

CNC technology

Computer Integrated machining
↓ major component
CNC -

N/C

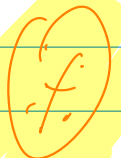
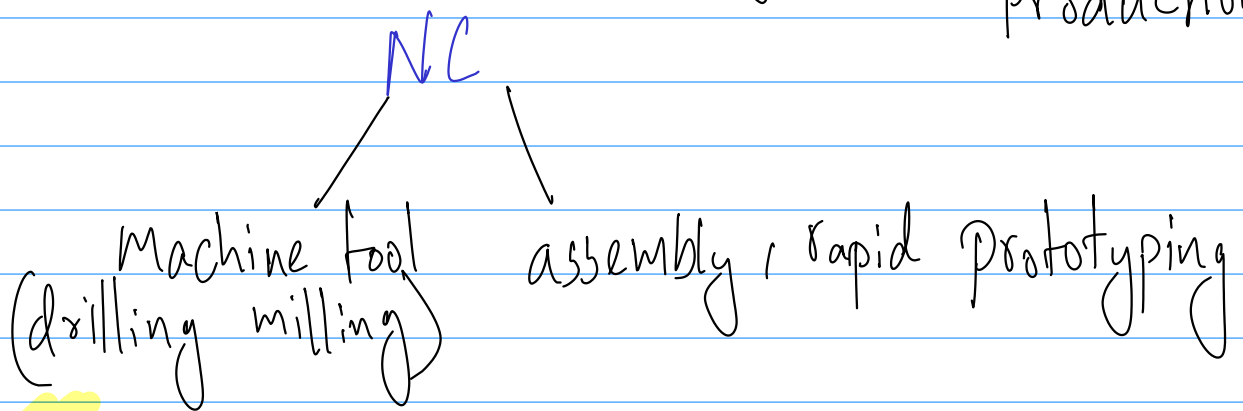
mechanical action of a machine controlled by alphanumeric data (Gcode)

↳ consists of

- ↳ position w.r.t Part
- ↳ other instructions

→ Once job is completed, instruction can be given to process new job

↳ Suitable for low & medium production



first NC was developed 1952

In mid 1960

→ direct numerical control

↓
machine tools controlled by
mainframe computer located remotely

Rise of MCV → dedicated computer

↓
Computer numerical control

Advantages due to MCV

→ Increased memory

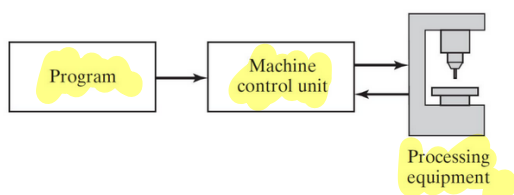
→ Increased storage

→ Easy editing

→ Control logic

→ Improved reliability

Basic Components of NC

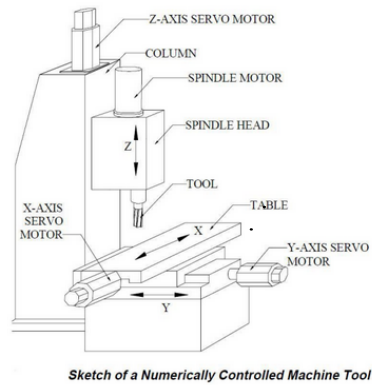


→ Program

→ machine control unit

→ processing equipment

Principle of CNC



→ Servo drive Individual axis (x, y, z)

