Investigationon Automation of Lathe Machine

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Abstract

Modern technology can now be used in industries to make goods by using computer hardware, software, and firmware. To obtain more precise measurements and irregular shapes, a CNC lathe is required.

Therefore, CNC machines are playing a bigger and bigger role in modern industry. In our nation, there are lots of traditional lathe machines. These traditional lathe machines need to be retrofitted in order to become semi-automatic control lathe machines in order to establish a new modern developed nation. There are three components that must be developed and changed into a semi-automatic control lathe machine: mechanical, electronic, and hydraulic. In this project, we transform standard lathes with 5 foot bed lengths into semi-automatic lathes.

For improved accuracy on the mechanical side, we swap out the lead screw for a ball screw, and we get rid of extra parts like gears to make room for motors. For the installation of motors, we add additional plates or a structure. furthermore offers a coolant hydraulic circuit. For the Z and X axes on the electronic side, we employed servo/stepper motors and a controller to ensure smooth operation.

Intoduction

Retrofitting is the process of integrating new features or technology into existing systems. This description almost completely explains what the word "retrofitting" means. When we refer to retrofitting in relation to a component, we mean that we are attempting to modernise and enhance the efficacy of that component using current technology.

However, this article only discusses the retrofitting of a lathe machine at this time. An otherwise mechanically sound machine tool can be retrofitted to replace the CNC, servo, and spindle systems, extending its usable life.

A CNC retrofit is typically used during rebuilding and remanufacturing. The expected advantages include improved uptime and availability at a cheaper investment cost than buying a new equipment. But there are frequently additional, unexpected advantages to retrofitting, such as lowerenergy costs, higher performance and a new level of manufacturing data accessibility.

If the machine tool is mechanically usually in good condition, CNC retrofitting is frequently the most affordable way to increase the overall performance of an older machinery tool.

Even while some electrical subassembly is frequently carried out at the retrofitter's office, the majority of the work can be done there, saving money on machine rigging and shipping costs and reducing the amount of time the machine is out of action.

Rebuilding frequently include fixing or replacing some worn-out mechanical parts, including electrical wiring, ball screws, lubricating pumps, safety interlocks, guards, hoses, and belts. Considering that the rebuild is usually done at the rebuilder's facilities, there can be extra transportation and rigging fees.

Remanufacturing takes a step further and fixes or replaces mechanical parts to the factory's original, as-new specifications. The machine will probably be disassembled entirely before being cleaned, examined, mended, and painted. Updates will be made to all electrical, hydraulic, and pneumatic systems. To adapt the machine for a different use, it may also be changed or given mechanical accessories. Remanufacturing will almost always happen at the remanufacturer's location.

The primary goal of lathe machine retrofitting is to enhance the current conventional lathe machine so that it can deliver features of CNC machines at a significantly cheaper cost than the new CNC machines.

In addition to the aforementioned primary goal, the retrofitting also has various other goals, some of which are listed below.

To Increased productivity and improved control of machine

1. Far superior repeatability

2. To reduced machine downtime.

3. Fast machining cycles.

4. High accuracy, high feed-rate.

5. To increased accuracy and part finished due to controller.

6. User friendly programming and simulation software enables 3D graphic representation of job with automatic generation of G-Code.

7.Eliminate additional tooling cost.

8. The Up-gradation Package is less expensive and more readily justifiable.

LITERATURE REVIEW.

