Automation in manufacturing

1) Automation def
2) Types of Automation → Fixed, Programmable Automation, Flexible Automation
3) Historical developments
4) Def.
5) Intro to CNC machines
6) ~~Relative~~ Merits and demerits
7) CNC → elements, merits, de-merits

teach

Fixed Automation

~~Fixed~~ Automation

- sequence of operating or processing ~~that is~~ has to be carried out is fixed by the equipment config
- → sequence of operations → integrated into equipment
- → high volume of production is required
  - ↳ production rate of fixed automation is high

Features

- → high ~~not~~ production volume
- → ~~Relat~~ Inflexibility in product variety
- → high initial investment for custom-engineered parts.

Programmable Automation

- → equipment is designed to handle various product configs.
- ~~Usually~~ in order to change the sequence of operations ~~by~~ with the help of control program
- → low and medium volumes
- → for each new batch, a new control program is loaded.

Features

- → ~~to~~ lower production volumes
- → more suitable for batch production
- → Flexibility in changes in products configuration.

eg: NC machine tools

Flexible Automation

- ↳ designed to reduced time taken for part manufacturing
- → can design different products ~~for~~ with no time loss
- → used in interconnecting works stations / material handling

and storage systems.

Features

→ high investment for a custom engineering system
→ medium production rates
→ flexibility to deal with product design change
→ continuous production of variables mixtures of products.

Automation

Adv

1. high production rates
2. less time
3. human errors eliminated

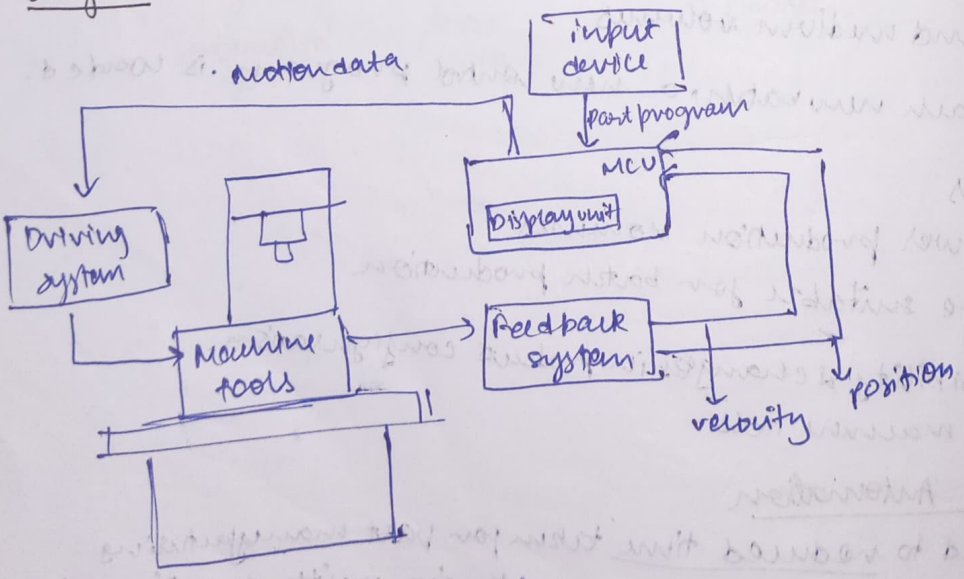
Disadvantages

1. Initial investment very high
2. requires high skilled labour
3. Indirect cost for R&D ↑↑

CNC

→ advanced NC
→ ~~control~~ control unit is a dedicated micro computer instead of hard-wired controller.
→ features like → high speed operation
→ large memories
→ improved servos

diagram



Computer Numerical system

CNC → advanced N
↳ Micro computer not a controller

Elements

1) Input device - part program is entered into the CNC
eg: USB → universal serial Bus
- serial communication
- Ethernet communication.
- conversional programming

2) Machine control Unit
↳ ~~CPU~~
• CPU → Gets Data from memory & generates signals ⇒ activates all M/C parts
- ALU — performs arithmetic and logical operation.
- Int. Access Memory — holds data and programs temporarily

3) Machine ~~Tools control units~~ Tools

4) Driving system

5) Feedback devices

6) Display unit

MCU → Machine control Unit

CPU
- → A control section
- → ALU
- → Intermediate Access memory

CNC: memory
- → RAM
- → ROM

In/Out Interface
establishes connection between → machine operator
↳ components of CNC system

Machine control tools
various axes → X Y Z A B C + spindle
↳ Rotates the axes → ~~B design~~
at the given RPM
↳ ~~with~~ con

~~Sequence control for auxilary functions~~

driving system –

- amplifier circuits
- drive motors
- motors → DC servo motors
  - → stepper motors
  - → linear motor

Feedback Devices

- for accuracy → position & speed values of axes need to be continously updated
- Positional feedback devices
- velocity feedback devices –

Display unit

- current status of operation

eg
- spindle RAM
- feed rate
- position of machine slide

displays warnings, simulations etc.

Machine tools

- machine slides
- machine table
- the driving lead screw, ball screw

Adv of CNC

disadv of CNC