LECTURE # 8

TOPIC OF DISCUSSION

COMPUTER NUMERIC CONTROL OF MACHINE TOOL

INTRODUCTION TO CNC

- CNC was developed in late 40's and early 1950's by the MIT servomechanisms laboratory
- With CNC curves are easy to cut as straight lines, complex 3-D structures are relatively easy to produce
- Number of machining steps that required human action, have been dramatically reduced

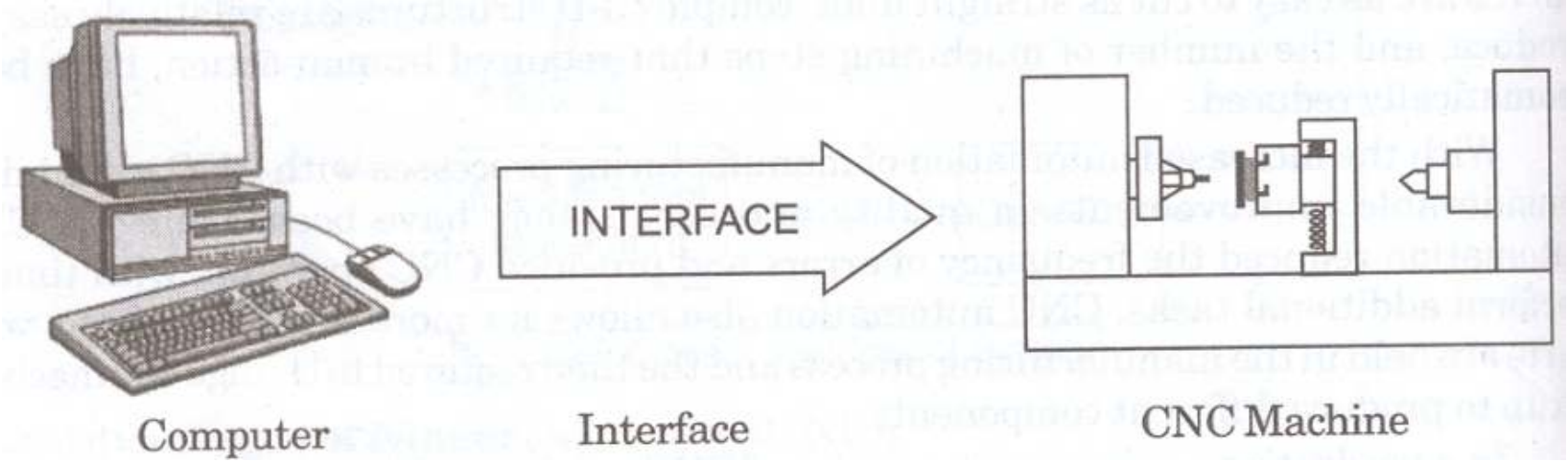
CONFIGURATION OF CNC

- A CNC mechanism requires three pieces of equipments as shown

  - A computer
  - An Interface
  - CNC Machine

CONFIGURATION OF CNC

- ***A Computer***
  - A computer generates design model first using a CAD package
  - This design model is a geometrical model and CNC machine cannot use this to manufacture the product directly
  - CAM package is used to convert the model into an understandable format for CNC machine i.e. in numeric (numbers, symbols etc.)

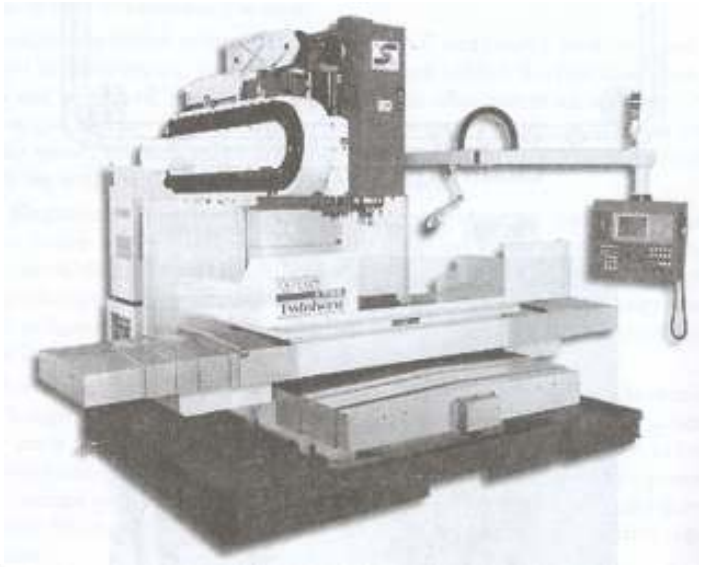


CONFIGURATION OF CNC

- ***An Interface***
  - ❖ A computer cannot be directly connected to CNC
  - ❖ The computer is connected to interface and it converts the signals from the computer to a form that the CNC machine understands
  - ❖ The signals are in the form of digital signals when they are sent to CNC machines
  - ❖ The derives defines the movements through stepper motors to the lead screws to move the working table, starting, rotating the cutting spindles in clockwise or anticlockwise directions

