SNS COLLEGE OF TECHNOLOGY

Coordinate Measuring Machines

19MEB303 CADCAMAND AUTOMATION

V.KARTHIK
AP/MECH

Definition CMM

- A **coordinate measuring machine** (**CMM**) is a device that measures the geometry of physical objects by sensing discrete points on the surface of the object with a probe. Various types of probes are used in CMMs, including mechanical, optical, laser, and white light.

Overview

- Coordinate measuring machines (CMMs) are extremely powerful metrological instrument
- It is a device for measuring the physical geometrical characteristics of an object
- This machine may be manually controlled by an operator or it may be computer controlled.
- Measurements are defined by a probe attached to the third moving axis of this machine
- This probe touches the part of interest and allows collecting discrete points on the object's surface.

Measuring using CMM

https://tinyurl.com/y934hzdw

THE ROLE OF COORDINATE MEASURING MACHINES

CMMs play an important role in a large number of industries, including;

- Aerospace
- Automotive
- Food processing
- Health care
- Paper
- Pharmaceuticals
- Plastics
- Research and development
- Semiconductor

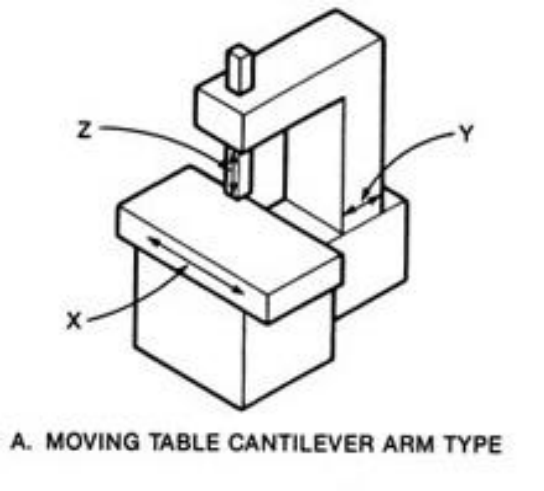
Comparison between conventional and coordinate measuring technology

CONVENTIONAL METROLOGY	COORDINATE METROLOGY
Manual, time consuming alignment of the test piece	Alignment of the test piece not necessary
Single purpose and multi-point measuring instruments making it hard to adapt to changing measuring task	Simple adaptation to the measuring test by software
Comparison of measurement with material measures, i.e., gauge block	Comparison of measurement with mathematical or numerical value
Separate determination of size, form, location and orientation with different machines	Determination of size, form, location and orientation in one setup using one reference system

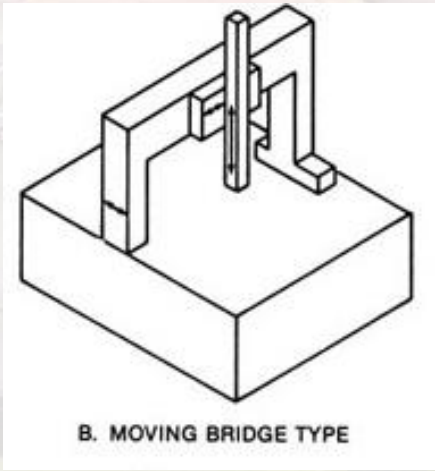
TYPES OF CMMs

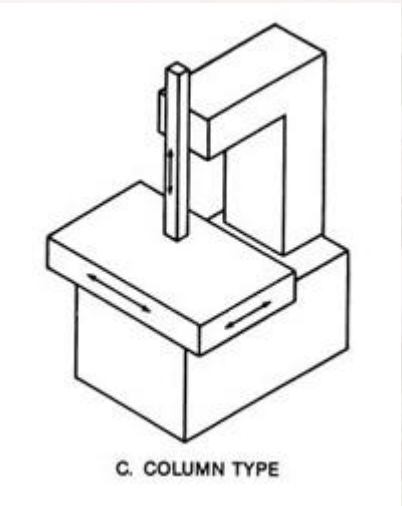
- The basic CMM has three perpendicular axis; x,y,z
- The physical configuration of CMMs vary widely, but they all provide a way to move a probe in three axes with respect to workpiece
- Five basic configurations that are used more frequently
  1. Cantilever
  2. Bridge
  3. Column
  4. Horizontal arm
  5. Gantry

