CH - 02 CNC LATHE

Contents:-

BY:- SUMIT GANGULY

1.INTRODUCTION TO CNC:-

CNC (computer numerical control) is a manufacturing process in which pre-programmed computer software dictates the movement of factory tools and machinery. The process can be used to control a range of complex machinery, from grinders and lathes to mills and routers. With CNC machining, three-dimensional cutting tasks can be accomplished in a single set of prompts.

Fig.1

2.INTRODUCTION TO CNC LATHE:-

In lathe machines, pieces are cut in a circular direction with indexable tools. With CNC technology, the cuts employed by lathes are carried out with precision and high velocity. CNC lathes are used to produce complex designs that wouldn't be possible on manually run versions of the machine. Overall, the control functions of CNC-run mills and lathes are similar. As with the former, lathes can be directed by G-code or unique preparatory code. However, most CNC lathes consist of two axes - X and Z.

3.CLASSIFICATION:-

The CNC control system can be classified based on:-

1) Motion type CNC:

i.Contouring system.

ii.Point-to-point system.

2) Control loop CNC:

i.Closed loop system.

ii. Open loop system.

3) On the basis of number of axis:

i.2-axis CNC

ii.3-axis CNC

iii.4-axis CNC

iv.5-axis CNC

3.1) MOTION TYPE CNC:

i.Contouring System:-In contouring system the machine tool cuts the material following a contour of a part, so it works in a continuous path, this type equipment including lathes, mills. These machine require simultaneous control of axes.

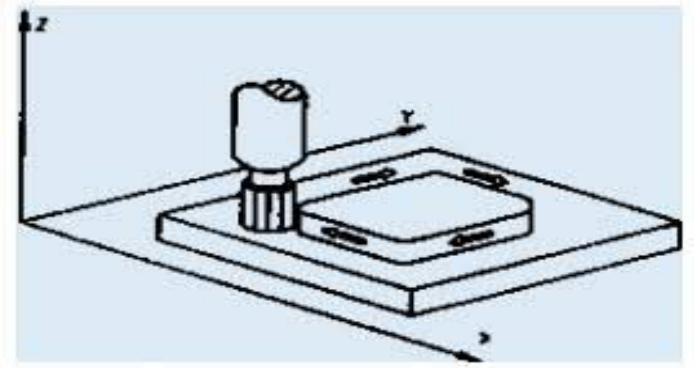


Fig. 2

ii.Point-to-Point System:-The work piece and the tool are placed in the position and the tool does its work. These types of machines are called point to point systems. The work piece is not moved until the tool finishes the job and retracts to the safety.

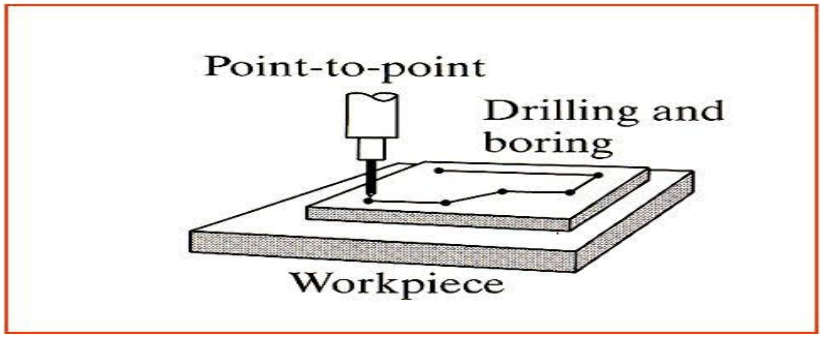


Fig.3

3.2) CONTROL LOOP CNC:-

i.Closed loop system:- The closed loop system has a feedback system to monitor the output of the motors. Closed systems are also able to correct errors in position, velocity, and acceleration, and also fault the system if the error is too large.

