. In the figure 1 is demonstrate X-Axis movement haggle is show Z-Axis movement wheel.

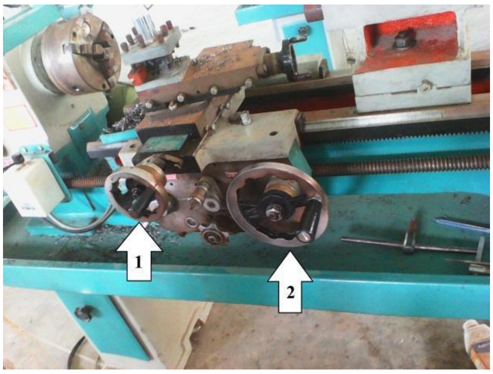


Figure 1X-Axis and Z-Axis Motion Wheel

V. MODELLING

A. Base Plate for Z Axis

This is main base plate of the z axis attachment. It is provide support to the vertical plate and motor. This plate is fixed with carriage. This main base plate is show in below figure 2.

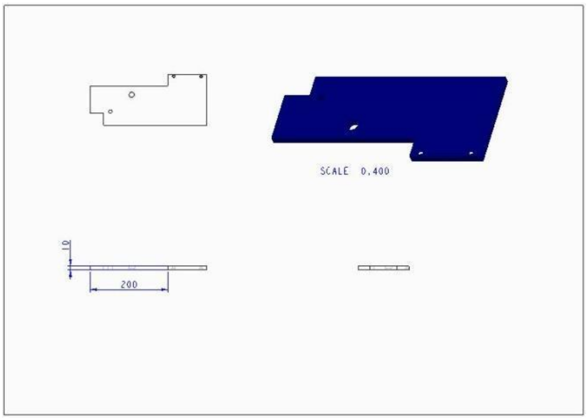


Figure 2 Base Plate for Z-Axis

B. Vertical Plate for Z Axis

This plate provides support to the z axis motor and z axis motor is fixed on this plat. Plate is shown in below figure 3.

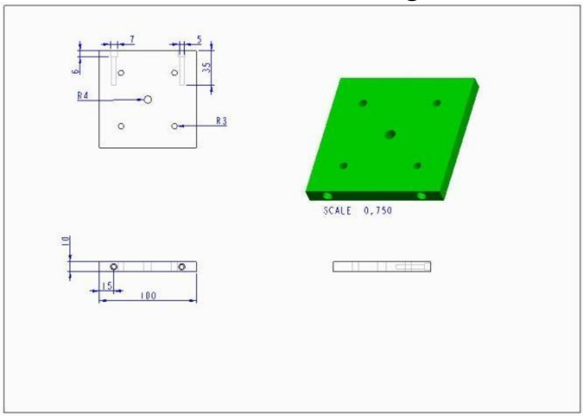


Figure 3Vertical Plate for Z-Axis

C. Base Plate for X Axis

The part is support to the x axis vertical base plate and at the one end of the plate is hanging. Base plate is shown in below figure 4.

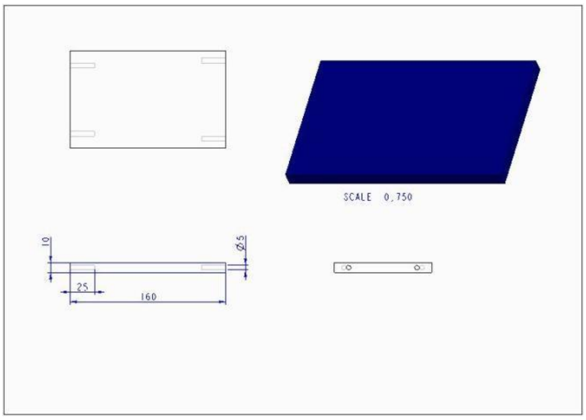


Figure 4 Base Plate for X-Axis

D. Vertical Plate 1 for X Axis

This plate provides support to the x axis motor and x axis motor is fixed on this plat. Plate is shown in below figure 5.

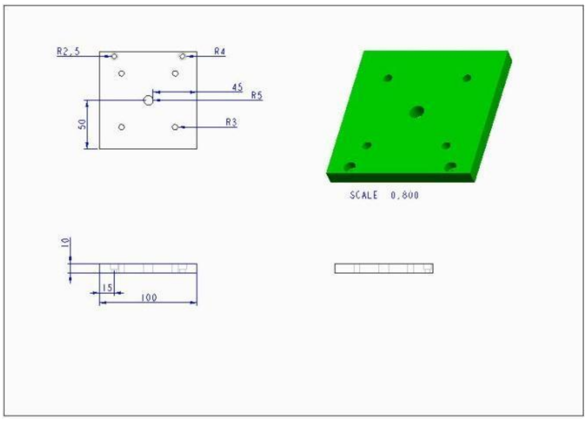


Figure 5 Vertical Plate 1 for X-Axis

E. Vertical Plate 2 for X Axis

This is main base plate of the x axis

attachment. This plate provides support to the base plate for x axis and vertical plate. This plate is fixed with carriage.
Plate is shown in below figure 6.

