# Introduction to Robotics

## Types / Classification of Robot

# Classification by complexity

Robots are generally classified into three categories based on their complexity.

✓ **Simple level Robots-** These are automatic machines which do not contain complex circuit. They are developed just to extend human potential.

✓ **Middle level Robots**– These robots are programmed but can never be reprogrammed. These robots contain sensor based circuit & can perform multiple tasks.

✓ **Complex level Robots-** These robots are programmed and can be reprogrammed as well. They contain complex model based circuit.

# Classification as per Application

1. **Industrial**: Industrial robots are generally fixed manipulators which perform in various working environments. They perform various general-purpose tasks like Welding, Painting, assembling, etc.

2. **Non-Industrial or Special Purpose:** These are robots which assist humans in their chores

   ❖ **Medical:** There has been an increasing use of robots in the medical field for surgery, rehabilitation and training. Medical robots are not meant to replace the surgeons but serve as a surgical assistant to the surgeon.

   ❖ **Space:** With the advent of robotic technologies, the exploration of various celestial bodies has been a reality. Tasks like space manipulation, surface mobility, and scientific experiments are performed by space robots.

# Classification as per Application

❖ **Defense Robots:** These include bomb disposal robots, transportation robots and reconnaissance drones. Equipped with infrared sensors, these robots react more rapidly than humans in emergency and hazardous situations.

# Classification as per Application

❖ **Security Robots:** These robots are used for surveillance and guarding large civilian facilities.

# Classification as per Application

❖ **Domestic:** These robots are used to perform daily tasks at home, such as robotic vacuum cleaner, cleaning robots.

# Classification as per Application

❖ **Entertainment:** These robots are used in various entertainment places like amusement parks, joy rides, sports, etc. Examples include KUKA Robocoaster (amusement ride robot), Honda's Asimo, Sony's Aibo, Aplha etc.

# Classification as per Application

**2. Non-Industrial or Special Purpose:** These are robots which assist humans in their chores

- ❖ **Medical:** There has been an increasing use of robots in the medical field for surgery, rehabilitation and training. Medical robots are not meant to replace the surgeons but serve as a surgical assistant to the surgeon.
- ❖ **Space:** The robots that works for space manipulation, surface mobility and scientific experiments are performed by space robots.
- ❖ **Defense Robots:** These include bomb disposal robots, transportation robots and reconnaissance drones. Equipped with infrared sensors, these robots react more rapidly than humans in emergency and hazardous situations.
- ❖ **Security:** These robots are used for surveillance and guarding large civilian facilities such as Power generating plants, oil refineries, etc which are under threat from terrorists. An example is DRDO's NETRA (An Unmanned Aerial Vehicle)
- ❖ **Domestic:** These robots are used to perform daily tasks at home, such as robotic vacuum cleaner, cleaning robots.
- ❖ **Entertainment:** These robots are used in various entertainment places like amusement parks, joy rides, sports, etc. Examples include KUKA Robocoaster (amusement ride robot), Honda's Asimo, Sony's Aibo, etc.

# Classification of Robots

**Classification by Degrees of Freedom**

Degrees of freedom refers to the different directions a robotic arm can move. They represent the location as well as the orientation of an object. Basically, such type of robots is pick and place robots, which pick and place the objects on a location and with an orientation.

> **3 Degrees of Freedom:** A robot with 3 degrees of freedom can only pick up the object and place it anywhere in its workspace, using the 3 different coordinate axes.

> **6 Degrees of Freedom:** A robot with 6 degrees of freedom can pick the object and place it anywhere in its workspace, at any orientation.

**Other Degrees of Freedom:** A robot with degrees of freedom other than 3 or 6 has restricted movement in either linear or angular direction. In other words, it may orientate the object in any desired direction , but can place the object in only limited directions.