→ Slides are driven by ball screw

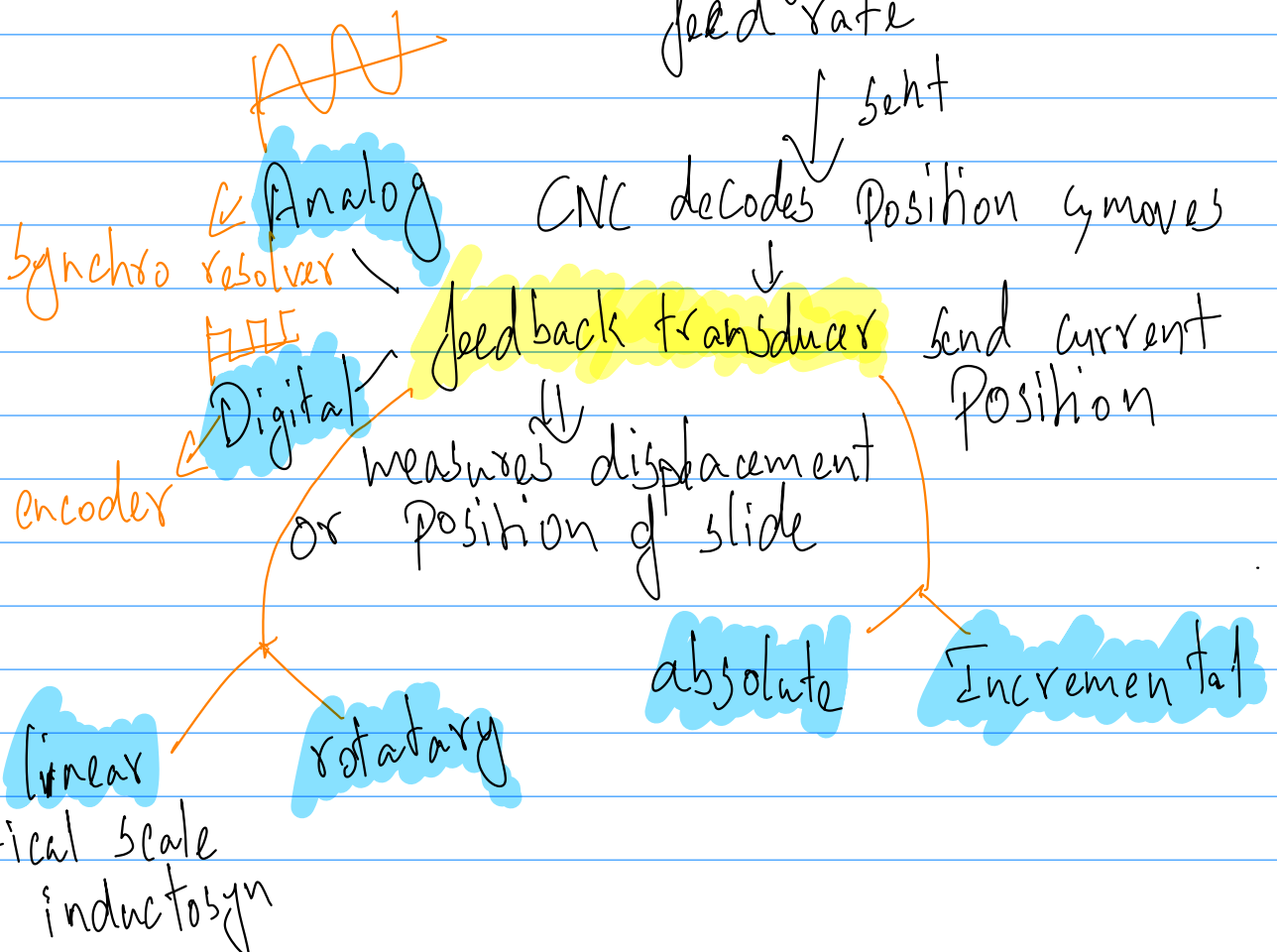
reduces friction, back lash wear



reduces the required torque of motor

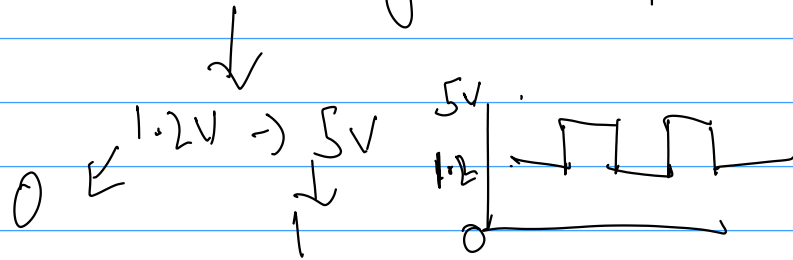
In modern design → linear motor are Used

