Lecture 7

Kinematic Parameters

Presented By

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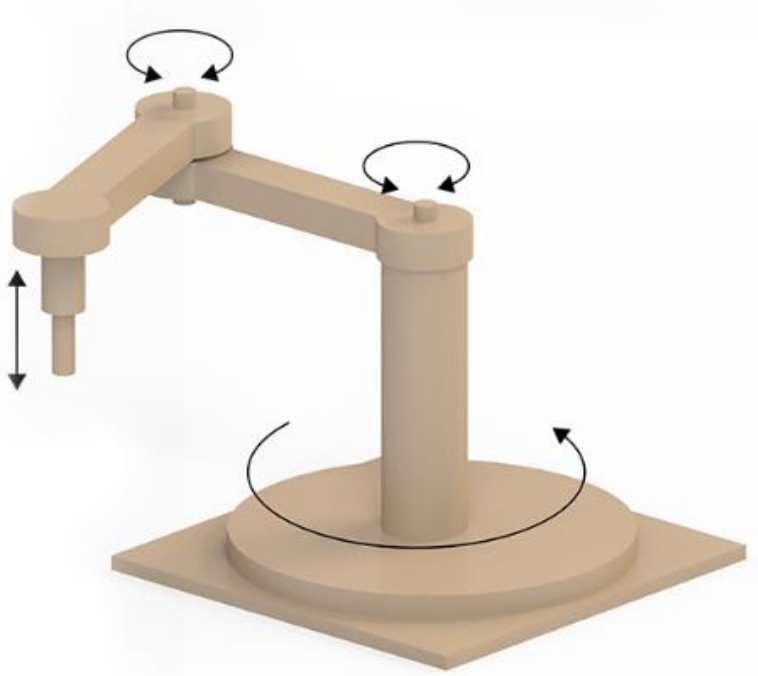
SCARA (Selective Compliance Assembly Robot Arms)

- 2R (rotary) joints and 1P (prismatic) joint.
- High speed in the horizontal.
- High forces within the vertical direction.

Applications:

- pick and place tasks.
- Handling machine tools.
- Product assembly.



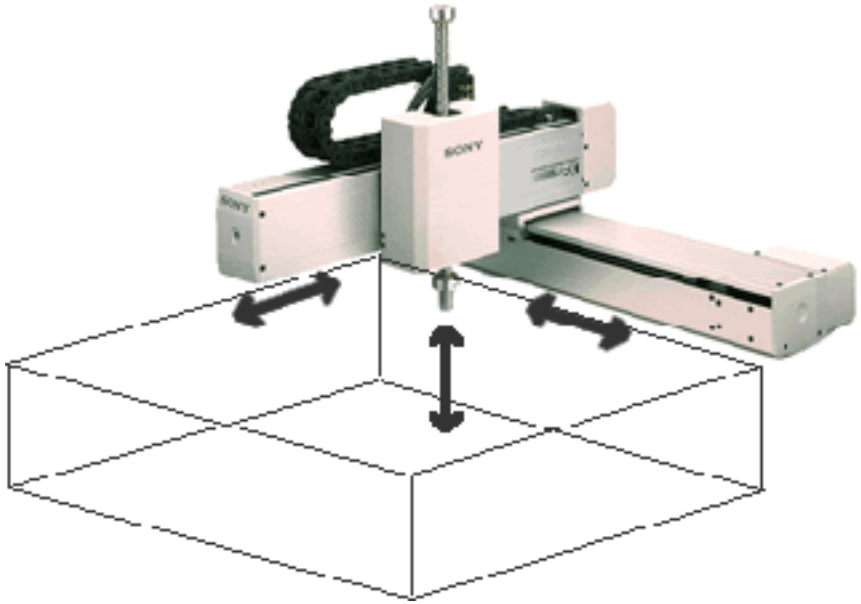
Scara

Cartesian Robot

- Three sliding joints for constructing the XYZ axes.
- 3 intersecting perpendicular straight lines used to model the arm movement of a robot using the Cartesian configuration.

