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# Review on Automation Lathe Machine

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***ABSTRACT: The purpose of this paper is to discuss how to improve the automation of lathe machines. Modern technology, which utilizes computer software, hardware, and firmware in industries, can now produce products. It is necessary to employ a CNC or semi-automated control lathe machine to increase the pace at which parts are produced while maintaining the same quality for all work parts while improving dimensional accuracy, resulting in precise and correct dimensions. As a result, in modernized industrialization, these machines are becoming increasingly vital. Retrofitting these traditional lathe machines into semi-automatic control lathe machines is required to build a new modern developed country. There are three components required for developing and changing into a semi-automatic control lathe machine, namely mechanical electronics and hydraulics. In this project, we add additional plates or a structure for motor installation. Remove any unneeded components, such as gears, from the mechanical side to provide room for motors. On the electronic side, we employed a stepper motor for both the Z and X axes, as well as a controller to ensure smooth operation.***

***KEYWORDS: Automation, Retrofitting, CNC, Machine tool, Stepper Motor,Encoder.***

## 1. INTRODUCTION:

Modern technology, which uses computer software, hardware, and firmware in industries, can now make items [1]. To obtain more accurate dimensions and irregular shapes, a CNC lathe machine is required [2]. As a result, CNC machines are becoming increasingly crucial in modernized manufacturing. In our country, there are a lot of traditional lathe machines. Retrofitting these traditional lathe machines into semi-automatic control lathe machines is essential to establish a new modern developed country [3]. The addition of new technology or features to outdated systems is referred to as retrofitting. This definition covers practically all aspects of the term retrofitting. When we state that we are retrofitting a component, we are attempting to modernize that component and improve its efficacy using current technologies. However, we are only discussing the retrofitting of a lathe machine at this time. The process of changing the CNC, servo, and spindle systems on an otherwise mechanically sound machine tool in order to extend its usable life is known as retrofitting. CNC retrofits are common in rebuilding and remanufacturing.

The expected advantages include a cheaper cost investment than buying a new equipment and increased uptime and availability. However, there are often other unintended benefits to retrofitting, such as cheaper energy costs, improved performance, and increased access to production data. CNC retrofitting is frequently the cheapest way to improve the overall quality of an older machine tool, assuming the machine tool is mechanically sound. Ball screws, lubrication pumps, safety interlocks, guards, hoses, belts, and electrical wiring are some of the mechanical parts that are generally repaired or replaced during a rebuild. Though some electrical subassembly is generally done in the retrofitter's shop, the majority of the work can be done on-site, saving money on rigging and transportation and reducing the amount of time the machine is out of action. Ball screws, lubrication pumps, safety interlocks, guards, hoses, belts, and electrical wiring are some of the mechanical components that are generally repaired or replaced during a rebuild. Because the rebuild is usually done at the rebuilder's site, additional transportation and rigging fees may be incurred.

  

Remanufacturing takes things a step further by repairing or replacing mechanical components to factory specifications. The machine will most likely be disassembled, cleaned, inspected, fixed, and repainted. The pneumatic, hydraulic, and electrical systems will all be modernized. To repurpose the machine for a new application, it can be modified or mechanical components added. Remanufacturing will almost always take place on the remanufacturer's premises. The decision to refit, rebuild, or remanufacture a machine is based on the existing state of the machine and the expected return on investment. Examining maintenance records [4]and part yield statistics might help you figure out how well your machine's mechanical systems are working. A ball bar analysis can also be utilized to figure out what's wrong with your machine. Companies that retrofit, repair, and remanufacture machines will be able to assess the existing state of the equipment and offer the best option.

Machining is a broad phrase that refers to a variety of industrial procedures aimed at removing undesired material from a work piece, usually in the form of chips. Machining is a process[5] that transforms castings, forgings, or prefabricated metal blocks into desired shapes, with size and finish specifications to meet design requirements. Almost every produced product has components that must be machined, frequently to extremely fine tolerances. Metals account for the vast bulk of machining applications in industry. Despite the fact that the metal cutting process has eluded theoretical explanation due to its complexity, its use in the industrial sector is widespread. Independent input variables, dependent variables, and independent – dependent interactions or correlations can all be found in metal cutting operations. When setting up the machining process, the engineer or machine tool operator has direct control over the input variables and can specify or pick them. The next sections go over a few of the input variables.

