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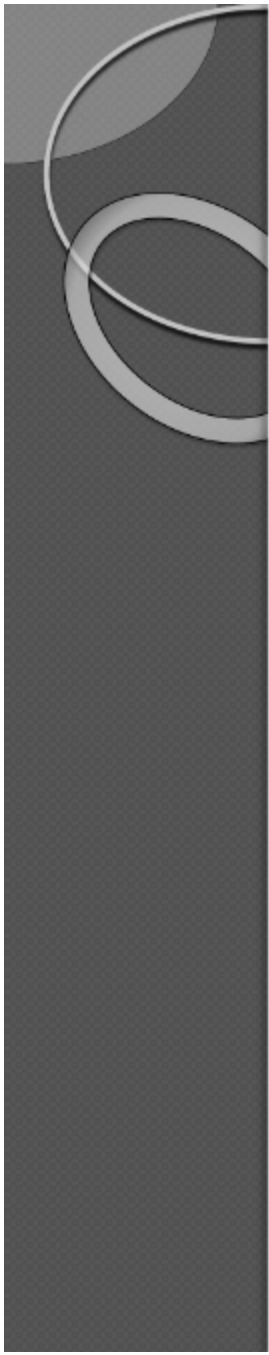
Material handling robots





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- Applications



Introduction

- Material handling is the essence of industrial robotics with most robotic applications falling within this category.
- Material handling robots can automate some of the most tedious and unsafe tasks in a production line.
- Material handling robots enhance the efficiency of production line, increase in quality of products and productivity.
- End-users deploy robots to improve throughput, quality, flexibility and consistency.

Robots

- Robot is a Machine designed to execute one or more tasks automatically by means of variable programmed motions with high speed and precision.

Material Handling Robots

- Material handling (MH) makes use of the robot's simple capability to transport objects. By fitting the robot with an appropriate end of arm tool (e.g. gripper), the robot can efficiently and accurately move product from one location to another.





Need to replace human by robots

- Work environment hazardous for human beings
- Repetitive tasks
- Boring and unpleasant tasks
- Multi-shift operations
- Infrequent changeovers
- Operating for long hours without rest



Applications

- Part Transfer
- Packaging
- Palletizing
- Machine Loading
- Machine Tending



Part Transfer

- Though part transfer was once done entirely by hand, companies have now converted to robot part transfer systems as a way to save on labor costs and speed up production processes.
- Part transfer automation also increases accuracy and precision, which helps shops to create a better product.



Packaging

- Packaging robots are very flexible.
- By adjusting the end-of-arm-tooling, a robot can complete any packaging process.
- In fact, many manufacturing managers see robot packaging as a necessity.
- Packaging robots offer companies savings on labour costs, as well as higher ROI (return on investment) with the increase in productivity.



Palletizing

- Industrial palletizing refers to loading and unloading parts, boxes or other items to or from pallets.
- Robot palletizing can be seen in many industries including food processing, manufacturing, and shipping.



Machine Loading & Tending

- Machine loading involves loading a part onto a machine.
- Machine tending refers to overseeing a machine while it performs a job, as well as the process of feeding parts in and out.
- This applications can sometimes be a dangerous work environment.
- By using industrial robots to automate the machine loading & Tending process, you can protect workers from injury while increasing your part cycle time
- Machine loading & Tending robots work efficiently, tirelessly, and accurately. They do not need breaks, days off or vacations.

