MORE THAN A MANIPULATOR

Introduction to Industrial Robots

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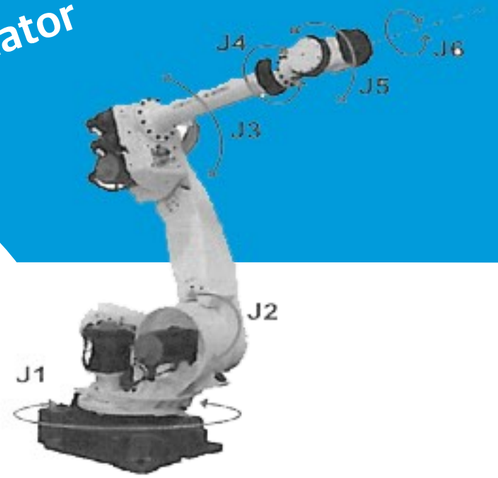
Most people, when they first see a robot, identify the manipulator as the robot, but a robot is much more than only a manipulator.

More than a manipulator



MANIPULATOR

The manipulator consist of joints and links.

1. Joints provide relative motion
2. Links are rigid members between joints
3. Various joint types: linear and rotary
4. Each joint provides a “degree of Freedom
5. Most robots possess 3 or more degrees of freedom.

A manipulator consists of two section:

1. Body and Arm – For positioning the object in the robot’s workspace.
2. Wrist assembly – For the orientation of the object.

The manipulator is driven by servomotors. The area at each junction is called a joint, or axis. In the popular industrial 6-axis robot the first three axes are usually called the major axes (ex. J1, J2, and J3). The second three are called the minor axes (ex. J4, J5, and J6).

More than a manipulator

MANIPULATOR

Since people tend to use the shortest word form to convey an idea, the manipulator is no identified as the “Robot”.

Most industrial robots have 6 degrees of freedom (6-axis) with each axis typically driven by an AC servomotor. Each motor uses a Serial Pulse Coder to determine its position.

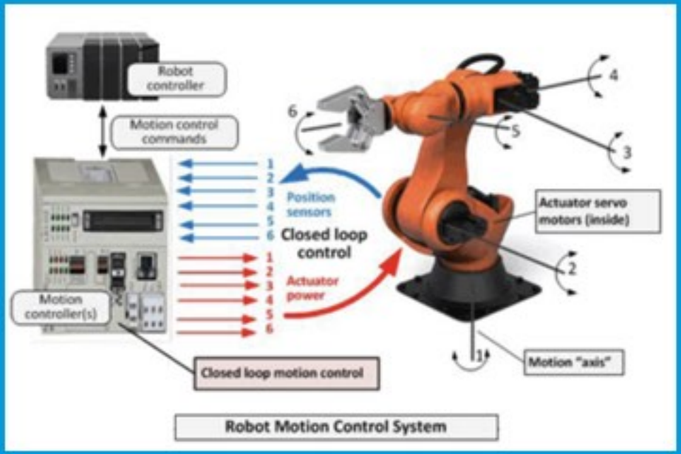
These encoders are direct descendants of the original encoder developed by Unimation. Most of the servo motors also have an internal brake that is applied mechanically and released electrically by a signal from the servo amplifier.

It is also possible to add external axes to the robot to increase the workspace of the manipulator.

CONTROLLER

The controller consists of a computer with memory, power supply, operator controls and control circuitry. The controller’s computer memory stores the application software, as well as user-defined programs and data. There are also USB/Ethernet communication ports and emergency stop connections.

The controller converts program data into servo drive signals using a closed loop controlling system. This allows the control to direct the operation and motion of the robot and additional external axes to a precise, desired location.



More than a manipulator

SOFTWARE

The controller cannot function without software. The controller software defines the function of the robot. It contains the communication protocols, fault isolation, and diagnostics. The motion control of the robot is restricted mostly by the limits of the software. Motion control is an area where most robot manufacturers are lagging in development relative to multi-axis CNC controls.

Manufacturers are become more demanding in the level of motion control, repeatability and accuracy to be correctly and cost effectively done by robots.

PERIPHERAL EQUIPMENT

Peripheral equipment is any item which is not a part of the robot, controller, or control software. Examples would be proximity switches, limit switches, photo eyes, force sensing units, and Ethernet IP or other various communication interfaces such as the controller teaching pendant.

THE PRICE?

A typical 6-axis robot can cost between $20,000 and $80,000 USD (2016 $) depending on the size of the robot.

The high-accuracy robots are more expensive due to the precision gears, special software and double encoders.

The heavy lifter high capacity robots are also more expensive due to the size of the motors, casting and machining time required to produce the robot.

FUN FACT!

6-axis robots can be so large, powerful and fast that a company has attached roller coaster seats to an industrial robot so it can be used as a radical amusement park ride. The author has personally “ridden the robot” at Legoland in Denmark and the one in the photo below.

It is not always manufacturing! YEEEE, Fun!

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