## 2. LITERATURE REVIEW

In 2013, V. Roy & S. Kumar [9] from J institute Engineering, India published development of Lathe machine attachment for CNC machine. He has developed attachment for an existing CNC machine. The CNC machine operates on mechatronic controls and a computer interface called CAMSOFT, and is used as a CNC Lathe after installing the respective attachment to it. He has design the attachment using CAD software & fabricated different model. He has susseccfully design & fabricated the model. The working of the CNC Lathe attachment is tested & checked by making proper machining operation like turning and thread cutting. The machining operations are successfully done. The CNC machine becomes multifunctional with the presently developed lathe attachment and can be used accordingly by installing the respective attachment to it.

In 2013, P. Hadraba and Z. Hadaš [10] is invented about Multi Spindle Lathe. Multi spindle lathe comprising a machine frame as spindle drum which is arranged in the machine frame is rotatable about a spindle drum axis and is made up at least partially of segments which are cut out from flat material in a stacking direction parallel to the spindle drum axis and extend in stacking planes transverse to the stacking direction these segments having receiving cutouts and cooling channel cutouts which overlap with one another such that the spindle drum has spindle motor receptacles for spindle motors and a cooling channel system separated there from by wall webs characterized in that the cooling channel system has several channel subsystems for a liquid cooling medium Which are fed in parallel.

Ahmed developed the methodology required for obtaining optimal machining parameters for prediction of surface roughness in Al turning. For development of empirical model

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nonlinear regression analysis with logarithmic data transformation was applied. The developed model showed small errors and satisfactory results. The study concluded that low feed rate was good to produce reduced surface roughness and also the high speed could produce high surface quality within the experimental domain.

B. Kumaragurubaran, P. Gopal, T. Senthil Kumar, M. P. Mugunthan, and M. Ibrahim [11] studied the impact of turning parameters on surface roughness. He studied the impact of Feed, Speed and Depth of Cut, Nose radius of tool and work material on the surface roughness of work material. He found that the feed has most significant impact on the observed surface roughness and also observed that there were strong interactions among different turning parameters.

According to studied on development of a back propagation neural network model for prediction of surface roughness in turning operation and used mild steel work-pieces with high-speed steel as the cutting tool for performing a large number of experiments. The authors used speed, feed, depth of cut and the cutting forces as inputs to the neural network model for prediction of the surface roughness. The work resulted that predicted surface roughness was very close to the experimental value.

## 3. DISCUSSION

*a. Determine the drive mechanism:*

- Identify the drive mechanism first [6]. A basic body of rotation, a spherical screw, a belt pulley, and a rack-and-pinion are examples of drive mechanisms. You must also calculate the size, mass, and friction coefficient, among other things, that are required for the load calculation, in addition to the type of drive mechanism. The next sections go over the major points.

- Load dimensions and mass (or density).
- Each part's dimensions and mass (or density).
- Friction coefficient of each moving part's sliding surface.

*b. Check the required specifications:*

- Examine the technical specs of the equipment. The next sections go over the major points.

- Speed and duration of operation.
- Distance and time spent positioning.
- Resolution.
- precision in halting.
- Maintaining a position.
- Voltage and frequency of the power supply.
- Working conditions.

*Calculate the load:*

Calculate the values for load torque and load inertia atthe motor drive shaft.

*Select a motor type:*

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Select a motor type from standard AC motors, brushless motors or stepping motors based on the required specifications.

*Selection calculation:*

Make a final determination of the motor after confirming that the specifications of the selected motor and gear head satisfy all of the requirements, such as mechanical strength, acceleration time and acceleration torque. Since the specific items that must be checked will vary depending on the motor model, refer to the selection calculations.