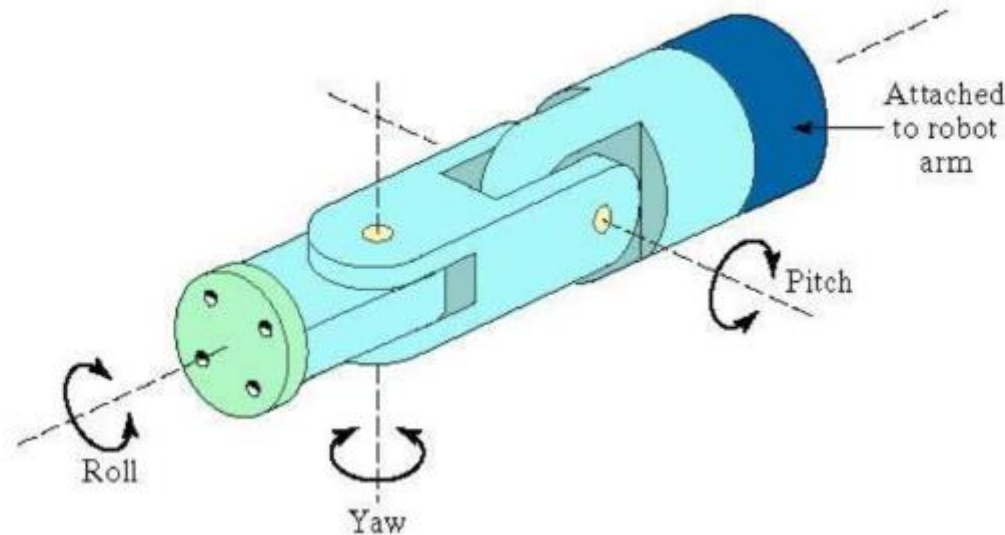


General Considerations

- If a robot has to transfer parts or load a machine, then the following points are to be considered.
 1. Part Positioning and Orientation
 2. Gripper design
 3. Minimum distances moved
 4. Robot work volume
 5. Robot weight capacity
 6. Accuracy and repeatability
 7. Robot configuration

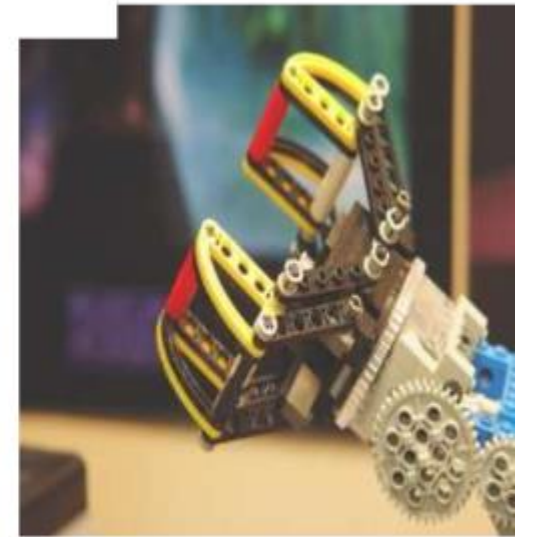
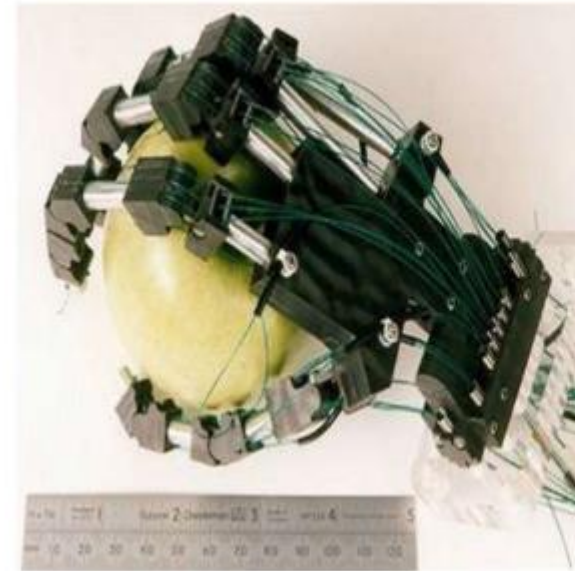
Part Positioning and Orientation

- Wrist assembly is attached to end-of-arm
- End effectors is attached to wrist assembly
- Function of wrist assembly is to **orient end effectors**
- Body-and-arm determines **global position of end effectors**
 - Two or three degrees of freedom:
 - Roll
 - Pitch
 - Yaw



End Effectors

- The special tooling for a robot that enables it to perform a specific task
- Two types:
 - Grippers –
 - Tools –





