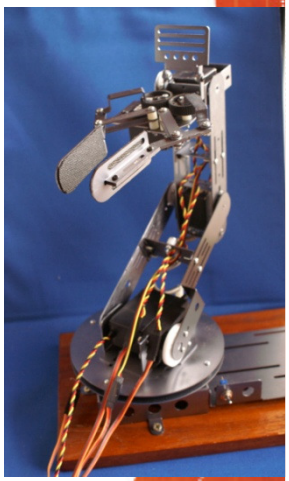
Robotics

- What is a robot?
- Intelligent device who's motion can be controlled, planned, sensed. . .
- Electro-mechanical system
- Actions and appearance conveys it has intent of its own
- Performs jobs- cheaper, faster, greater accuracy, reliability compared to human.
- Widely used in manufacturing and home

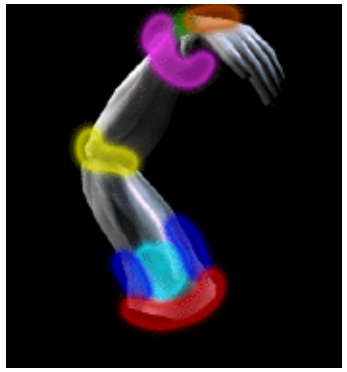
Robotics

- Robots are machines expected to do what humans do
- A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks: Robot Institute of America, 1979
- Robot arms come in a variety of shapes and sizes
- Many contain elbows, shoulders which represent: - Degrees of freedom
- Motors provide the ‘Muscles’
- Control circuit provides the ‘Brain’



Degrees of Freedom

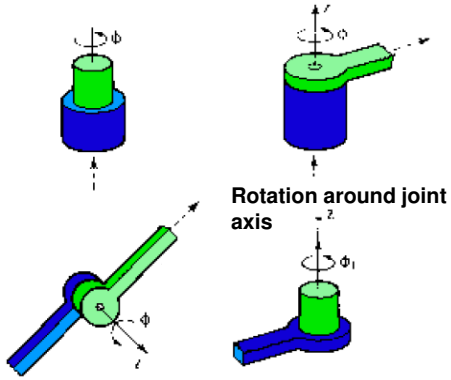
- Degree of freedom - one joint one degree of freedom
- Simple robots - 3 degrees of freedom in X,Y,Z axis
- Modern robot arms have up to 7 degrees of freedom



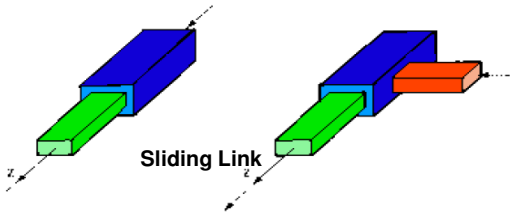
Robotic Joints

To provide a variety of degrees of freedom, different robotic joints can be used: -