*Types of Lathe:*

A lathe is a machine tool which rotates the work-piece on its axis to perform various operations such as cutting, knurling, drilling, Thread cutting etc. with tools that are applied to the work-piece to create an object which has symmetry about an axis of rotation. Lathes are used in woodturning, metalworking, metal spinning, Thermal spraying, parts reclamation, and glass-working.

A suitable classification of these machines is difficult because there are so many variations in the size, design, method of drive, and application. Most lathes are designated according to some outstanding design characteristic: speed lathes, engine lathes, bench lathes, tool room lathes, special-purpose lathes, turret lathes, automatic-turning machines, and modifications of these types.

*Speed Lathes*

The simplest of any and all lathes is the speed lathe, which consists of a bed, a headstock, a tailstock, and an adjustable slide for tool support. It's usually powered by a variable-speed motor incorporated into the headstock, although it might also be a belt connected to a step cone pulley. The lathe is run at high rates up to 4000 rev/min because hand tools are employed and the cuts are small, and the work is either held between centers on a chuck or mounted to a face plate on the headstock. The speed lathe is principally used for turning wood for small cabinet work or for patterns, and for centering metal cylindrical parts prior to further work on the engine lathe. In the latter operation, the center drill is held in a small chuck fastened to the headstock, and the work is guided to the center drill either by a fixed center rest or by a movable center in the tailstock. Metal spinning is done on lathes of this type by rapidly revolving a stamped or deep-drawn piece of thin, ductile metal and pressing it against a form by means of blunt hand tools or rollers [7].

*Engine Lathes*

The engine lathe derives its name from the early lathes, which were powered by engines. It differs from a speed lathe in that it has additional features for controlling the spindle speed and for supporting and controlling the feed of the fixed cutting tool. There are several variations in the design of the headstock through which the power is supplied to the machine.

*Step-Cone Pulley Drive*

Light- or medium-duty lathes receive their power through a short belt from the motor or from a small cone-pulley countershaft driven by the motor. The headstock is equipped with a four-step- cone pulley, which provides four different spindle speeds when connected directly from the motor countershaft. In addition, these lathes are equipped with back gears which, when connected with the cone pulley, provide four additional speeds.

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*Geared-Head Drive*

The spindle speeds of this lathe are varied by a gear transmission, the different speeds being obtained by changing the gear trains through the positioning of levers on the headstock. Such lathes are usually driven by a constant-speed motor mounted on the lathe, but in a few cases variable- speed motors are used. A geared-head lathe has the advantage of a positive drive and has a greater number of spindle speeds available and found on a step cone driven lathe. Heavy-duty models range in size from 305 mm to 610 mm swing and from 610 mm to 1220 mm center distances, with swings up to 1270 mm and center distances up to 3.7 m being common.

*Bench Lathes*

The name bench lathe is given to a small engine lathe that is mounted on a work bench. In design it has the same features as speed or engine lathes and differs from these lathes only in size and mounting. It is adapted to small work, having a maximum swing capacity of 255 mm at the face plate. Many lathes of this type are used for precision work on small parts.

*Tool Room Lathes*

This lathe, the most modern engine lathe[8], is equipped with all the accessories necessary for accurate tool work, being an individually driven geared-head lathe with a considerable range in spindle speeds. It is often equipped with center steady rest, quick change gears, lead screw, feed rod, taper attachment, thread dial, chuck, indicator, draw-in collet attachment, and a pump for a coolant. All tool room lathes are carefully tested for accuracy and, as the name implies, are especially adapted for making small tools, test gages, dies, and other precision parts. Their beds frequently are shorter than ordinary engine lathes having comparable swing dimensions because they are usually used for machining relatively small parts.