Minimum distances moved

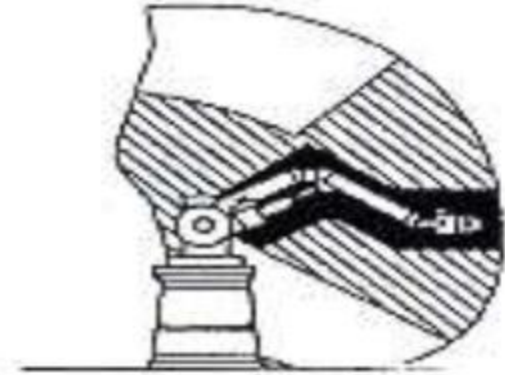
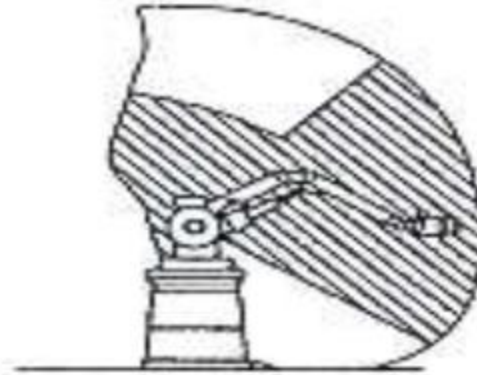
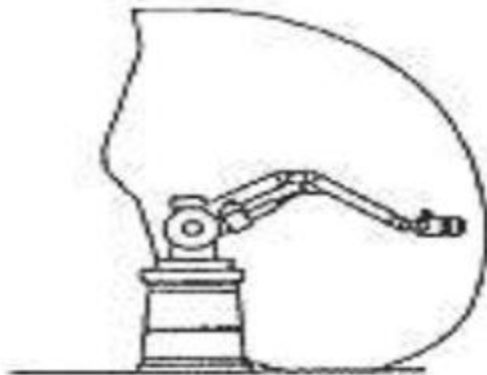
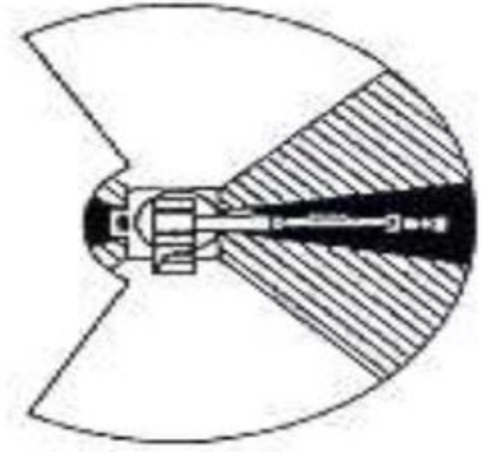
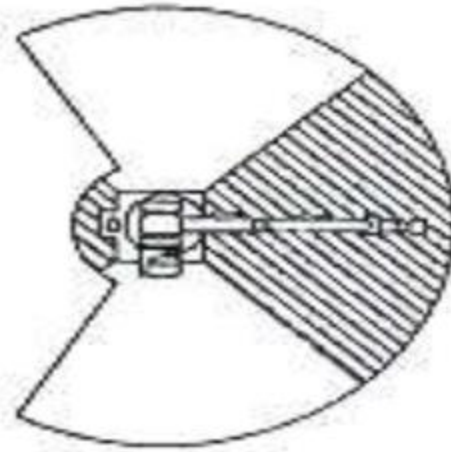
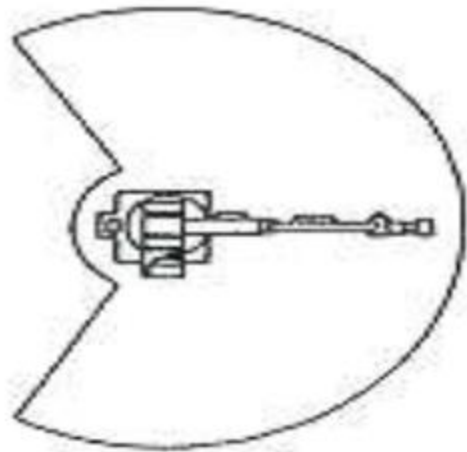
- **Spatial Accuracy** – It refers to the smallest increment of motion at the wrist that can be controlled by the robot. It is sum of the control resolution and mechanical accuracies. The arm movement must be divided into its basic motions and the resolution of each degree of freedom is figured separately.