- Rotary joints
  - Waist joint
  - Elbow joint

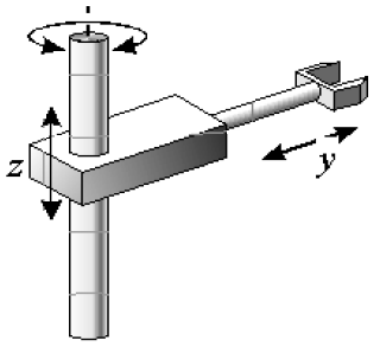


- Linear/ Prismatic joints
  - Sliding joints
  - Simple axial direction



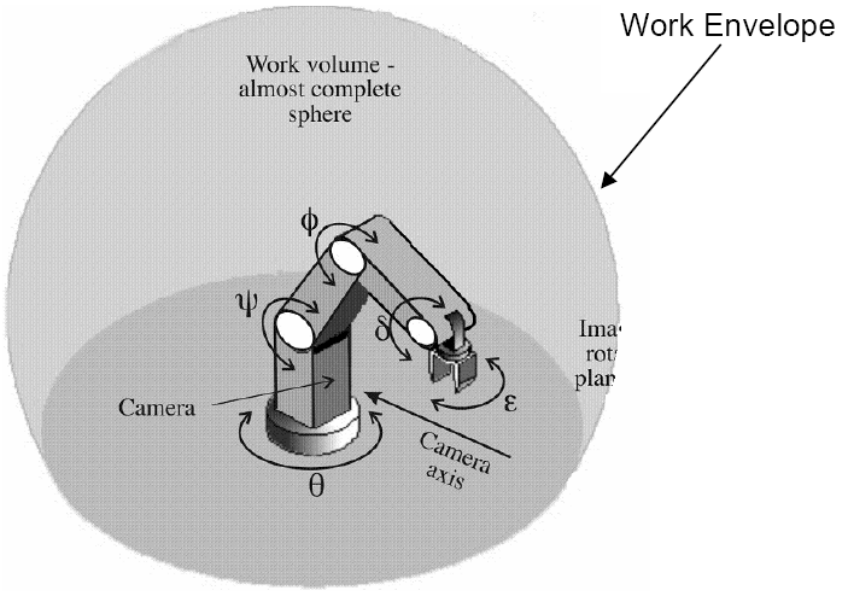
Both used together to achieve required movement i.e.

'Cylindrical Robot'



Robot ‘Work Envelope’

The volume of space in which a robot can operate is called the ‘Work Envelope’.



The work envelope defines the space around a robot that is accessible to the mounting point for the end-effector

Classification of Robots

- Robot designs fall under different coordinate systems or frames
- Depends on joint arrangement
- Coordinate system types determine the position of a point through measurement (X, Y etc.) or angles
- Different systems cater for different situations
- The three major robotic classifications are:

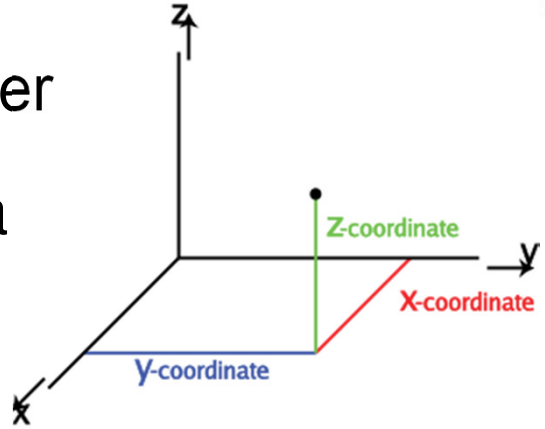
  (i) Cartesian

  (ii) Cylindrical

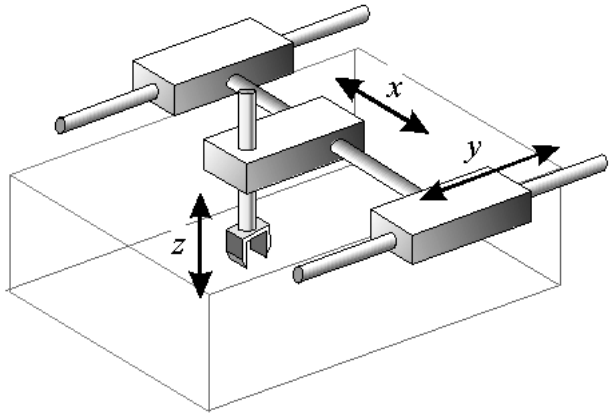
  (iii) Spherical / Polar

Cartesian Coordinate Frame

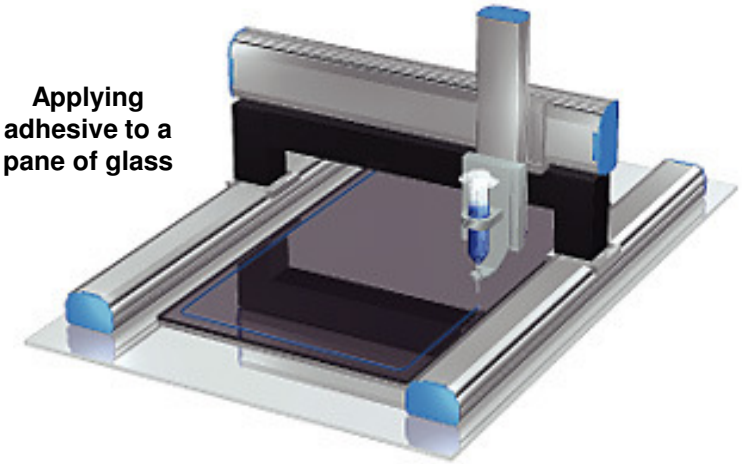
- Most familiar system
- Uses three axes at 90° to each other
- Three coordinates needed to find a point in space
- The right-hand rule.