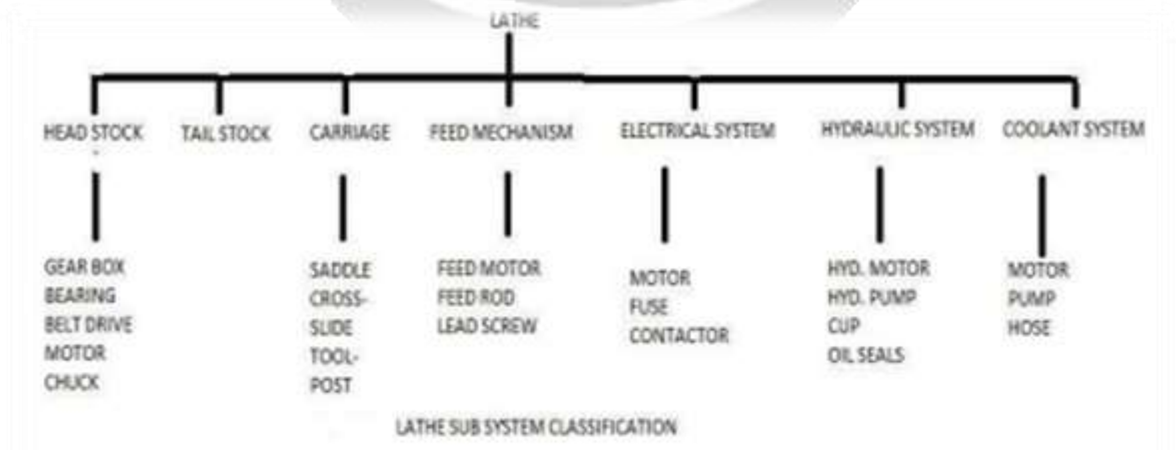
Analysis of machine tool fault information for condition monitoring applications. As modern technology has advanced,flexible

production, production technology The system has emerged as crucial factory machinery.automation. Flexibility's core components are machine tools.system for production. as ina lathe

most FMSs employ this type of machine tool in general.When using this machine tool, the varieties of failures the sector has encountered. systematic examination of Such mistakes can be used to locate significant subsystems.of these mechanical devices. This information will help determine Needs for monitoring machine tool condition. Here discuss identifying significant subsystems based on

fault data analysis for many machine tool types.

As depicted in the diagram, lathes were initially divided into many subsystems. In the a number of the subsystems depicted in Figure. In order to identify the weakest sub-system, failure modes and frequency of failures for each sub-system have been taken into consideration. Critical machine tool sub-systems have been chosen after analysis that took into account failure frequency and downtime. It can be seen that the headstock and carriage sub-systems experienced the greatest number of failures. These subsystems frequently have issues with the clutch, cross-slide jib, gear, gearbox bearing, and spindle bearing. Here, it was clear that bearing failures result in lengthier downtime.



Wearing Parts of Conventional lathe

Four failure modes—component damage, fuse burnt out, circuit fault, and looseness—have been gathered on the histogram from various failure modes and their relative failure frequencies. Component damage is the most common failure mode, as can be seen. The parts fall under the mechanical, electrical, and electronic categories.

Development of Lathe machine attachment for CNC machine was published in 2013 by V. Roy and S. Kumar from J Institute Engineering, India [2].

For an existing CNC machine, he has created an attachment. After attaching the appropriate attachment, the CNC machine is utilised as a CNC Lathe. It is controlled by mechatronics and a computer interface called CAMSOFT. He created several models and used CADsoftware to build the attachment. He skillfully designed and made the model.

The

Fig. 1 Developed attachment

operation of Developed design is successfully implemented in the proposed work for the development of the lathe attachment including headstock, tailstock and tool post. The work shows the process of the conceptual design and use of proper process planning for the development of the different components of the lathe attachment. The previously attachment and developed lathe attachment make the CNC machine multifunctional. Thus further research can be carried out in both the fields respectively. The CNC machine is based on the mechatronic controls and the computer interface CAMSOFT. Various lathe operations like plain turning, step turning, taper turning, arc turning, threading operations and manufacturing of a bolt are successfully performed on the CNC machine, when installed with lathe attachment. The successful development of the lathe attachment for the CNC machine is done.

In 2013, Karl-Heinz Schumacher [3] is invented about Multi Spindle Lathe.A multi-spindle lathe that has a machine frame as well as a spindle drum that is arranged in the frame and is rotatable about a spindle drum axis a portion of the pieces cut from flat material ina stacking path perpendicular to the spindle drum axis,stretch in stacking planes perpendicular to the stackingThese segments have receiving cutouts in one direction, andcooling channel cuts that cross each othersuch that the spindle drum has receptacles for the spindle motor.separate cooling channel system for spindle motorsWebs on the walls there, which are distinguished by the coolingA liquid channel system has numerous liquid channel subsystems.cooling medium that is fed simultaneously.