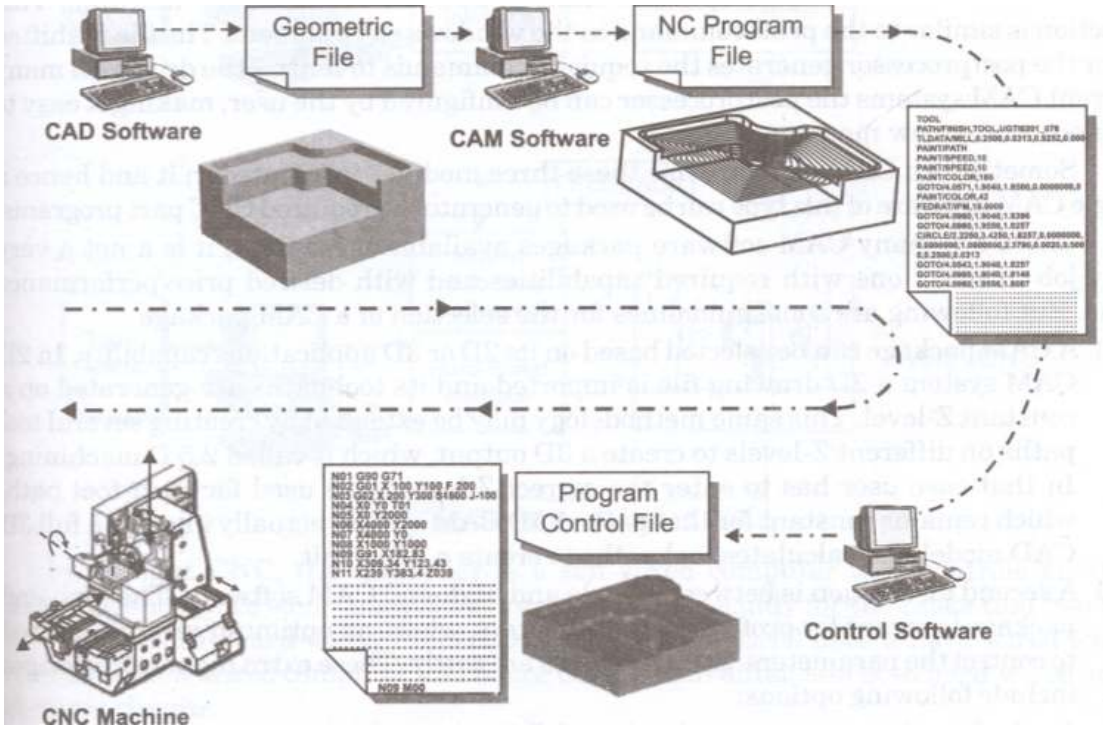
CONFIGURATION OF CNC

- ***CNC Machine***
  - ❖ The signals from the interface control the motors on the CNC machine
  - ❖ The signals determines the way the vice or lead screws moves
  - ❖ The movement may be in any of the three directions X, Y, and Z (Horizontally, Vertically and Depth)



CAM SOFTWARE

- In a typical CNC part programming, the operator writes a part program on the computer and shifts it to the CNC machine for execution
- It becomes very labor intensive to write the part program
- Therefore, a CAM package is used for complex contoured shapes



- CAM software automatically generates NC part program files from the geometric model

CAM SOFTWARE

- In order to manufacture the part, now-a-days typically three different software programs are used

  - ***CAD Software:*** To make the design of part

  - ***CAM software:*** To calculate the tool paths based on the design, compensating for the cutter's geometry

  - ***Control software:*** To read the tool paths and let the machine actually move along these paths

FUNCTIONS OF CNC

1. **Manufacturing the components or Machine Tool Control**

   The CNC helps to generate the components with lesser inputs from the user and can generate the optimized path to be traversed by the cutter and speed up the process of manufacturing

2. **In process control over the machine and process**

   The CNC provides this as the biggest advantages of dynamic correction of the machine tool motions for changes or errors that creep into during processing using adaptive control mechanism

3. **Improved programming and lesser losses**

   The introduction of computer have helped in number of ways to generate better part programs through graphic displays, dynamic movement control and verification of tool path etc.

4. **Improved feedback and programming**

   The feedback systems and online diagnostic tools helps to get the feedback and the components may be maintained/repaired well in time

ADVANTAGES OF CNC

- CNC machines can be used continuously 24 hours a days 365 days a year and only need to be switched off for maintenance purpose
- CNC machines are programmed with a design which can then be manufactured hundreds or even thousands of times
- Less skilled/trained people can operate CNC's unlike manual lathes/milling machines etc. which need skilled engineers
- CNC machines can be updated by improving the software used to drive the machine
- Training in the use of CNC's is available through the use of virtual software
- CNC machines can be programmed by advanced design software

DISADVANTAGES OF CNC

- CNC machines are more expensive than manually operated machines, although cost are coming down slowly
- The CNC machine operator only needs basic training and skills, to supervise several machines (old skills lost)
- Fewer workers are required to operate CNC machines compared to manually operated machines (lead to unemployment)
- Many countries no longer teach pupils / students how to use manually operated lathes/ milling machines etc.