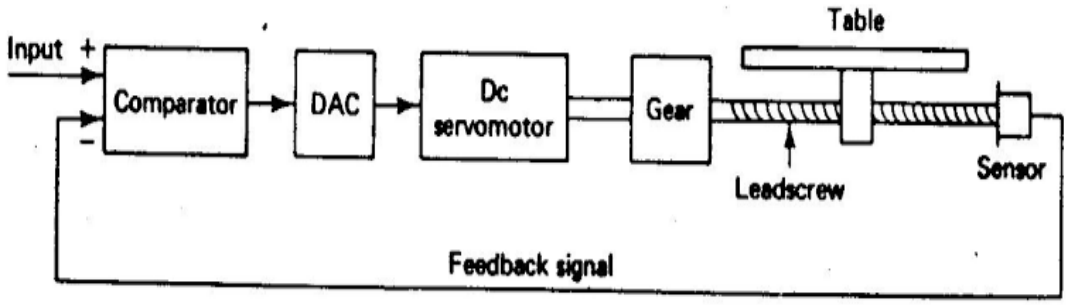


Fig.4

ii.Open loop system:- Open loop refers to a system where the communication between the controller system and the motor is one way. The process for an open-loop system is simple, CNC software creates the information with necessary step and direction signals based on the user's purpose, the computer relays this information to the controller which then energizes the motor and no feedback.

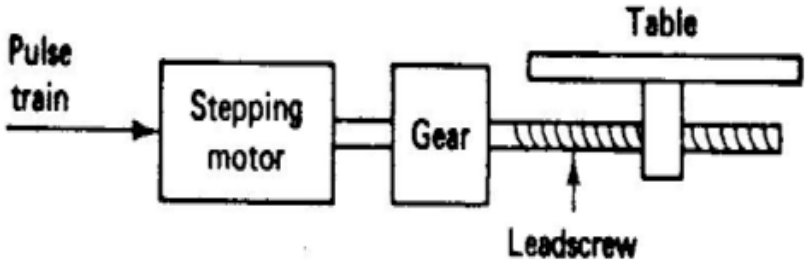


Fig.5

3.3)ON THE BASIS OF NUMBER OF AXIS:-

i.2-axis CNC machines:- A machines gives access to only two axis, like the lathe machines, the tool moves in 2 directions, like X and Z.

ii.3-axis CNC machines:-Three axes (X, Y and Z) move simultaneously in three-dimensional, it's the most widely used and versatile machine that can achieve high accuracy and precision, can be used for automatic/ interactive operation, milling slots, drilling holes, and cutting sharp edges

iii.4-axis CNC machines:-The 3-axis machine with one more rotation on axis or B-axis, the common example is a vertical machine or horizontal machine. In the case of 4-axis machining, milling is performed ne additional axis, while the operation on the X, Y and Z is there as the 3 -axis system, and the rotation on the A or B axis is at the X-axis

iv. 5-axis CNC machines:-The 3-axis machine with extra rotation along two directions (Y and Z) on A-axis and B-axis, the rotations are respectively given by the bed and spindle movement (pivot point). 5 axis machines are advanced CNC machines and its multidimensional rotation and tool movement allows the creation of precise and intricate parts due to the improved access to undercuts and deep pockets, unparalleled finish and speed, often used for high-level applications, like aerospace parts, artificial bones, titanium pieces, oil and gas machi parts, military products and more.