The article Development of a new machining setup for energy efficient turning process was published in 2013 by M. Moses and Dr. Denis Ashok [4] of the School of Mechanical and Building Science, VIT University, Vellore, India. The lathe is one of the key protective equipment in the production facility. The goal of this study is to develop a quality product in a lathe machine while using less energy. A customised setup is created in the lathe machine for turning and finishing the components in order to achieve a high-quality end product and to increase productivity. This novel method allows for substantial energy savings, the production of high-quality products, and an extension of tool life. The study's objective was to assess The ideal process environment is one that can simultaneously meet quality and productivity criteria. Numerous trials revealed that this unique setup approach enhances quality while lowering power.theconsumption as compared with the existing process. Figure of developed attachment as shown below,

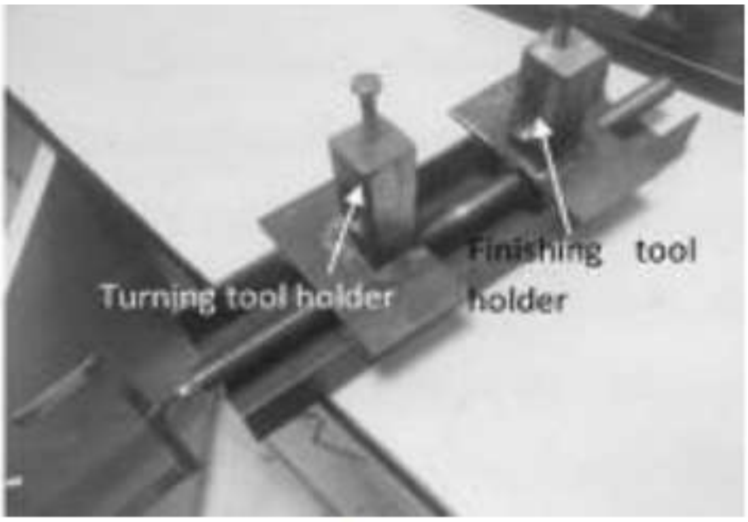


Fig. 2 Machine set up

RETROFITTING PROCEDURE

I've broken down the entire construction process into five phases here. where I created a whole Retrofitted lathe machine from a traditional lathe machine.

Below is a list of all these steps.

Step 1: Buying electronic components

I've bought electronic components such a control panel, stepper motor, stepper drive, spindle drive, and proximity switch.

Step 2: Take apart a few components of a traditional lathe.

I must take out unused components from the traditional lathe machine in accordance with the definition of the retrofitting process.

The Head Stock Gearing Mechanism, the Apron, the Lead Screw, the Lead Screw Mounting Bracket, the Hand Wheel, etc. have all been removed.

I utilised turcide, a polytetrafluoroethylene (PTFE) and bronze compound, to reduce friction on the slide and lengthen the life of such a part.

Fig. 3 Turcide on sliding portion

Step 3:- Dimensionally Design and fabrication of required mechanical parts I have dimensionally design some parts which are required for retrofitting & fabricated and/or manufactured. Some of parts design are shown below