*Automatic Turning Machines*

A machine that moves the work and tools at the proper rates and sequences through a cycle without the attention of an operator to perform an operation on one piece is commonly called an automatic. Strictly speaking, the machine is a semiautomatic if an operator is required to load and unload the machine and start each cycle. Often an operator can do this for several machines in a group. Work- pieces may come to a fully automatic machine on a conveyor or an operator may load a magazine or hopper at intervals. Automatic machines are widely used for drilling, boring, milling, broaching, grinding, and other operations. Automatic turning machines are made massive, rigid, and powerful to drive cutting tools at their highest speed and get the most from gangs of tools and multiple and combined tooling. Automatic machines intended for large lots of pieces and infrequent changeover is not usually designed for quick setup. For instance, speeds and feeds are not changed by sliding levers or turning dials, as on an engine lathe, but by removing and replacing pick-off gears. The multiplicity of tools must be set with respect to each other as well as to the machine. In some cases, common practice is to preset the tools in blocks off the machine. The blocks then go into position quickly on the machine at setup time, and machine downtime is saved. Setup time may be less than an hour in favorable cases in which few changes are needed between jobs, but normally changeover takes several hours, and not infrequently up to a day or more, compared to a few minutes on an engine lathe.

Careful scheduling to run similar jobs in succession can save changeover time. Although setup time is long, an automatic machine has the advantage when cutting because it is fast and often able to make up the time lost in setup in less than 100 pieces. A basic mechanical device for driving tool slides and other units is the cam. Some machines require a set of cams for each job. The shape of each cam programs one or more movements. Because the operation is costly, only large production runs are warranted. However, each set of cams can be made to do the job in the shortest time (other machines that do not require cam changes for each job are called camless automatics). One kind has a permanent set of cams that act through adjustable linkages. Without cams, activities are carried out through adjustable electro- and hydro- mechanical devices. A different kind of automatic operation is numerical control (NC), in which the program is expressed in numbers that are fed into the controller to make the machine go through the steps of a desired operation. Leading kinds of automatic turning machines are presented here under the classifications of automatic lathes, and single-spindle and multiple-spindle automatic bar and chucking machines.

*Automatic lathes*

Automatic lathes have the basic units of simple lathes: bed, headstock, tool slides, and sometimes a tailstock. In addition, an automatic lathe drives the tools through all the steps of a cycle without operator attention once the machine has been set up. The work piece is rotated between centers. The tools are carried on blocks on the front and rear slides. The front slide is traversed along the bed, and the tools in this case make straight cuts along the work-piece, retract at the end of the cut, and are withdrawn to the starting position. The rear tool slide typically feeds the tools toward the center of the work-piece for facing, necking, grooving, and forming, but can be given a sideways movement to relieve the tools at the end of a cut. All automatic lathes perform basically similar functions, but they appear in a variety of forms. Many have no tailstock. Some models have one slide, and others have two or three. Some slides move in one direction only; others move in two directions. Some machines have level tool slide ways; others have sloping ways, and some have overhead slides for additional tools. Some slides are fed by screws, others by hydraulic or air hydraulic means, and still others entirely by cams and templates. There are horizontal and vertical models according to spindle position. Some automatic lathes have two or three work spindles so that two or three sets of tools can perform the same cuts on two or three work-pieces at once. Automatic lathes, particularly vertical machines, without tailstocks are commonly called chucking machines, or checkers. The distinguishing feature of this automatic lathe type is that all the tools cut the work-piece substantially at the same time.

*Automatic Bar and Chucking Machines*

Automatic machines for internal and external operations on bar stock have been called automatic screw machines for years, but the term automatic bar machines is now preferred because screws are seldom made on them anymore. Their counterparts for individual pieces are called automatic chucking machines. They can be further categorized as single-spindle, Swiss-type screw machine, or multiple-spindle automatics.

*Retrofitting:*

it refers to the addition of new technology or features to older systems this definition gives an almost all information about the word retrofitting. When we say that retrofitting related to some component that mean we try to upgrade that component and improve their efficacy through a present technology. But here we only talk about the retrofitting in lathe machine at time Retrofitting is the process of replacing the CNC, servo and spindle systems on an

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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. But there are often other unanticipated benefits to retrofitting including lower energy costs, higher performance and a new level of manufacturing data accessibility. Assuming the machine tool is generally in good shape mechanically, CNC retrofitting is typically the lowest cost solution to improve the overall performance of an older machine tool. Rebuilding typically includes the repair or replacement of some worn mechanical components such as ball screws, lubrication pumps, safety interlocks, guards, hoses, belts and electrical wiring.