Application:

- CNC(Computer numerical control) Machine tooling.
- 3D Painting.
- Packaging automation.



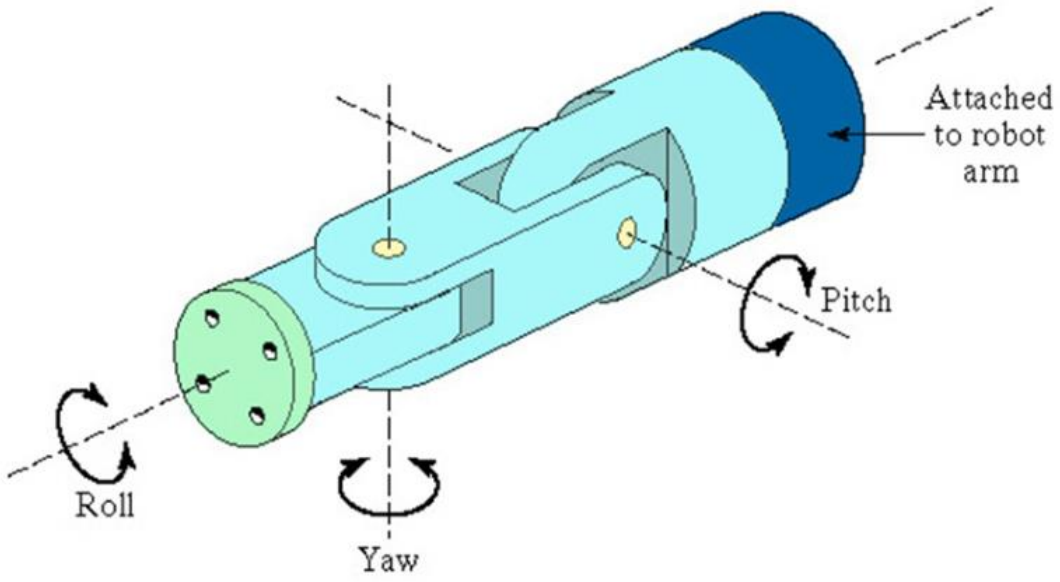
Wrist Configuration

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

Wrist Configuration

Typical wrist assembly has two or three degrees-of-freedom (shown is a three degree-of freedom wrist).

- Notation :RRR



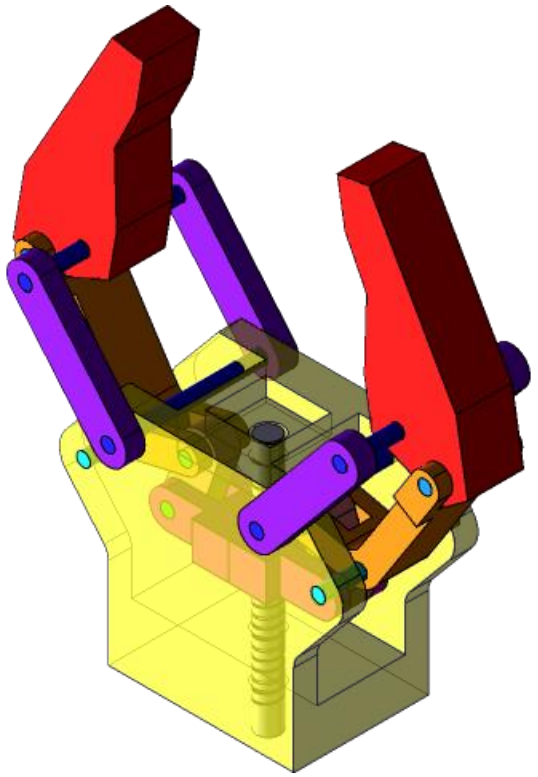
- Roll- This is also called wrist swivel, this involves rotation of the wrist mechanism about the arm axis.
- Pitch- It involves up & down rotation of the wrist. This is also called as wrist bend.
- Yaw- It involves right or left rotation of the wrist.