Robot work volume

□ Maximum Envelope

▨ Restricted Envelope

■ Operating Envelope





Robot weight capacity

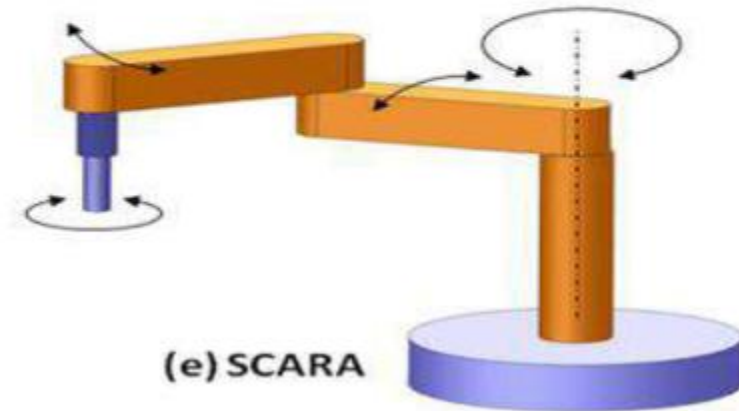
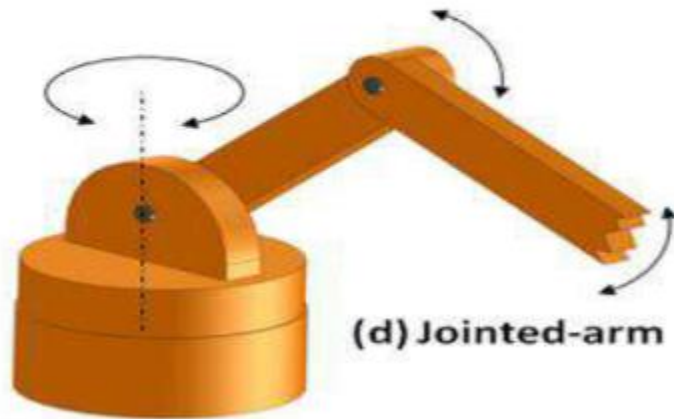
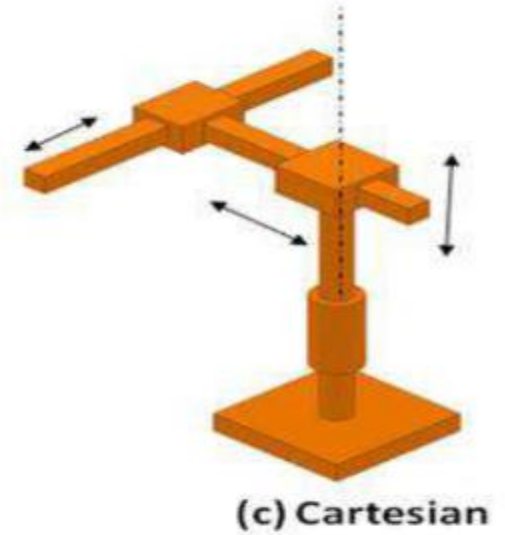
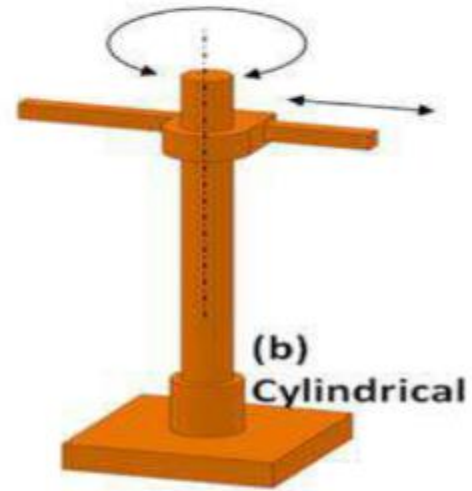
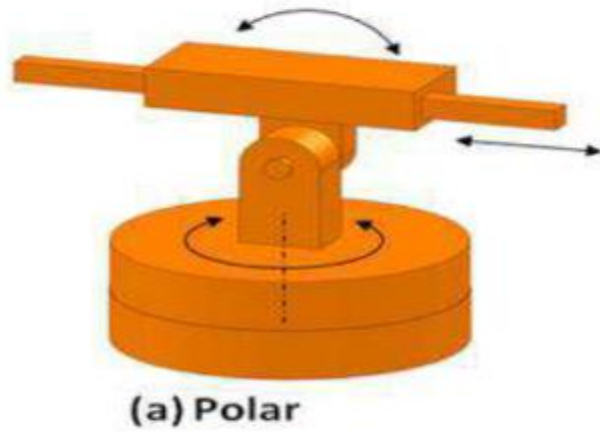
- **Payload** - The weight capacity of each robot and includes the tooling weight as well.
- **Robot Mass** - Every robot has a specific weight or mass.