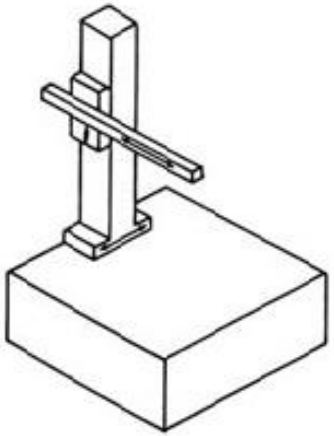
Types of CMM



A. MOVING TABLE CANTILEVER ARM TYPE


B. MOVING BRIDGE TYPE


C. COLUMN TYPE


D. MOVING RAM HORIZONTAL ARM TYPE

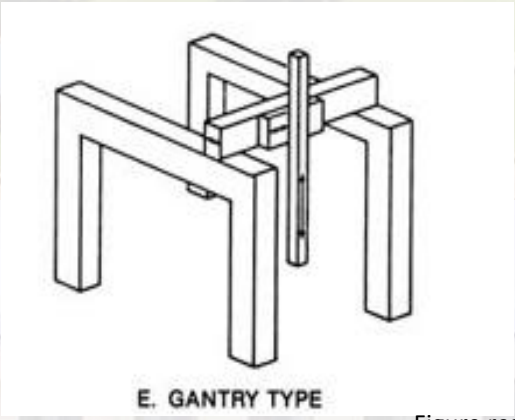
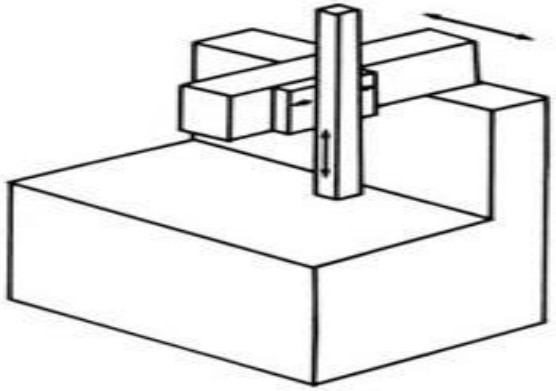
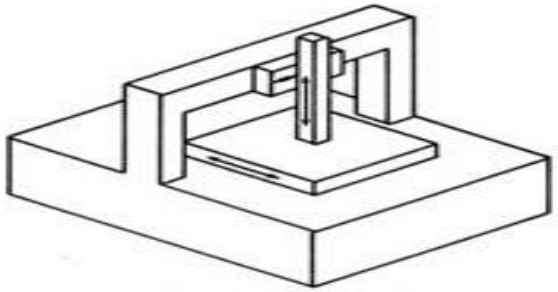