End Effector

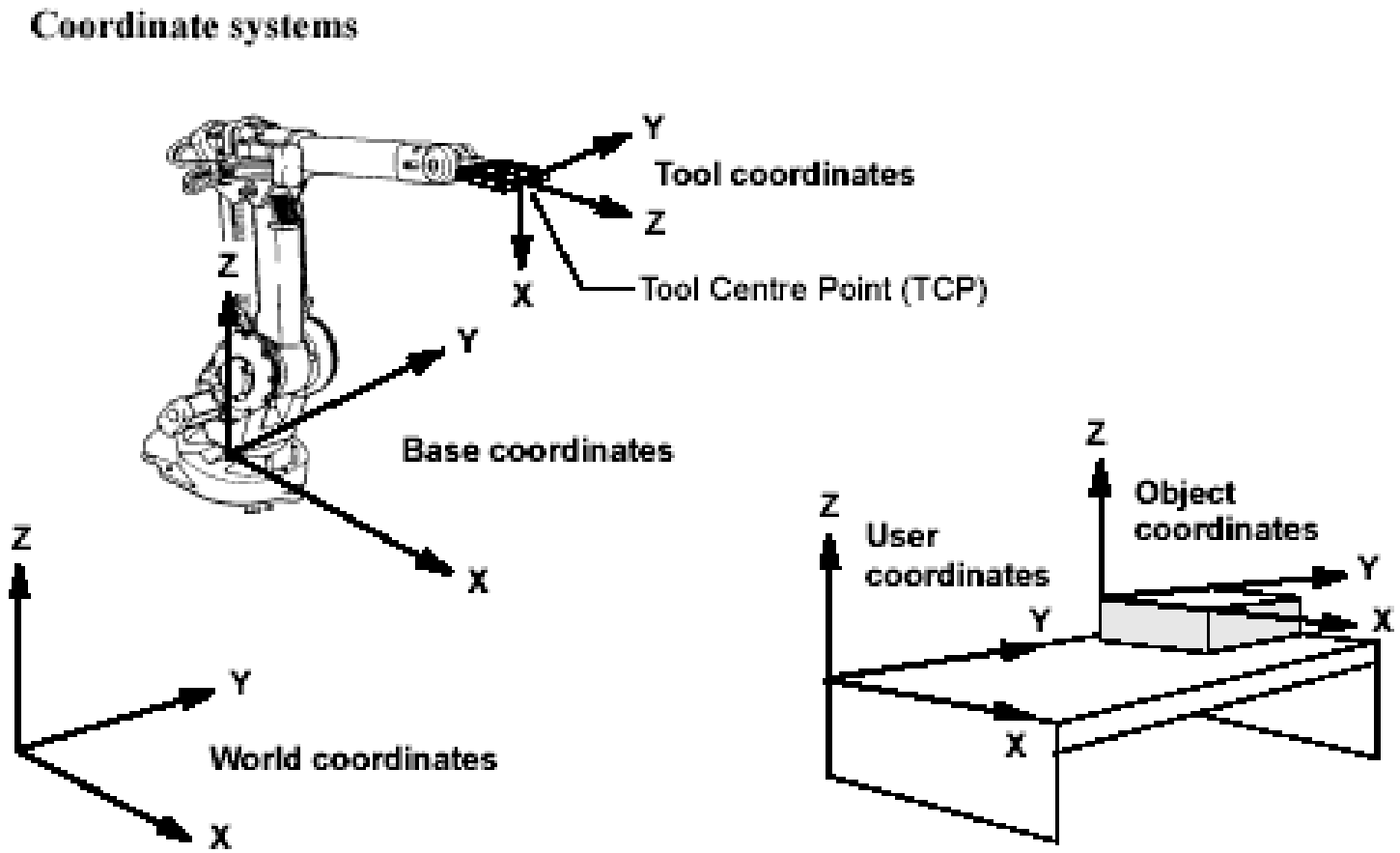
- The special tooling for a robot that enables it to hold materials or perform a specific task.