Accuracy and repeatability

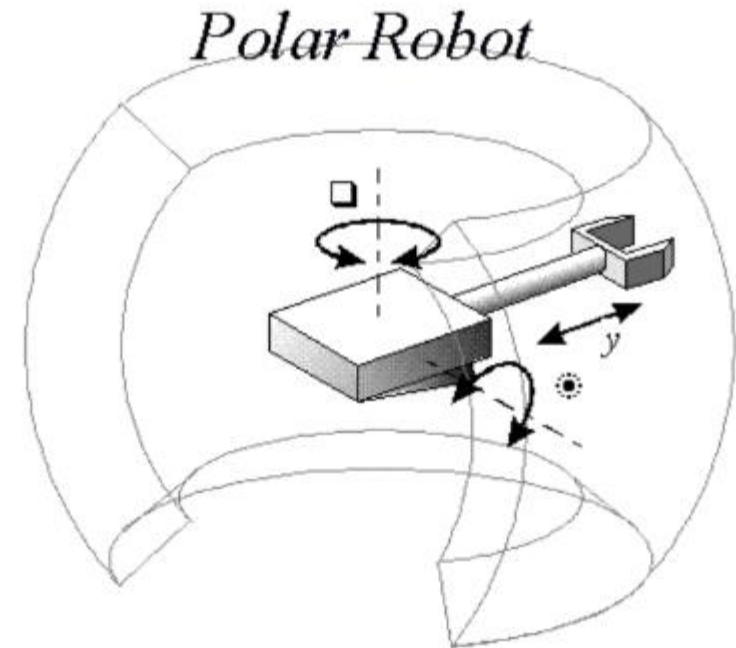
- **Accuracy** – the accuracy of the robot is its capability to position its wrist end at a given point within its work volume.
- **Repeatability** - Ability to return to an exact location again and again, known as a robot's repeatability.

Robot configuration



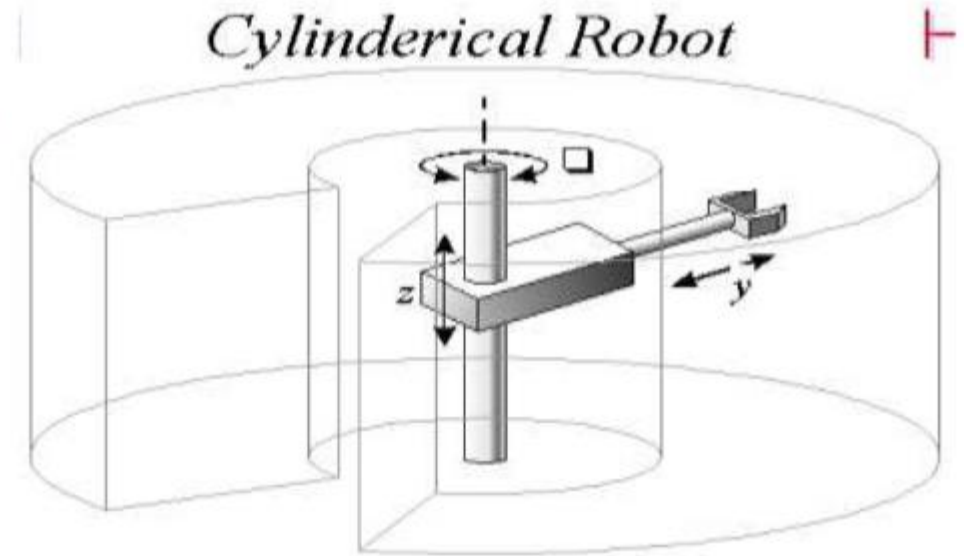
Polar

- Used for handling at machine tools, spot welding, die-casting, fettling machines, gas welding and arc welding. It's a robot whose axes form a polar coordinate system.
 1. sliding arm (L - joint)
 2. vertical axis (T - joint)
 3. horizontal axis (R - joint)