Coordinate of start by → direction of rotation
end is sent
use of coolant
feed rate



Principles of operation of CNC

CNC servo \rightarrow Controlled by electric pulse

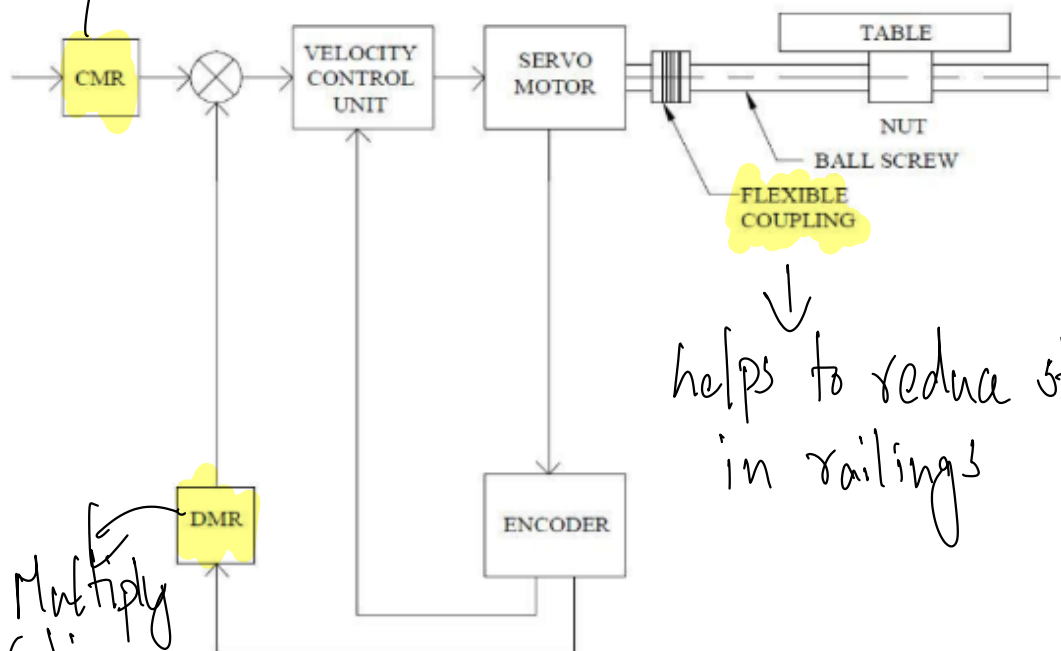


1 Pulse for 1 micro meter

for 100mm \rightarrow 10,000 Pulse

Principle of a CNC Servo

Command Multiply Ratio

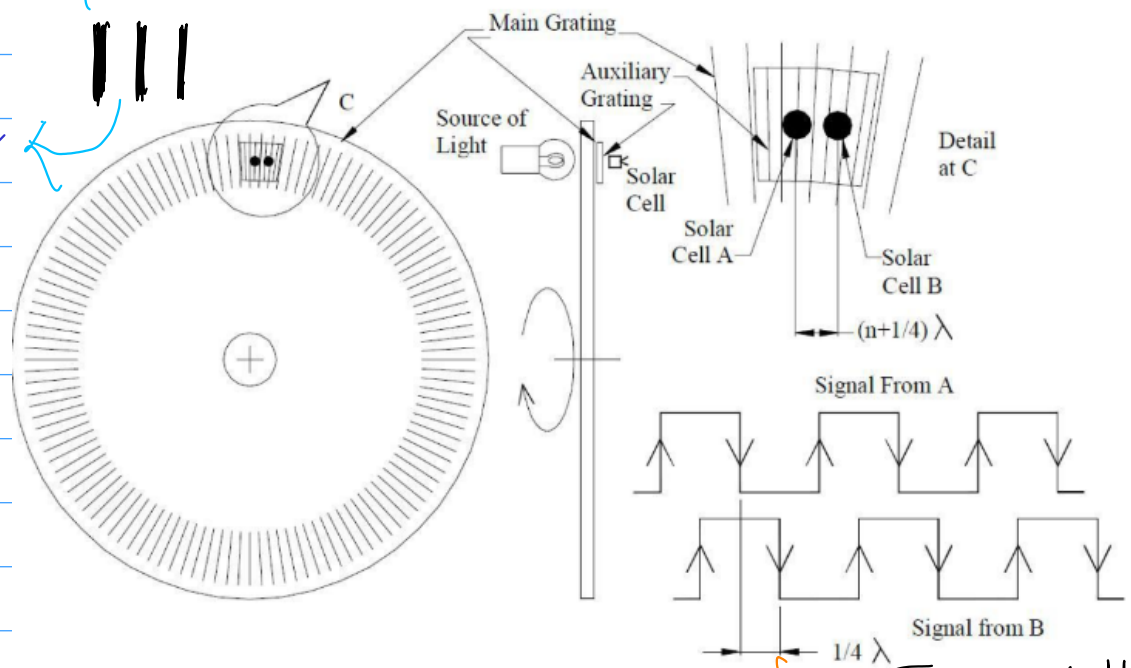


Detect Multiply Ratio

\downarrow