Categorized in 2 major types:

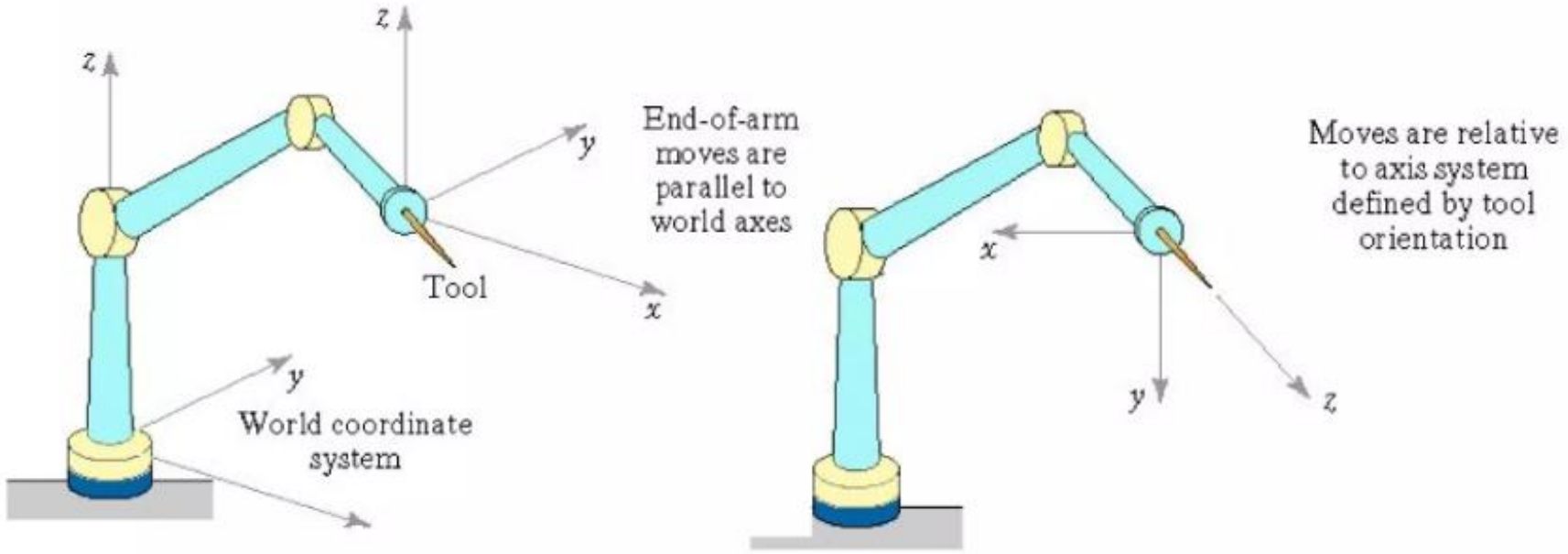
  - Grippers - to grasp and manipulate objects (e.g. parts) during work cycle
  - Tools- to perform a process, e.g., spot welding, spray painting