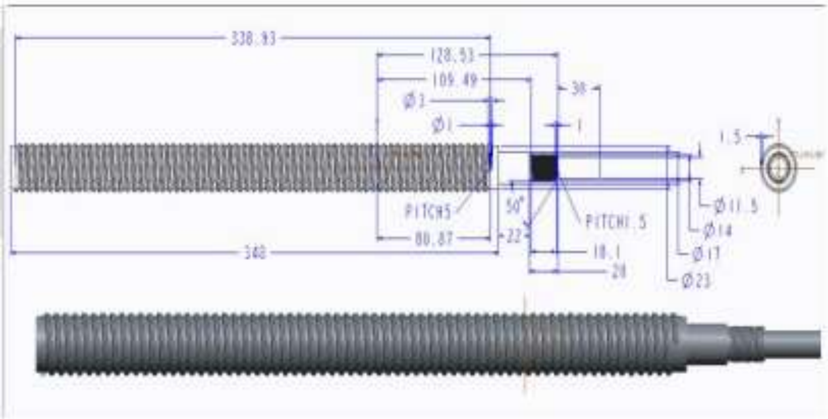


Fig. 4 Dimensionally design X-axis ball screw

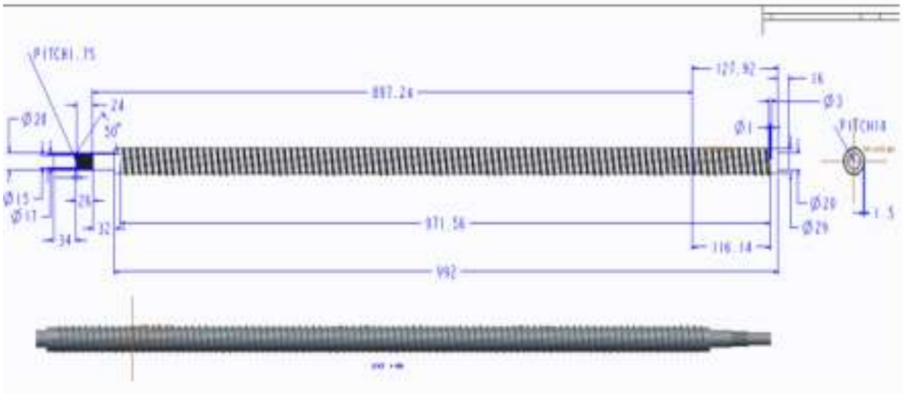


Fig. 5 Dimensionally design Z-axis ball screw

Step 4:- Assemble all manufactured parts & electronics parts at desired place After manufacturing and/or fabricating all required parts, assembly procedure carried out. All the mechanical & electronics parts are attached to their desired place. Some of parts are shown below,