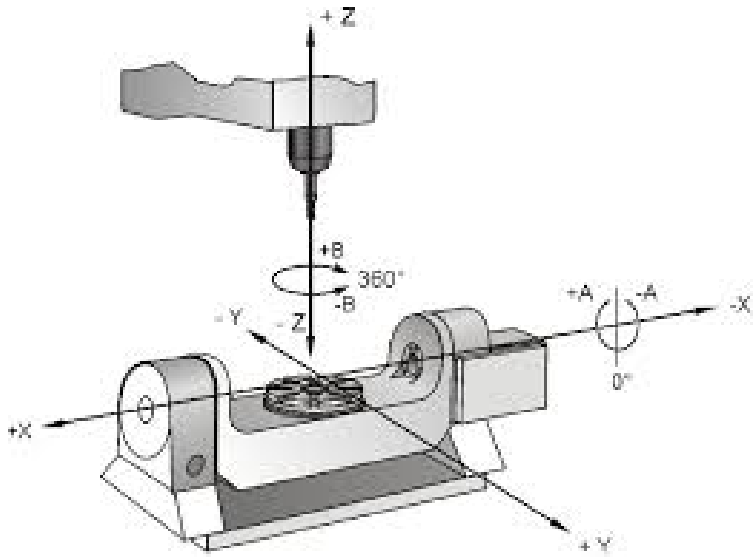


Fig.6

4.ADVANTAGES:-

1. Machine is accurate.

2. Time taken to perform a job is very less.

3. Safe to operate.

4. Number of operators required to operate a machine is reduced.

5. No possibility of human error.

6. It is reliable.

7.Very complex design can also be made.

4.1 DISADVANTAGES:-

A few disadvantages of CNC Machines are:

1.CNC machines are more expensive than manually operated machines, although costs are slowly coming down. CNC machines are more complex machines.

2.Cost of control systems used is high.

3.Maintenance cost is high.

4.The CNC machine operator needs basic training and skills, enough to supervise machines.

5.POSITIONING SYSTEM IN CNC:

There are two basic positioning system in CNC. And these are:

1. Absolute positioning system.

2. Incremental positioning system.

5.1) ABSOLUTE POSITIONING SYSTEM:- An absolute movement moves to a co-ordinate based on a zero point i.e. When programming in absolute,all of the co-ordinates and movement values will come from the origin (0.0) point.

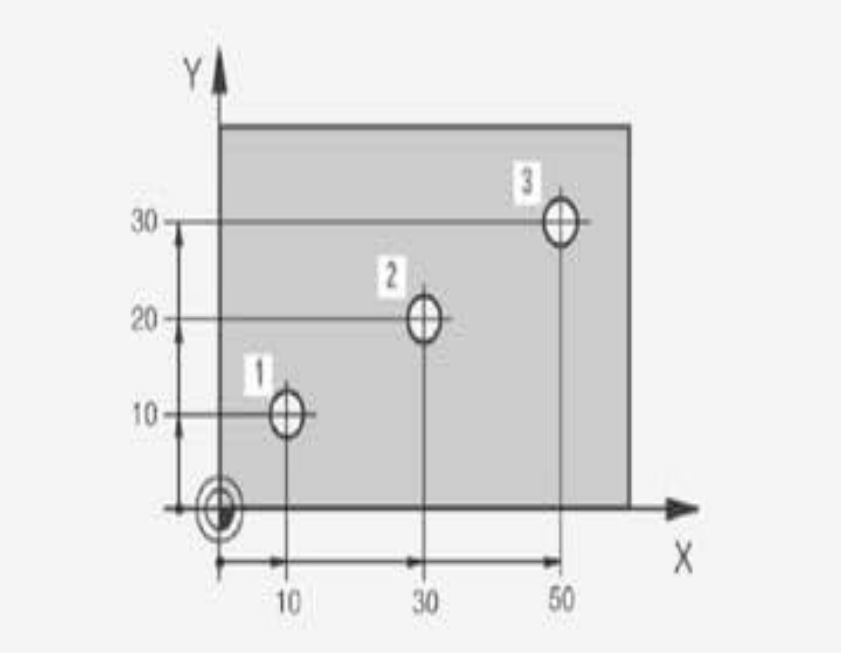


Fig.7

5.2) INCREMENTAL POSITIONING SYSTEM:-In incremental positioning system every measurement refers to the previously dimensioned position (point to point) Incremental dimensions are the distance between two adiacent points.