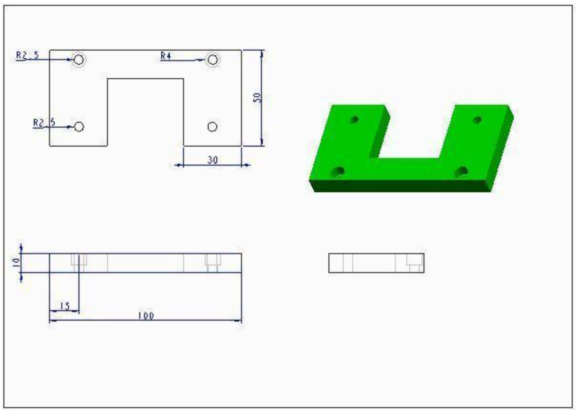


Figure 6 Vertical Plate 2 for X-Axis

F. Final Assembly

All the plates are assembled in this meaner. So the final assembly is shown in below figure 7.

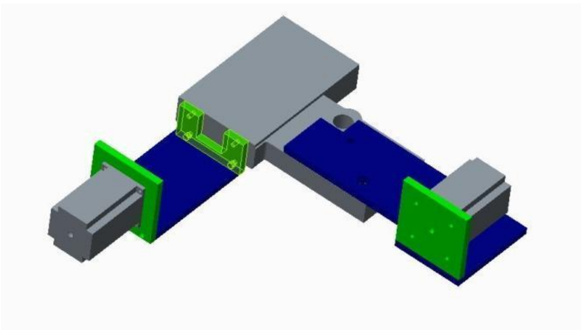


Figure 7 Final Assembly

Figure 8 Actual Final Assembly on Lathe Machine

VI. CALCULATION

For the starting of the calculation some input parameter are required for calculation like diameter of x or z axis wheel, mass etc.

First of all find the diameter of x axis wheel and z axis wheel.

- X axis wheel diameter is 17.2 cm
- Z axis wheel diameter is 10.5 cm

Now, find the how much mass required to rotate the wheel.

- X axis wheel mass is 3.5 kg.
- Z axis wheel mass is 1 kg.

This mass is at the study or ideal moment of machine so we assume that three time more load at the machining time for that time mass are required.

- X axis wheel mass (working) is 10.5 kg.
- Z axis wheel mass (working) is 3 kg.

A. X axis wheel calculation

Where, D = Diameter of X-axis wheel
R = Radius of X-axis wheel
m = mass
l = Working condition load
Mass is 36 kg and we are taking 40 kg.

Where, g = gravity force
F = Force
τ = Torque
Now, taking moment

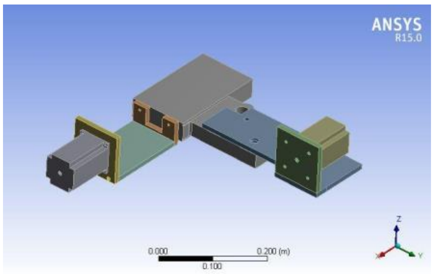
B.Zaxiswheelcalculation

Where, D = Diameter of X-axis wheel
R = Radius of X-axis wheel
m = mass
l = Working condition load
Mass is 36 kg and we are taking 10 kg.
Where, g = gravity force F = Force

τ = Torque
Now, taking moment

As per the calculation decided that for the X axis wheel minimum 23 kg and for Z axis wheel minimum 11 kg motor are required to rotate the carriage and tool post.

VII. ANALYSIS



In the analysis obtain the 7.422e5 N max equivalent stress and that stress converted into the Mpa than that stress is 0.7422 Mpa.

The stress of MS is 450 Mpa and obtained 0.7422 Mpa stress there for our design is safe. We obtain 2.2705e-6 Meter Total deflection. Total deflection is converted in to mm so obtain 0.0022705 mm deflection.

A. Equivalent (Von-Mises) Stress

The Von-Mises Stress analysis result image is shown in below figure 9.

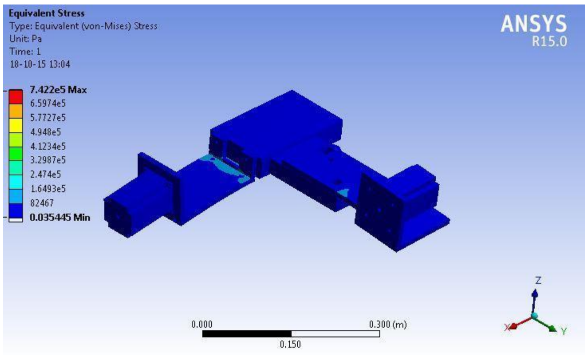


Figure 10 Equivalent (Von-Mises) Stress

B. Total Deformation

The total deformations in plates are shown in below analysis figure 10.

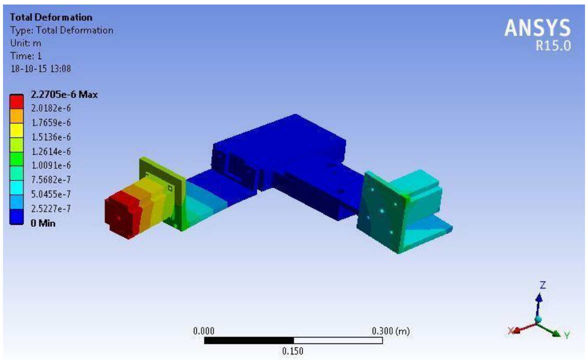


Figure 11 Total Deformation

VIII. CONCLUSION

Only one attachment is required to modify the conventional lathe machine into semi-automatic conventional lathe machine.

Our design is safe.

Reduce the cost as compare to the new CNC machine.

Attachment is easily removable for manual work on lathe machine.

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