Coordinate System of Robot



Coordinate System of Robot



World coordinate system

- Origin and axes of robot manipulator are defined relative to the robot base

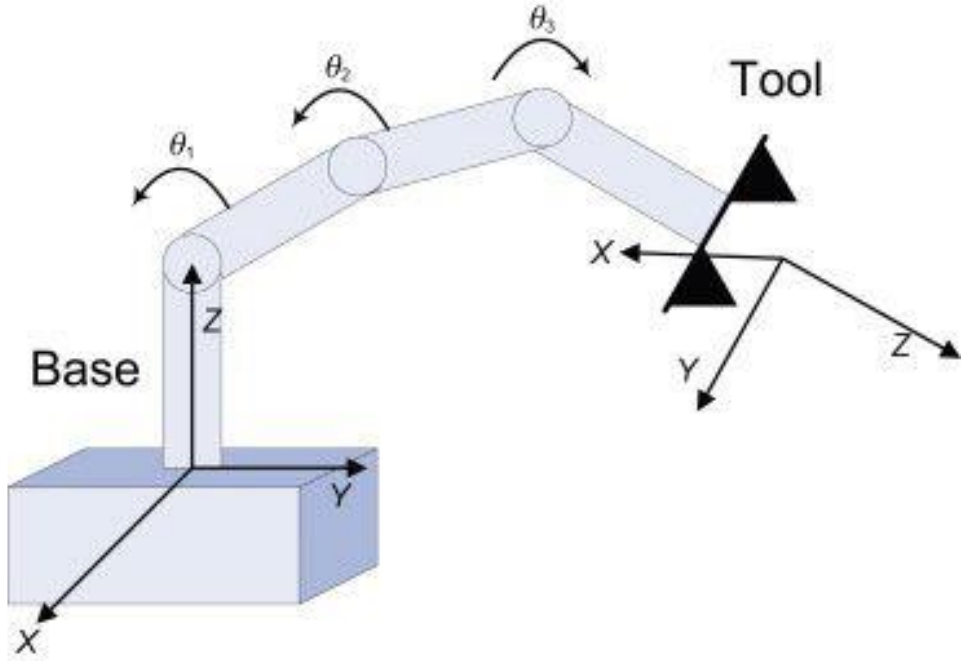
Tool coordinate system

- Moves are relative to axis system defined by tool orientation
- Alignment of the axis system is defined relative to the orientation of the wrist faceplate (to which the end effector is attached)

Forward(direct) kinematics

Forward kinematics refers to the use of the kinematic equations of a robot to compute the position of the end-effector from specified values for the joint parameters.

- In order to manipulate objects in space, it is required to control both the position and orientation of the tool/end effector in three- dimensional space.
- A relationship between the joint variables and the position and orientation of the tool is to be formulated.



Links And Joints

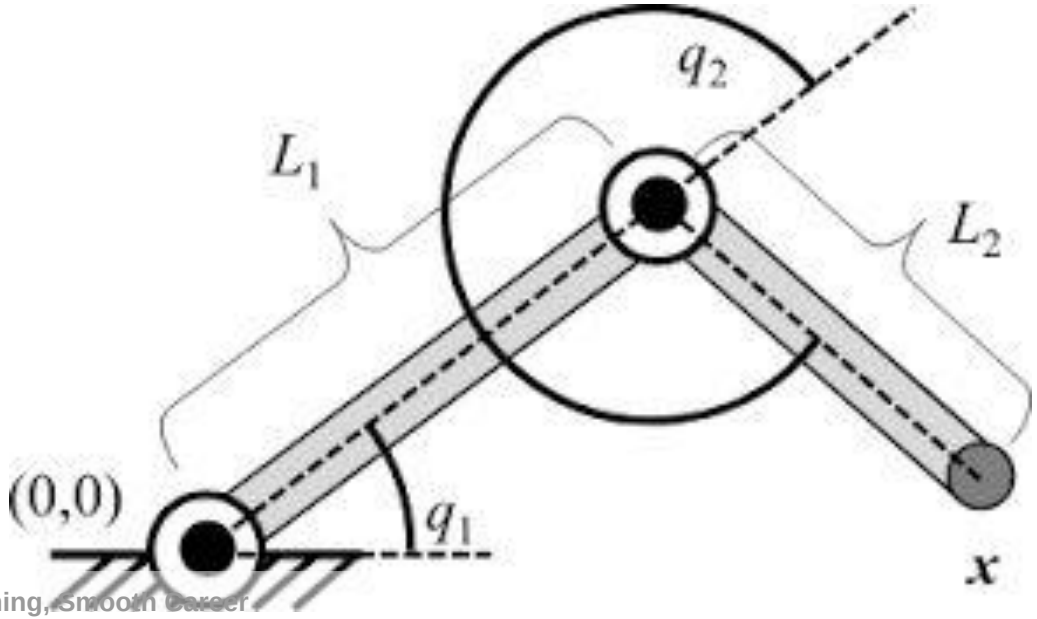
- A link is a solid mechanical structure connecting two joints
- A joint provides relative motion between links

Link Parameters-

- Length, twist angle, joint angle, distance

Joint Variable-

- Link parameter that is variable



Thank You!