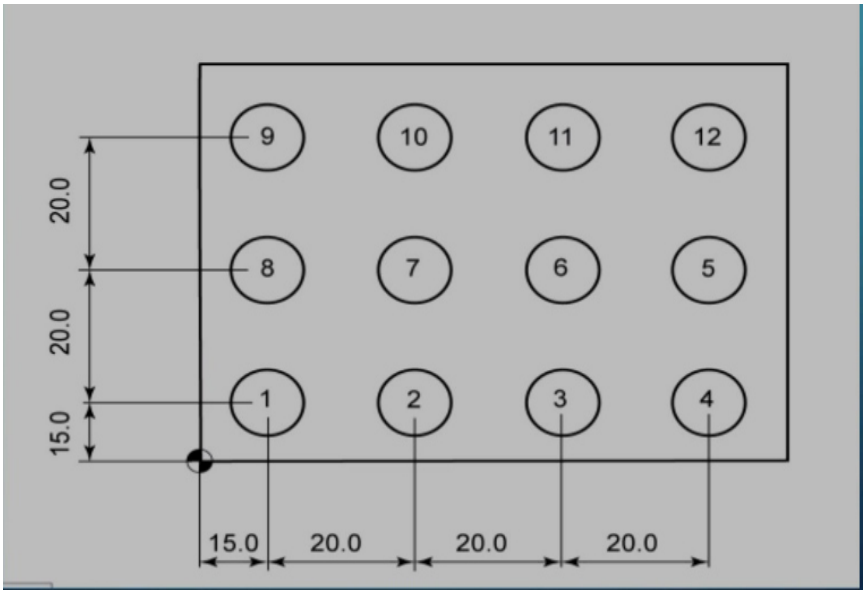


Fig.8

6.PART PROGRAMMING:

The part program is a sequence of instructions, which describe the work, which has to be done on a part, in the form required by a computer under the control of computer numerical control (CNC) software. It is the task of preparing a program sheet from a drawing sheet. All data is fed into the CNC system using a standardized format. Programming is where all the machining data are compiled and where the data are translated into a language which can be understood by the control system of the machine tool.

Example:- N10 G01 X5.0 Y2.5 F15.0

Where:- N10-Sequence number. G01-Linear interpolation mode.

X5.0=Coordinate (5.0"). Y 2.5-Coordinate (2.5") .F15.0=Feed rate(15in/min).

7.PART PROGRAMMING FORMAT:

Word address is the most common Programming format used for CNC programming system. This format contains a large number of different codes (preparatory and missleneous) that transfer program information from the transfer part to machine servos, relays,micro switches etc. Each block should contain enough information to perform one machining operation. Every programme for any part to be machined must be put into format that the machine control unit

can understand The part programming is based on block and word.

1)BLOCK:- Every CNC program is a sequence of many CNN program blocks which are written together to form a complete tool path and tells CNC machine how a machinist want his component to be machined.

2)WORD:- A variable block format which uses letters for instructions are known as word. Each instruction word consist of an address character vich as X,Y,Z,G,M or S. Numerical data follows this address character toentify a specific function such as distance,feed rate,speed value

The word in each block are in following orders:

N: Sequence Number.

G: Preparatory function.

XYZ: Dimensions.

F: Feed function.

S: Spindle function.

T: Tool function.

M:Miscellaneous function.

EOB End block.

8.PREPARATORY CODES:

Preparatory functions are the G-Codes that identifies the type of activities the machine will execute. The G-Codes guide the tool for various operation. A G code in CNC programming controls the movements of a machine, dictating how and where a machine should move to fabricate a part. program block may contain one or more G-coded.

G-Codes(Preparatory Codes)

GOO- Rapid positioning.

G01- Linear interpolation.

G02-Clockwise circular interpolation.

G03-Counter clockwise circular interpolation

G17-Set XY plane.

G18-Set XZ plane.

G19-Set YZ plane.

G20-Programming in inches.

G21- Programming in metric unit.

G27- Reference point return check.

G40- Cutter diameter compensation cancel.

G41- Cutter diameter compensation left.

G42-

G80-End of canned cycle.

G81-Call canned cycle.

G90-Absolute Co-ordinate.

G91-Incremental co-ordinate.