helps to reduce strain
in railings

high pulse \leftarrow

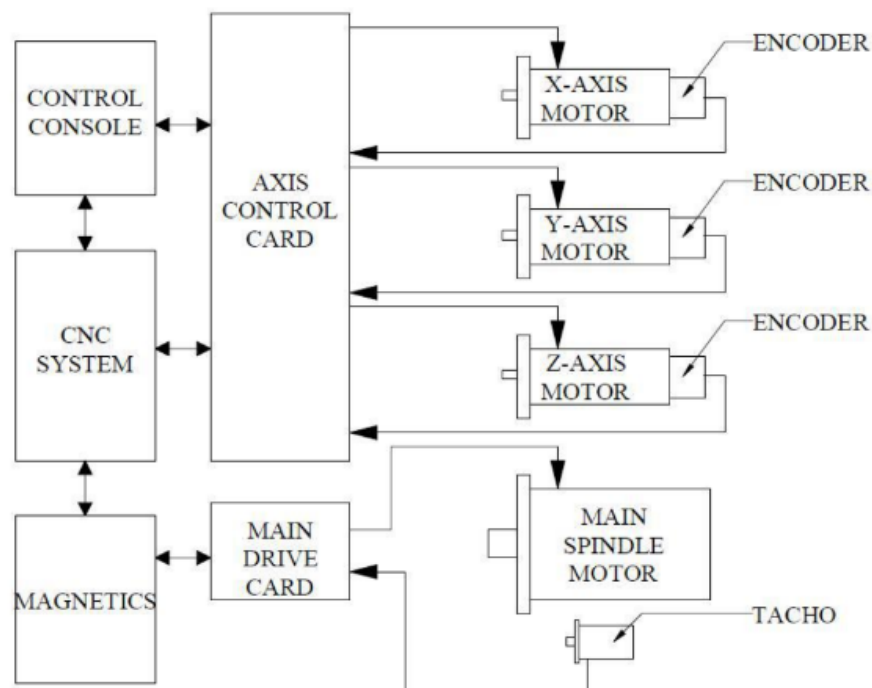
\rightarrow Causes low pulse



Feedback using encoder

Time difference \downarrow denotes direction

Overview of CNC



Advantages of CNC

- Precision Components - $1/10000$ th accuracy
- Reliable endurance - 24/7 working
- High production & scalability
- More Capability
- Less labour
- Uniformity