E. GANTRY TYPE

Figure resource :
https://tinyurl.com/ybw7jkpe

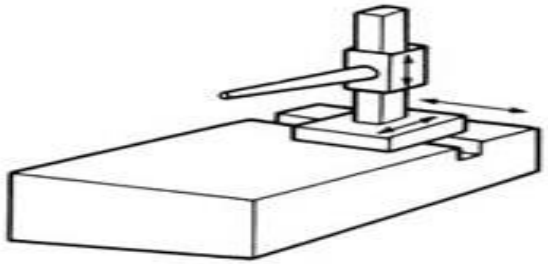
Other configuration



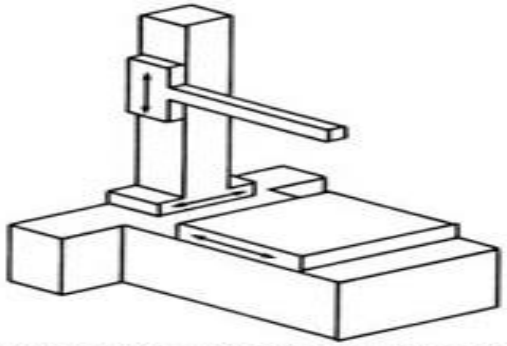
FIXED TABLE CANTILEVER TYPE



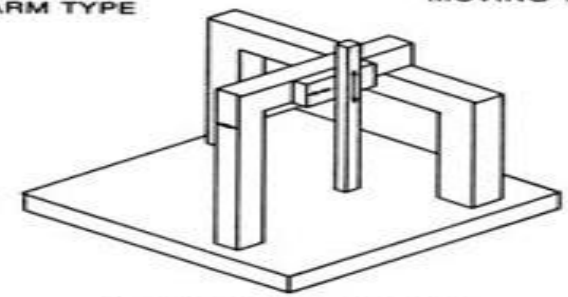
FIXED BRIDGE TYPE



FIXED TABLE HORIZONTAL ARM TYPE



MOVING TABLE HORIZONTAL ARM TYPE

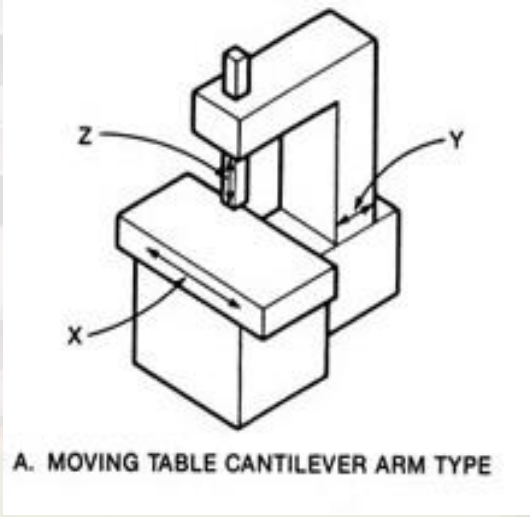


L-SHAPED BRIDGE TYPE

Figure resource :
https://tinyurl.com/ybw7jkpe

Cantilever type

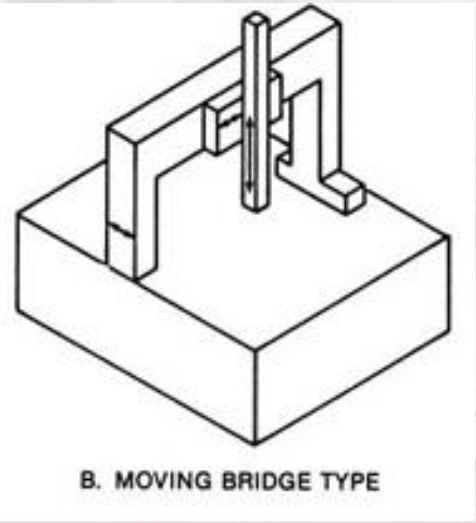
- A vertical probe moves in the z-axis
- Carried by a cantilevered arm that moves in the y-axis
- This arm also moves laterally through the x-axis
- Advantage- a fixed table allows good accessibility to the work piece
- Disadvantage- the bending caused by the cantilever design
- The cantilever design offers a long table with relatively small measuring ranges in the other two axis
- Suitable for measuring long, thin part



A. MOVING TABLE CANTILEVER ARM TYPE

Moving bridge type

- Most widely used
- Has stationary table to support work piece to be measured and a moving bridge
- Disadvantage- with this design, the phenomenon of yawing (sometimes called walking) can occur- affect the accuracy
- Advantage- reduce bending effect



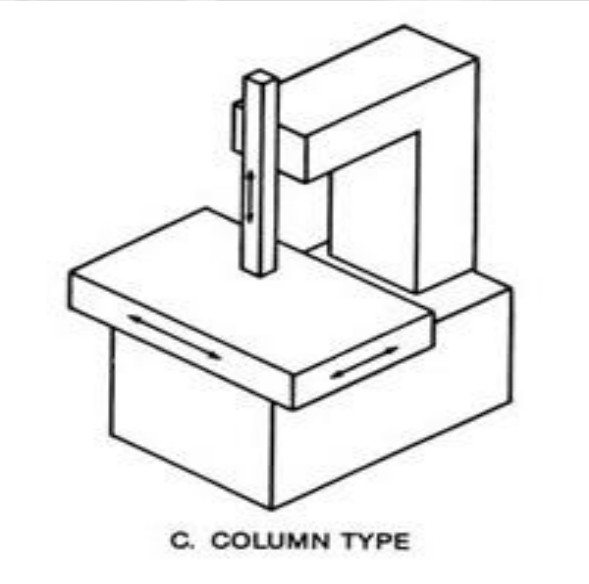
B. MOVING BRIDGE TYPE

Fixed bridge type

- In the fixed bridge configuration, the bridge is rigidly attached to the machine bed
- This design eliminates the phenomenon of walking and provides high rigidity

Column type

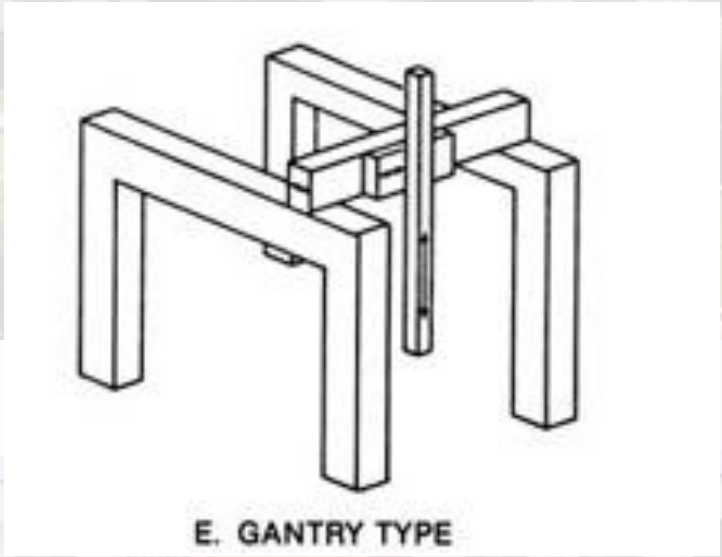
- Often referred to as universal measuring machine instead of CMM
- The column type CMM construction provides exceptional rigidity and accuracy
- These machines are usually reserved for gage rooms rather than inspection



C. COLUMN TYPE

Gantry type

- The support of workpiece is independent of the x and y axes, both are overhead, supported by four vertical columns rising from the floor
- This setup allows you to walk along the workpiece with the probe, which is helpful for extremely large pieces



E. GANTRY TYPE

Assessment Questions

1. What is so Special about this CMM Machine?
2. How accurate is CMM?
3. How can the accuracy of the CMM Machine be Verified?
4. Does CMM offer an Automatic Change of Objective Lenses?
5. Which Surfaces and Materials can be Measured with the Optical CMM Machine?

https://www.alicona.com/en/10-questions-about-the-ucmm/

THANK YOU