However, a robot with higher degrees of freedom – say 7, can have infinite possible ways to place as well as orientate the object.
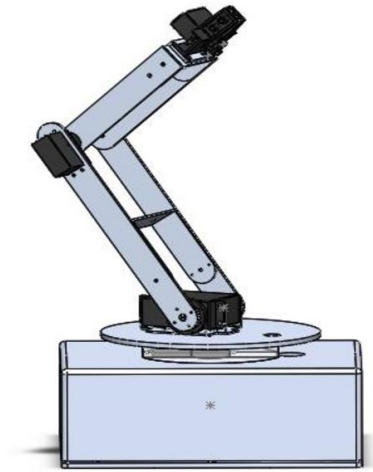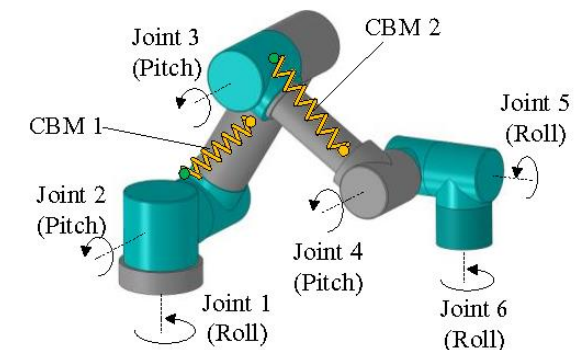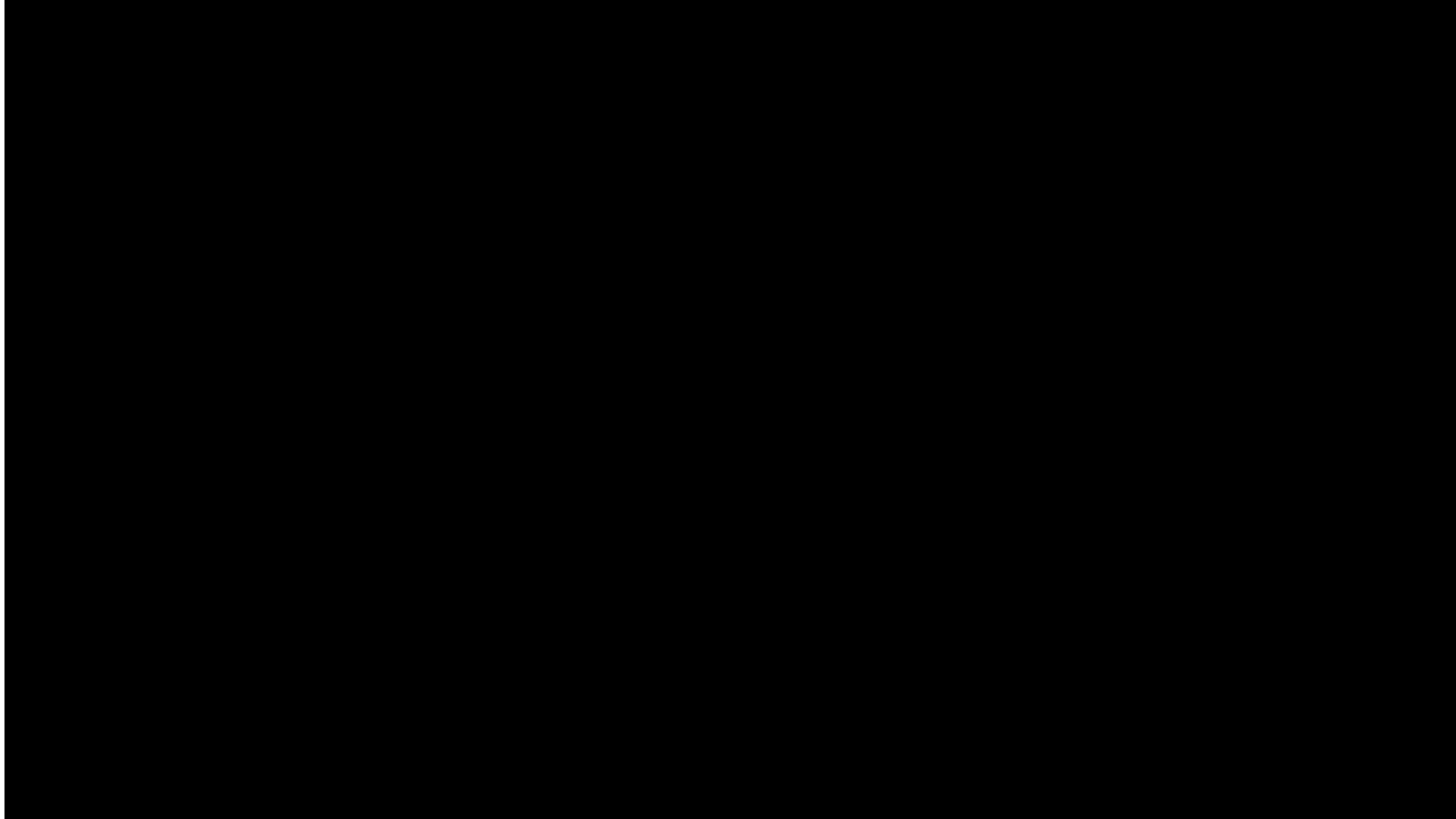
1: A SolidWorks model of the considered 3 DO

Figure 1. Schematic structure of a collaborative robot

# Robot-DOF

# Thank You