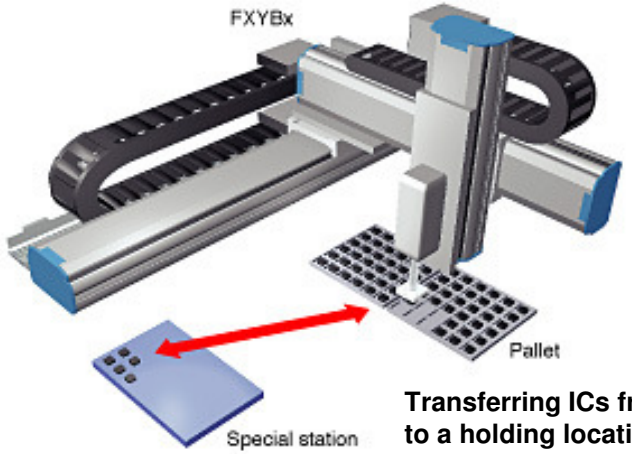
Cartesian Robot



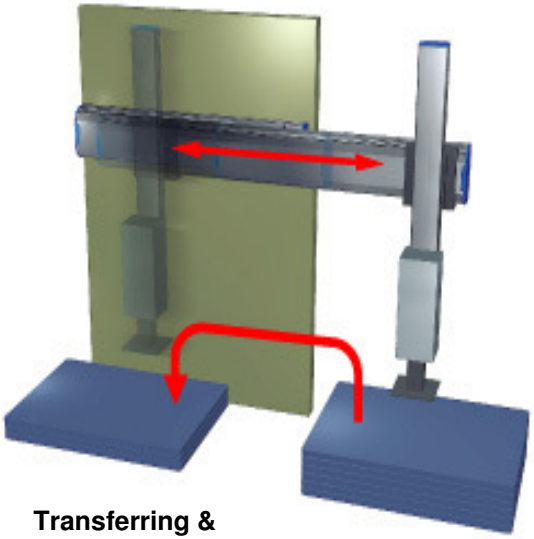
Cartesian Robot Applications



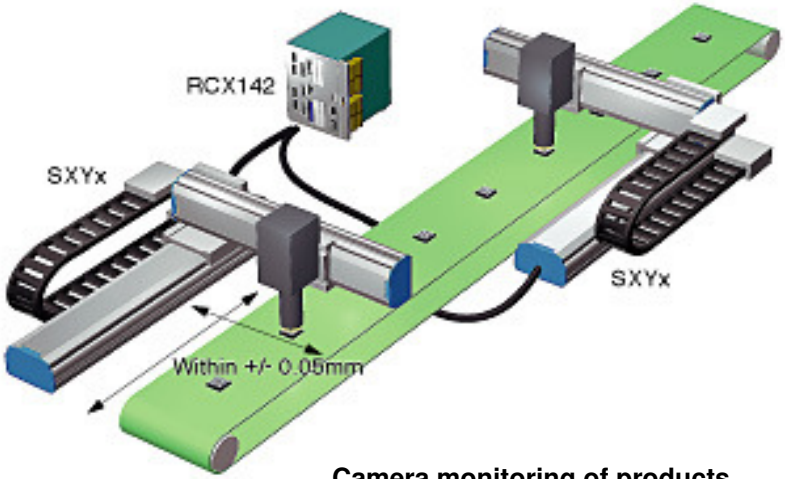
Applying adhesive to a pane of glass



Transferring ICs from a pallet to a holding location



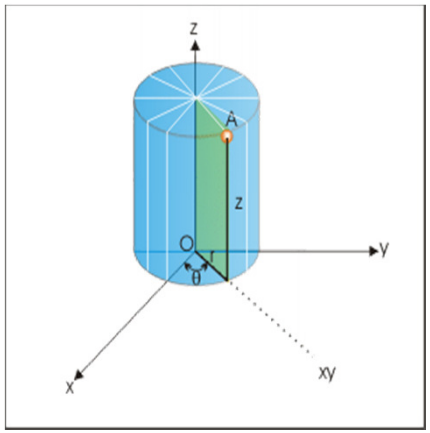
Transferring & Stacking



Camera monitoring of products

Cylindrical Coordinate Frame

- Point A- located on cylinder of known radius
- Height Z from origin
- Third point - angle on the XY plane