Disadvantage

- More expensive
- Unemployment

CNC Machines



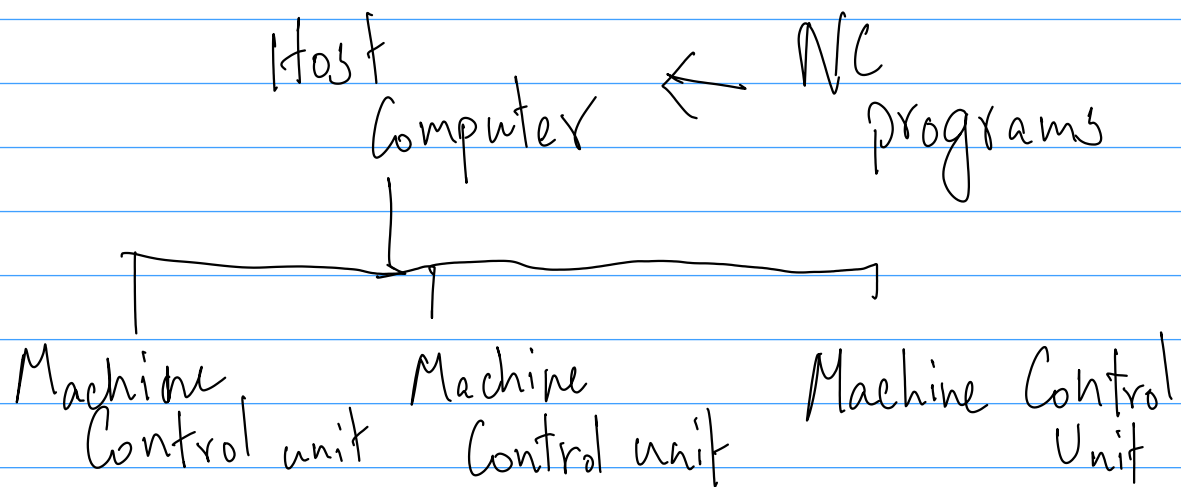
Drills → bit spins to make contact with material

lathes - material moves against drill bit

Milling → Rotary-cutting tool remove material from stock unit

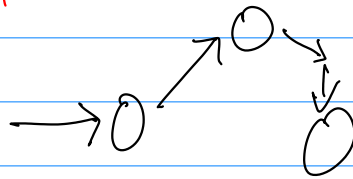


DNC - Distributed Numerical Control



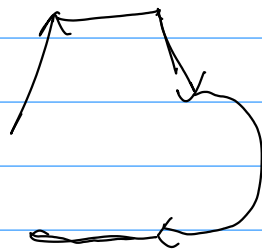
Motion Control system

Point-to-point



Moves to each x-y & stops to perform hole drilling

Continuous path control



Continuous movement • set offset equal to the radius of tool

Interpolation Method

- linear interpolation
- Circular interpolation
- helical interpolation
- Parabolic
- Cubic