The main objective of the retrofitting in lathe machine is to improve the existing conventional lathe machine to provide it features of CNC machine with very lower cost than the new CNC 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.

**Advantages**

- Increased speed at which parts are produced(productivity).
- Producing the same quality for all work parts.
- Better dimensional accuracy which gives exact and correct dimensions.
- Increased ability to produce difficult parts.
- Less scrap.
- High Repeatability and Precision.
- Volume of production is very high.
- Complex contours/surfaces need to be machined. Flexibility in job change, automatic tool settings.

## 4. CONCLUSION

By developing automation in conventional lathe machine by retrofitting stepper-based method, the machine works as CNC trainer for teaching, learning of the student subject. Also Cost of machine is minimizes approximate 4 times below the original CNC trainer. As automation new developed retrofitted lathe is done by replacing or removing the components from conventional lathe machine, therefore setup cost is high as compare with standard lathe machine but production rate is too much high. So, it is very useful for mass production. The accuracy of the job manufactured in retrofitted lathe machine is also high so repeatability and dimensional stability of manufactured part is achieved. At last, some complex job which is not manufactured in conventional lathe machine can be manufactured in new developed retrofitted lathe machine. Enhancement in Automation lathe machine is minimizing Cost of machine approximate 4 times higher the original CNC. The accuracy of the job manufactured in Enhanced lathe machine is also high so repeatability and dimensional stability of manufactured part is achieved. Enhanced lathe machine is Reproducing the same quality for all work parts and Reduction in lead times. Working on Enhanced lathe machine is safer.

## REFERENCE:

[1] V. I. Agafonov, "Advanced technology is guarantee of high quality of machine," *Tyazheloe Mashinostr.*, 1996.

[2] G. Pant, S. Kaushik, D. K. Rao, and K. Negi, "Study and Analysis of Material Removal Rate on Lathe Operation with Varing Parameters from CNC Lathe Machine," *Int. J. Emerg. Technol.*, 2017.

[3] R. Jagarajan, M. N. Abdullah Mohd Asmoni, A. H. Mohammed, M. N. Jaafar, J. Lee Yim Mei, and M. Baba, "Green retrofitting – A review of current status, implementations and challenges," *Renewable and Sustainable Energy Reviews*. 2017, doi: 10.1016/j.rser.2016.09.091.

[4] R. Kimhi, Y. Barak, A. Ring, H. Szor, and A. Elizur, "Maintaining schizophrenic patients on benzodiazepines," *Schizophr. Res.*, 1995, doi: 10.1016/0920-9964(95)00054-2.

[5] D. Dimitrov and T. Szecsi, "Machining Accuracy on CNC Lathes under the Lack of Unity of the Process and Design Data," 2016, doi: 10.1016/j.procir.2015.10.001.

[6] M. Yamaguchi, H. Shimizu, Y. Takeuchi, H. Inada, and T. Sata, "Development of Precise Feed Mechanism by means of Friction Drive," *J. Japan Soc. Precis. Eng.*, 1990, doi: 10.2493/jjspe.56.146.

[7] L. Lu, S. Hu, L. Liu, and Z. Yin, "High speed cutting of AZ31 magnesium alloy," *J. Magnes. Alloy.*, 2016, doi: 10.1016/j.jma.2016.04.004.

[8] J. Grandol and M. Gershon, "Multiple criteria decision making," *Qual. Prog.*, 1994, doi: 10.5117/mab.67.13669.

[9] A. Prasad *et al.*, "Automation system in the finishing area of a rail and structural mill," *Steel Times Int.*, 2009.

[10] P. Hadraba and Z. Hadaš, "Dynamic analysis of multispindle lathe," 2018, doi: 10.1007/978-3-319-65960-2_40.

[11] B. Kumaragurubaran, P. Gopal, T. Senthil Kumar, M. P. Mugunthan, and M. Ibrahim, "Optimization of Turning Parameters of En-9 Steel Using Design of Experiments Concepts," *Int. J. Mech. Eng. Rob. Res. 2013 B Kumaragurubaran al*, 2013.