

## **CNC MACHINES LAB**

### **INTRODUCTION**

Automation is a technology adopted with the application of mechanical, electronic and computer – based systems to operate and control production.

### **COMPUTER NUMERICAL CONTROL (CNC)**

CNC stands for computer numerical control. It is a machine controlled by a computer. Its external appearance is similar to that of a NC machine. Tape or Computer Keyboard or Tutor Keyboard is used as input media for CNC machines. For NC machines tape is to be fit repeat to produce repeated jobs. But for CNC machine tape is fit once and the program is stored in the memory and can be run repeat to produce repeated jobs.

### **WORKING PRINCIPLE OF CNC MACHINES**

It contains two distinct controls, one is CNC controller which does the function of program decoding interpolation, diagnostics machine actuation etc. Another is programmable logic controller (PLC), which dose spindle on off, coolant on off, turret operation etc.

The slides are moved by their own feed drive (AC or DC) servomotors or through balls screw and nut drive. The feed drive controllers the feed drive motors. Suitable transducers fitted either to the table or motor measure the slide position. Also the position is monitored and checked through the feedback transducers to ensure the accuracy of positioning. Spindle is provided with stepped motors of AC or DC. A suitable control is used to vary is speed of the spindle motor. A suitable fed back device attached to the shaft monitors the speed.

### **Features of CNC machines**

- Part program input may be through keyboard.
- Part program is entered in to the computer and stored in the memory. Then it is used again and again.
- The part program once entered can be edited for any errors or design changes.
- Graphical display of the cutter path and shape of the finished job before actually running the program is possible (simulation).
- Tool wear compensation is possible.
- Able to get machine utilization information's like number of components produced, time per component, time for setting the job etc.,
- Sub-program facility for repetitive machining sequences also possible.

### **Types of CNC machine tools**

- CNC Lathe
- CNC Milling Machines.
- CNC Turning Centers.
- CNC Vertical Machining centers.

### **CNC TURNING CENTERS / CNC LATHES**

The CNC turning center is a machine tool capable of performing various turning and related operations, on work piece in one set up under CNC system. These are generally provided with two – axis control, z-axis parallel to the spindle and X-axis perpendicular to spindle axis.

Turning centers are provided with a slant bed to allow for better view of the machining plane as well as for easy placement of the various devices involved in the machine zone. It also provided with an index table tool turret which can hold 8, 12, or 16 tools of various types.

### **The controllable components of a simple CNC lathe are**

- Spindle rotation
- Feed drive
- Work piece clamping device
- Automatic tool changer (ATC)

The other types of popular CNC machines and are generally classified as:

- Horizontal machines
- Vertical machines

### **CNC MACHINING CENTERS**

The CNC machining center is a machine tool capable of performing multiple machining operations on work piece in one set up under CNC system. Typical machining operations performed on machining center include milling, boring, reaming, and tapping.

### **FEATURES OF MACHINING CENTRE**

CNC machining centers are usually equipped with the following features to reduce non-productive time.

#### **AUTOMATIC TOOL CHANGING**

A variety of machining operations require a variety of cutting tool. The tools are stored in a tool magazine that is integrated with the machine tool. When a cutter needs to be altered, the tool drum rotates to the appropriate position. An automatic tool changer (ATC) replaces the tool in the spindle with required tool in the tool magazine. The ATC operates under part program control. The capacity of tool magazine ranges from 16 to 80 cutting tools.

#### **AUTOMATIC WORK PIECE POSITIONING**

Many horizontal and vertical machining centers have the capability to orient the work piece relative to the spindle. This is achieved by means of a rotary table on which the work piece is fixed. The table can be oriented at any angle about a vertical axis to permit the cutting tool for machining almost the entire surface of the work piece in single setup.

#### **AUTOMATIC PALLET CHANGER**

Machining centers are generally equipped with two or more separate pallets. A pallet may be considered as a small table having standard dimensions. While machining is performed on the work piece with one pallet in position at the machine, the other pallets are in a safe location away from the spindle. In this safe location the operator can unload the finished part from the

prior cycle and then fix raw work piece for the next cycle, thus not disturbing the machining operation. An automatic pallet changer is used to move these pallets.

Machining centers are classified as follows:

- Horizontal machining centers
- Vertical machining centers
- Universal machining centers

### **VERTICAL MILLING MACHINES**

Vertical milling machining centers are also a bed type machine with 1. Single spindle and auto tool changers 2. Multi Spindle with turret head (turret machining centers). The structural configuration is as follows:

X-axis traverse provided by table or column.

Y-axis traverse provided by saddle or column or ram.

Z-axis traverse provided by the head stock.

### **HORIZONTAL MACHINING CENTERS**

A horizontal machining center has its spindle on a horizontal axis. These machines are used for machining heavier work pieces with large metal removal rates. So it requires large and heavier tools. As a result, these machines are provided with heavier tool magazines.

The rotary table used in the horizontal machining center provides both axis. These machines are used for machining the prismatic (box like) components. The availability of rotary table makes it possible for machining of all four faces of the component in a single setup. The rotary table can also have more than one axis rotation capability. If such rotary table is interfaced with a conventional three axis horizontal machining center, then it will be possible to machine complex sculptured surfaces.

#### **➤ Courses Offered.**

S.No	Domain	Course Name	Hours	Mandatory Prerequisite
1	<b>CNC</b>	CNC TURNING- Operation and Machining	32	Mechanical, Automobile, Production Engineering (2 <sup>nd</sup> Year)
2	<b>CNC</b>	CNC MILLING- Operation and Machining	32	Mechanical, Automobile, Production Engineering (2 <sup>nd</sup> Year)