G94- Feed per minute (inch,mm/min)

G95-Feed per revolution (inch,mm/revolution)

9.MISCELLANEOUS CODES:

Miscellaneous function or M-Codes control the working components like activating and deactivating coolant flow, spindal rotation,the direction of spindle rotation, and similar activities.

M-Codes Commands Summary for Lathe Operations:

M00 - Program stop

M01 - Optional program stop

M02 - Program end

M03 - Spindle on clockwise

M04 - Spindle on counterclockwise

M05 - Spindle off

M06-Tool change

M08- Coolant on

M09- Coolant off

M30 - Program end, return to start

M98 - Sub-program call

M99 - End of sub program

10.CANNED CYCLE:

When a same Operation has to be repeated number of times then the program becomes lengthy,time consuming and requires more computer memory space, in this case Canned cycle is written in the main program to reduce the length i.e. The Canned cycle may be defined as the set of instructions to perform a fixed sequence of operation. Canned cycle is used for repeatively and most commo used machining Operations and it is stored in the memory on G code.

11.SUBROUTINE:

When an identical machining Operation has to be performed repeatedly then the normal method of writing a program is lengthy,time consuming and uses more computer memory space. In such case Subroutine is very important technique. It is a separate program which is called in the main program. M98 is used to call subroutine and M99 is used to end subroutine.

12.DO LOOP:

If an operation is to be repeated over a number of equal steps, it may be programmed in what is referred to as a do loop. In a do loop, the MCU is instructed to repeat an operation (in this case, drill a hole five times) rather than be programmed for five separate hole locations to loop simply instructs the MCU to repeat a series NC program statementene cified number of time:

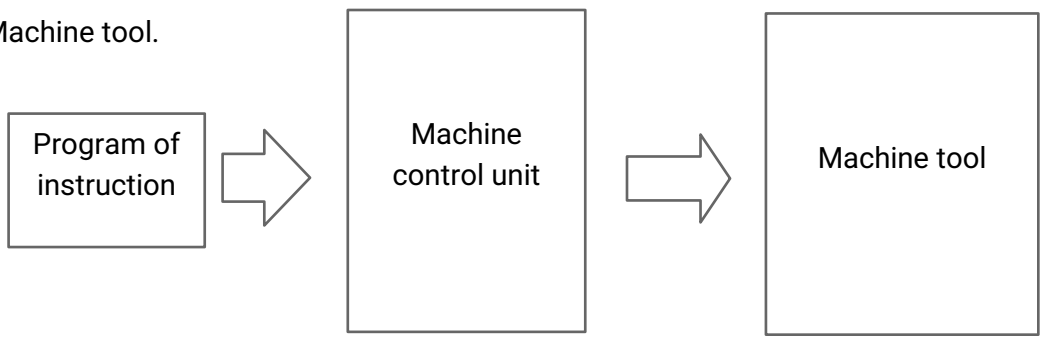
13.CONSTRUCTIONAL FEATURES OF CNC MACHINE:

CNC machine consist of the following basic elements:

1) Program of instruction

2) Machine control unit.

3) Machine tool.



13.1) Program of instruction: The part program is called program of instruction.It is prepared by the part programmer.It is a detail step by step set of instructions which tells the machine tool what to do. It is generally input through the keyboard manually.

13.2) Machine control unit: MCU or Machine Control Unit is the heart of a CNC system actually. It involves several actions to perform in a CNC machine. It helps us with the below performances: Read the coding instructions. Then, it helps to send the proper instruction to every part of the machine.

MCU consist of following components:

1)Central processing unit..

2) Memory.

3) Input/Output interface

13.3) Machine tool: The third basic element of CNC is the equipment which process the work piece. Such a component which perform the useful work is called machine tool.

The machine tool receive signal from the MCU. The signals are understood by the machine spindle,tool and other parts like motors and controls.

Important links:-

CNC LATHE :- https://youtu.be/jF4F8Zr2YO8i

5 Axis CNC MACHINE:- https://youtu.be/wbiFKF4ZXJ4

BY:- SUMIT GANGULY