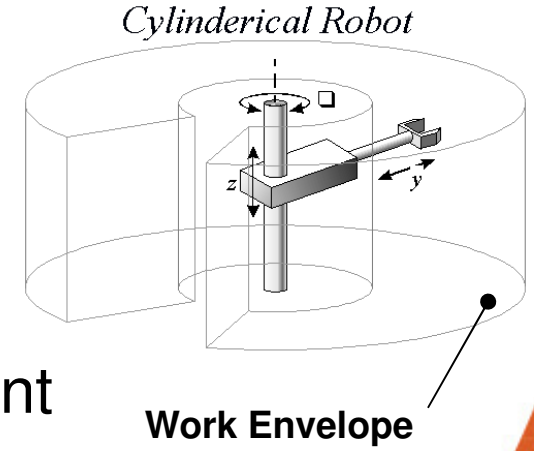


Cylindrical Robot:

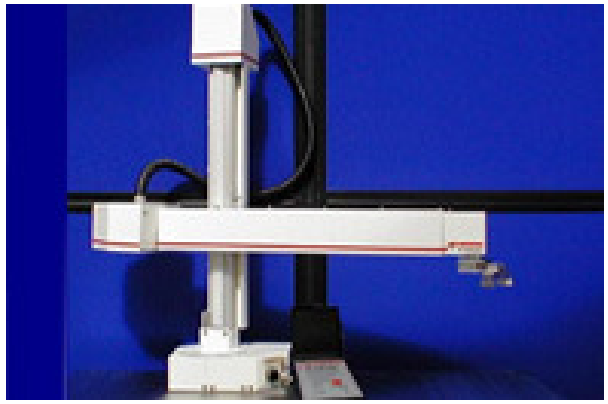
- Used mainly for assembly

  Repeatability and accuracy - Medical testing

- Two prismatic joints and one rotary joint



Cylindrical Robot Applications



Used extensively in medical research

DNA Screening

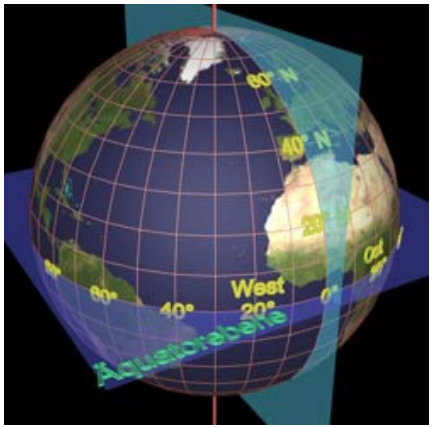
Drug Development

Toxicology

Spherical/ Polar Coordinate System

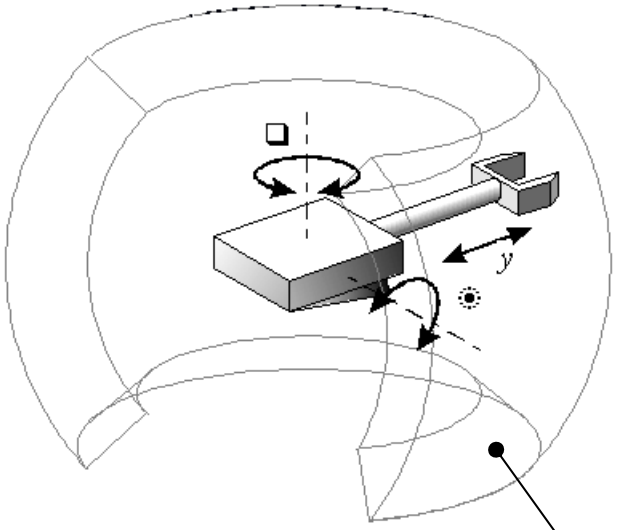
Similar to finding a point on the earth's surface

- Radius,
- Latitude
- Longitude



Spherical / Polar Robot:

- Spot, Gas and Arc Welding
- Reaching horizontal or inclined tunnels / areas



Robot sometimes known as the gun turret

Polar Robotic applications

Used extensively in the car manufacturing industry

Welding