Motion Control

Absolute

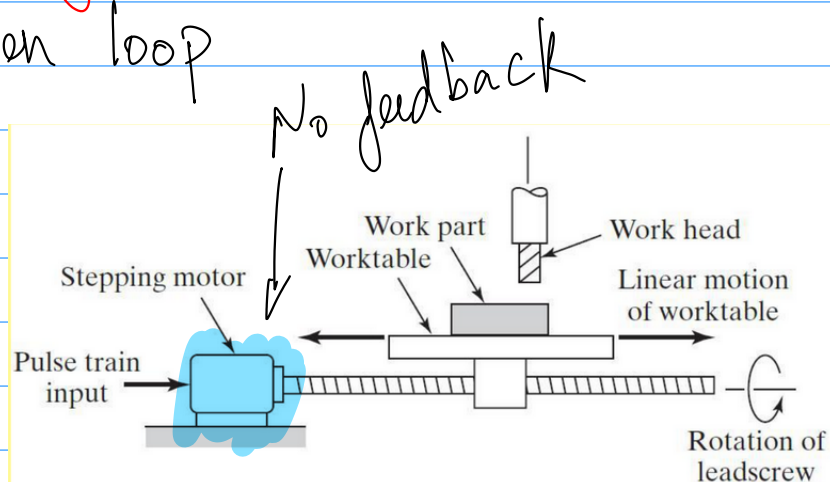
Co-ordinate are given
w.r.t origin

Incremental

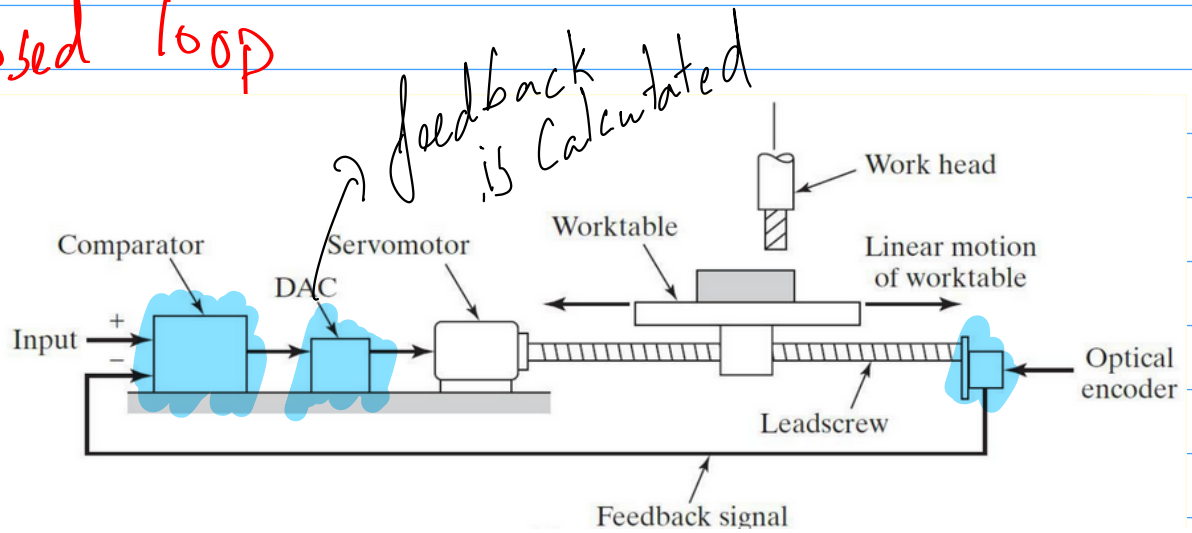
Coordinates are given
w.r.t tools current position

Positioning systems

Open loop



Closed loop

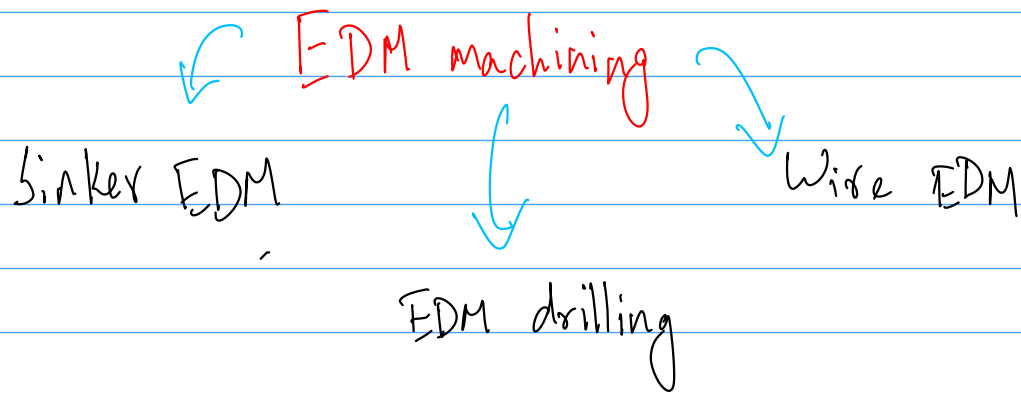


EDM → Electrical discharge Machining

- Used for Hard materials
- materials that are Conductive
- intricate contour
- titanium, hastellalloy
- Unconventional machining
- both tool & work material → Conductive

Dielectric fluid

- sufficient & stable dielectric strength
- low viscosity
- Chemically neutral
- high flash point
- Not harmful



Sinker EDM

- Machining Cavities
- electrode & workpiece are separated
- Material

Wire EDM

- electrically conductive wire
- Controlled by CNC
- drilling accurate & micro holes on hard material

EDM Drilling

- Tubular form
- Continuous spark

Advantage

- irrespective toughness, microstructure
- good surface finish
- Min after effects

Disadvantage

→ low MRR (material removal rate)

→ Not applicable for Non Conductive