

1 2 industrial robots definition and classification

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Industrial Robots: Classifications, Types, and Applications

Definition of an Industrial Robot

An industrial robot is an automated, programmable machine designed to perform tasks typically handled by humans in industrial settings. It consists of a mechanical structure, sensors, and an advanced control system.

Classifications of Industrial Robots

1. By Functionality:

- **Material Handling Robots:** lift, transport, and move materials.
- **Assembly Robots:** assemble components or products.
- **Welding Robots:** weld metal parts together.
- **Painting Robots:** apply paint or other coatings.
- **Inspection Robots:** inspect products for defects.

2. By Control System:

- **Manual Control:** Operated directly by a human operator.
- **Programmable Control:** Controlled by pre-programmed instructions.

- **Autonomous Control:** Robots that operate independently with minimal human intervention.

3. By Structure:

- **Articulated Robots:** Have multiple joints that allow them to move in various directions.
- **Cartesian Robots:** Move along three linear axes (X, Y, Z).
- **Cylindrical Robots:** Move in a cylindrical coordinate system.
- **Spherical Robots:** Move in a spherical coordinate system.
- **SCARA Robots:** Selective Compliance Assembly Robot Arms that are designed for assembly tasks.

Types of Industrial Robots

1. Fixed-Base Robots: Mounted on a fixed base, with a limited range of motion. **2. Mobile Robots:** Can move independently within a workspace, often using autonomous navigation systems. **3. Collaborative Robots (Cobots):** Designed to work alongside humans, without the need for safety barriers.

Industrial Automation Classifications

Industrial automation systems are classified into two main types:

- **Fixed Automation:** Dedicated to performing a specific task repetitively, with limited flexibility.
- **Programmable Automation:** Can be reprogrammed to perform different tasks, offering greater flexibility.

Applications of Industrial Robots

Industrial robots are used in various industries, including:

- Manufacturing
- Automotive

- Electronics
- Healthcare
- Aerospace

Classification of Robots by Control System

- **Manually Controlled:** Robots operated directly by a human operator using a controller.
- **Programmable Control:** Robots that execute predefined programs and can be reprogrammed.
- **Autonomous Control:** Advanced robots capable of self-navigation and decision-making.

First Definition of a Robot

The term "robot" was coined by Czech playwright Karel Capek in his 1920 play "R.U.R." (Rossum's Universal Robots), where it referred to artificial humans.

Most Common Type of Industrial Robot

The most common type of industrial robot is the articulated robot, which offers flexibility and maneuverability due to its multiple joints.

Robotic Process Automation Classifications

- **Attended RPA:** Humans interact with the robots in real-time.
- **Unattended RPA:** Robots operate autonomously without human intervention.

Classification of Robotic Process Automation (RPA)

- **Rule-Based RPA:** Follows predefined rules and logic.
- **Cognitive RPA:** Uses AI and machine learning to automate complex tasks.

Classification of Robot Control Systems

- **Open Loop:** The robot's output is not fed back into the control system.
- **Closed Loop:** The robot's output is used to adjust its control system, providing more accurate performance.

Classification of Robots in Kinematics

- **Serial Robots:** Joints are connected in a linear or branching chain.
- **Parallel Robots:** Joints are connected in closed loops, providing increased stability and accuracy.

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