

# MECHANICAL ENGINEERING SCIENCE

## INTRODUCTION TO MECHATRONICS AND ROBOTICS

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### INTRODUCTION TO INDUSTRIAL ROBOTICS

- An industrial robot is a general purpose, programmable machine possessing certain *anthropomorphic characteristics*.
- The most obvious anthropomorphic characteristic of an industrial robot is its mechanical arm, that is used to perform various industrial tasks.
- Other human like characteristics are the robot's capability to respond to sensory inputs, communicate with other machines and make decisions. These capabilities permit robots to perform a variety of useful tasks.



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Reasons for the commercial and technological importance of industrial robots include the following

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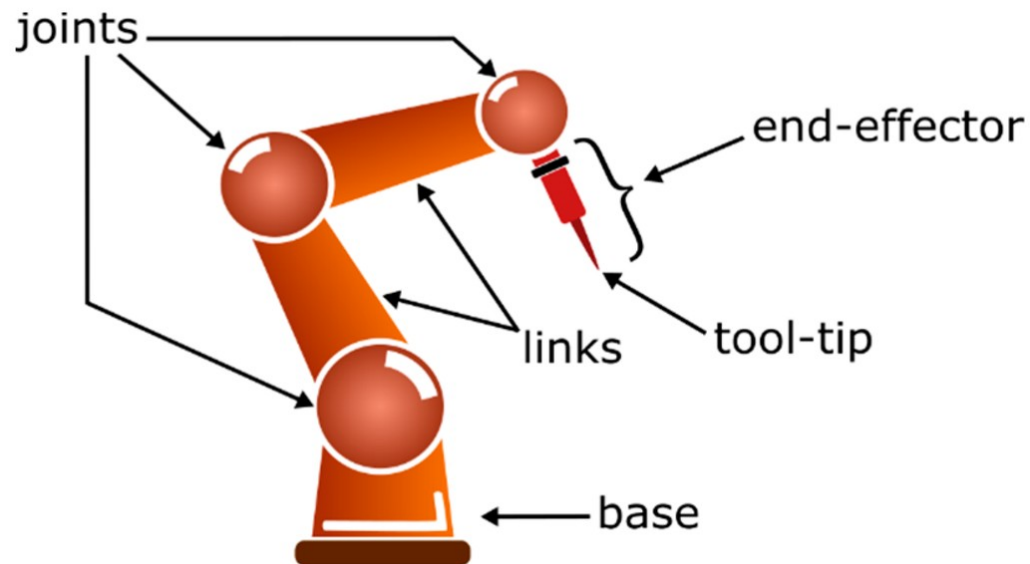
- 1) Robots can be substituted for humans in **hazardous or uncomfortable work environments**.
- 2) A robot performs its work cycle with a **consistency and repeatability** that cannot be attained by humans.
- 3) Robots can be **reprogrammed**. When the production run of the current task is completed, a robot can be reprogrammed and equipped with necessary tooling to perform an altogether different task.
- 4) Robots are controlled by computers and can therefore be connected to other computer systems to achieve **computer integrated manufacturing**.

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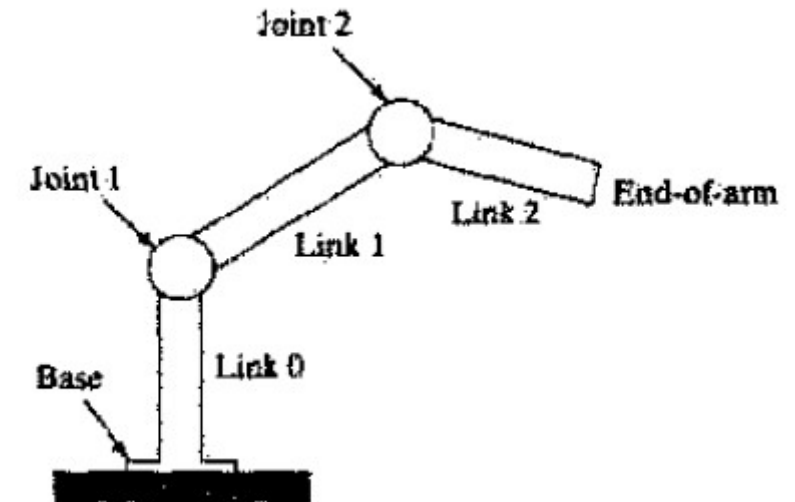
### Robot Anatomy