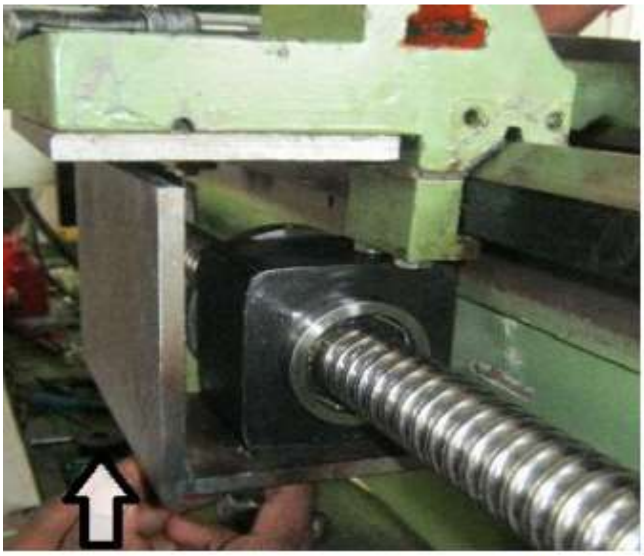


Fig. 7 Z-axis ball screw attached on main slide

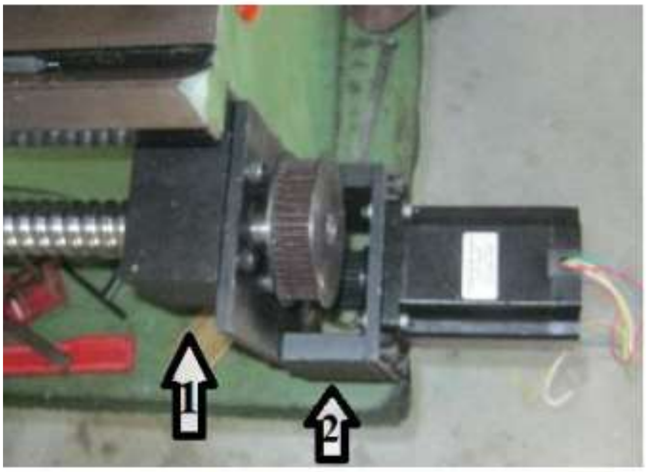


Fig. 8 Z-axis Mounting bracket & Stepper motor

Fig. 9 X-axis mounting & stepper motor

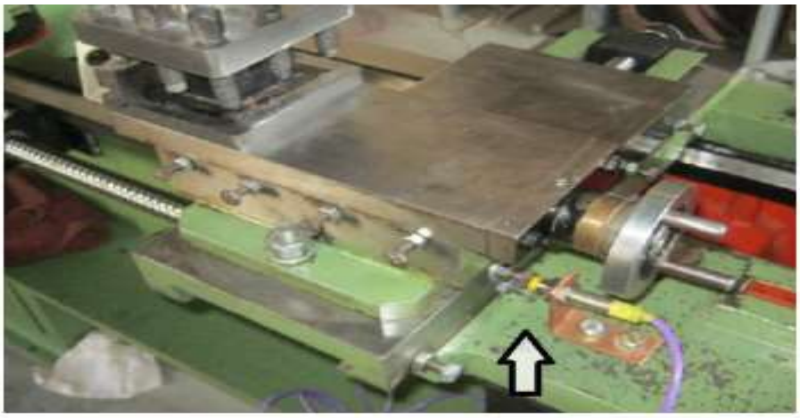


Fig. 10 Proximity switch

Fig. 11 Control panel

Step 5: Testing and inspecting the newly created retrofitted lathe machine

In this phase, I verified that both ball screws were aligned and that all components were fitted to the machine body properly. The appropriate operation of both slides was also verified by the stepper.

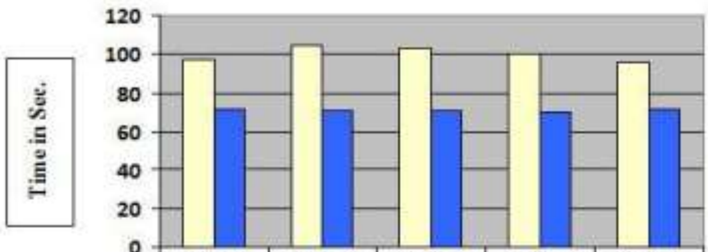
Then, using a turning operation programme that I generated utilising the manual component programme approach, I manufactured a work on a converted lathe machine. and examined the job's surface finishing.

Fig. 12 Developed retrofitted lathe machine

COMPARISON

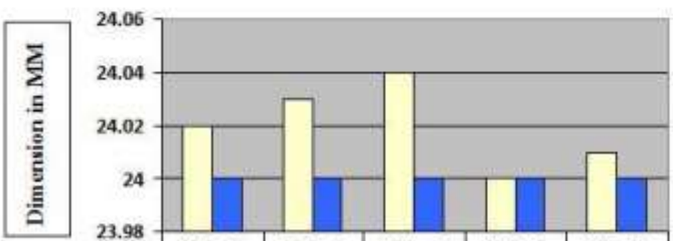
In order to make a comparison, I looked at work produced on traditional and designed retrofitting lathe machines.

And I've come to the conclusion that while machining time and machine slide wear are too low in retrofitted lathe machines, other factors such as surface roughness, production rate, dimension stability, and one-time setup cost are high.



	JOB - 1	JOB - 2	JOB - 3	JOB - 4	JOB - 5
Conventional Lathe	97	105	103	100	96
Retrofitted Lathe	72	71	71	70	72

Fig. 13 Comparison of machining time between job manufactured on proposed & existing lathe



	JOB - 1	JOB - 2	JOB - 3	JOB - 4	JOB - 5
Conventional Lathe	24.02	24.03	24.04	24	24.01
Retrofitted Lathe	24	24	24	24	24

Fig. 14 Comparison of job dimension between proposed & existing lathe machine

Also I have tested three samples (2 samples from retrofitted lathe & 1 sample from conventional lathe) for surface roughness in Tirth Agro P. Ltd. The job manufactured on both the machine are show

Fig. 15 Job Sample

CONCLUSION

By adding automation to a traditional lathe machine using a stepper-based approach, the machine serves as a CNC trainer for subject teaching and learning.

Additionally, the cost of the machine is almost 4 times lower than it was with the first CNC trainer.

Since a newly invented retrofitted lathe for automation is made by swapping out or removing parts from a typical lathe machine, setup costs are higher than they would be for a standard lathe machine, but production rates are excessively high. Therefore, it is excellent for mass production.

Repeatability and dimensional stability of the manufactured part are accomplished thanks to the high accuracy of the job manufactured on the converted lathe machine. Finally, some complex tasks that cannot be produced by traditional lathe machines can be produced by new

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[3] Karl-Heinz Schumacher (2013), Multispindle Lathe. US patent # 2013008702/2013

[4] In 2013, M. Moses & Dr. Denis Ashok M. Tech, Mechatronic from School of Mechanical and Building Science, VIT University, Vellore, India 978-1-4673-6150-7/13/$31.00 ©2013 IEEE

[5] We have also used following links, http://en.wikipedia.org/wiki/Numerical_control http://en.wikipedia.org/wiki/Lathe http://www.epa.gov/ozone/title6/609/technicians/retrguid.html