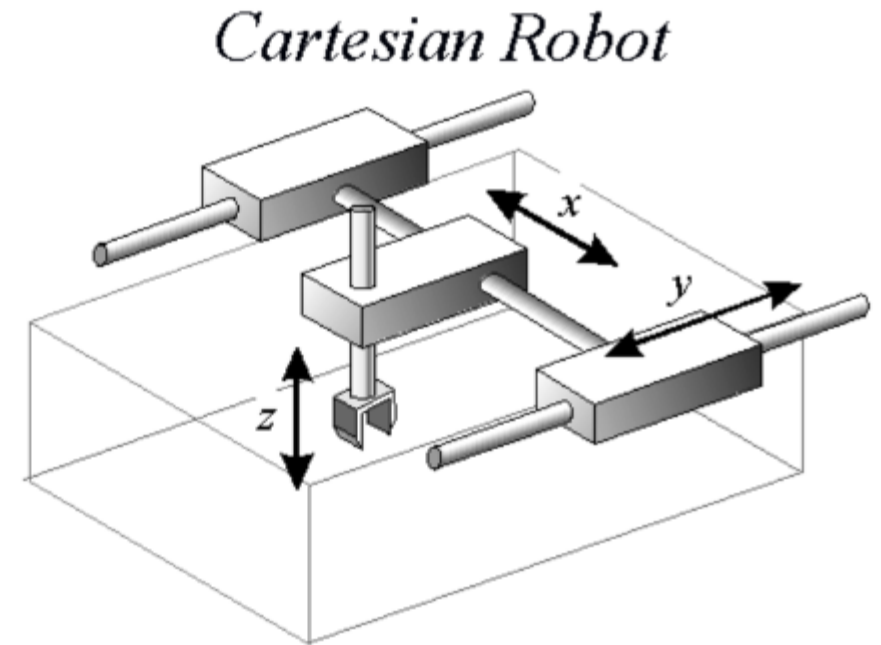
Cylindrical

- Used for assembly operations, handling at machine tools, spot welding, and handling at die-casting machines. It's a robot whose axes form a cylindrical coordinate system.
 1. Vertical column(T - joint)
 2. Arm assembly(L - joint)
 3. Arm(O - joint)



Cartesian

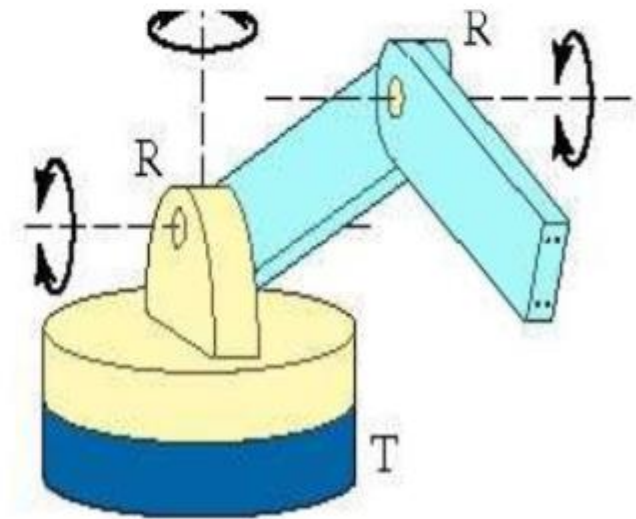
- A type of robotic arm that has prismatic joints only.
- The linear movement of the joints gives the Cartesian robot a highly rigid structure that allows it to lift heavy objects.
- Three sliding joints
 1. Z- (L - joint)
 2. X- (O - joint)
 3. Y- (O - joint)



Jointed-arm robot

- Used for assembly operations, die-casting, fettling machines, gas welding, arc welding and spray painting.

1. T - joint
2. R - joint
3. R - joint



SCARA

- SCARA - Selectively Compliant Assembly Robot Arm
- Used for pick and place work.

1. V - joint
2. R - joint
3. O - joint