- The manipulator of an industrial robot is constructed of **a series of joints and links**. Robot anatomy is concerned with the types and sizes of these joints and links and other aspects of the manipulator's physical construction. \_



### Joints and Links

- A joint of an industrial robot is similar to a joint in the human body. It provides relative motion between two parts of the body.
- Connected to each joint are two links, **an input link and an output link**. Links are the rigid components of the robot manipulator.
- The purpose of the joint is to provide controlled relative movement between the input link and the output link.



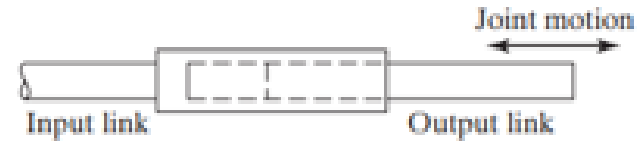
*Most robots are mounted on a stationary base on the floor. Let us refer to that base and its connection to the first joint as link 0. It is the input link to joint 1, the first in the series of joints. The output link of joint 1 is link 1. Link 1 is the input link to joint 2, whose output link is link 2 and so forth.*

### Types of Joints

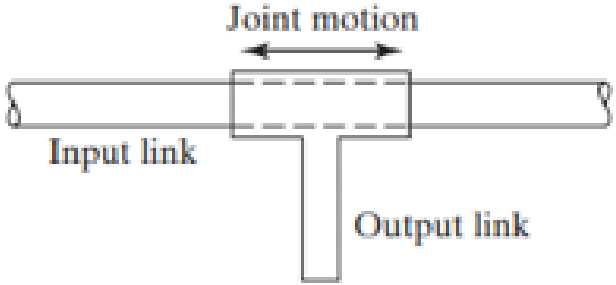
➤ Nearly all industrial robots have mechanical joints that can be classified into one of five types: two types that provide translational motion and three types that provide rotary motion. The five joints are:

- **Rotational joint**
- **Linear joint**
- **Twisting joint**
- **Orthogonal joint**
- **Revolving joint**

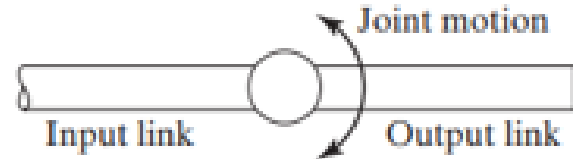
### Types of Joints

JOINT	DESCRIPTION	SCHEMATIC
Linear joint	<b>Type L</b> joint; the relative movement between the input link and the output link is a translational sliding motion, with the axes of the two links parallel	

### Types of Joints

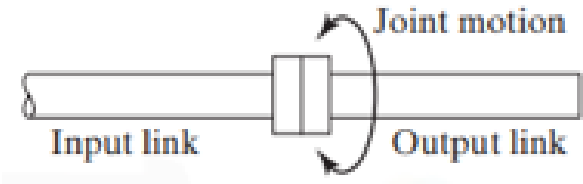
JOINT	DESCRIPTION	SCHEMATIC
Orthogonal joint	<b>Type O</b> joint; the relative movement between the input link and the output link is a translational sliding motion, but the output link is perpendicular to the input link	

### Types of Joints

JOINT	DESCRIPTION	SCHEMATIC
Rotational joint	<b>Type R</b> joint; this provides rotational relative motion, with the axis of rotation perpendicular to the axes of the input and output links	



### Types of Joints

JOINT	DESCRIPTION	SCHEMATIC
Twisting joint	<b>Type T</b> joint; this provides rotary motion, but the axis of rotation is parallel to the axes of the two links	

### Types of Joints

JOINT	DESCRIPTION	SCHEMATIC
Revolving joint	<b>Type V</b> joint; the axis of the input link is parallel to the axis of rotation of the joint, and the axis of the output link is perpendicular to the axis of rotation	