

TELE MANIPULATOR ROBOT

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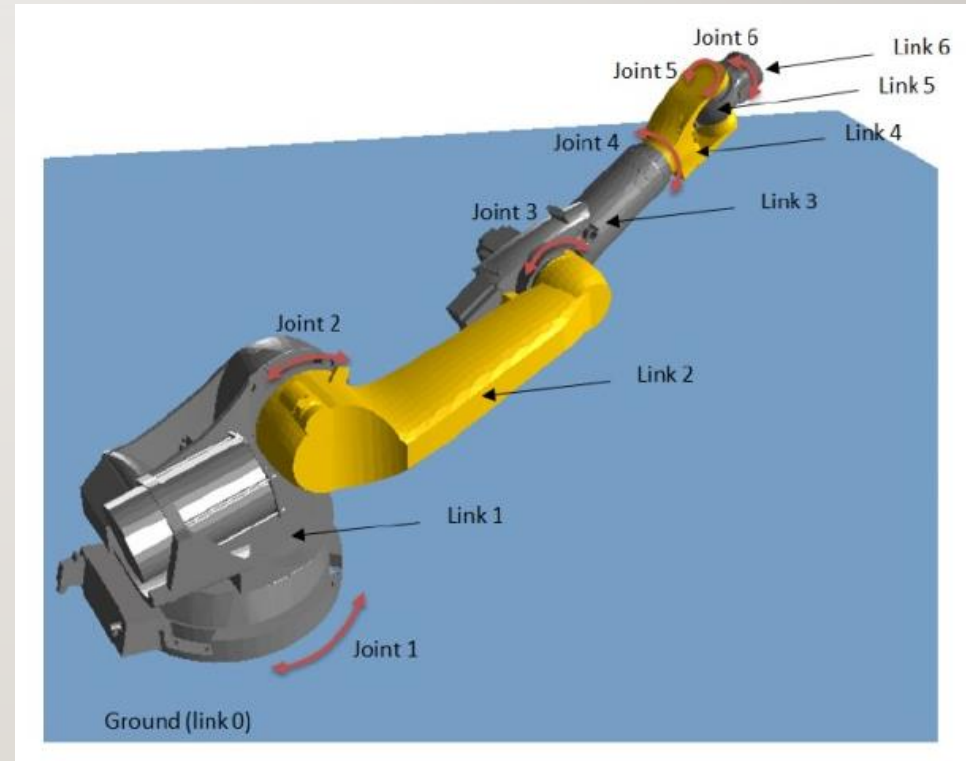
INTRODUCTION

- A robot manipulator (commonly known as robotic arm) is an electronically controlled mechanism, consisting of multiple segments, that performs tasks by interacting with its environment.
- The first teleoperated devices were built in 1890 by Nicola Tesla.
- In the 1950s tele manipulators were used mainly to handle toxic waste.



PHYSICAL DESIGN

- The robots manipulators consist of links that are connected by different types of joint to form a kinematic chain.
- Generally, these joints are either revolute (angular displacement) or prismatic (linear displacement).
- The type of the manipulator in terms of kinematic structure determine its physical design. Serial, parallel and hybrid are the three types of the manipulator in terms of kinematic structure.



SERIAL MANIPULATOR: links and joints are connected to form open kinematic chain.



PARALLEL MANIPULATOR: links and joints are connected to form closed kinematic chain.



HYBRID MANIPULATOR: Combining serial and parallel manipulators.

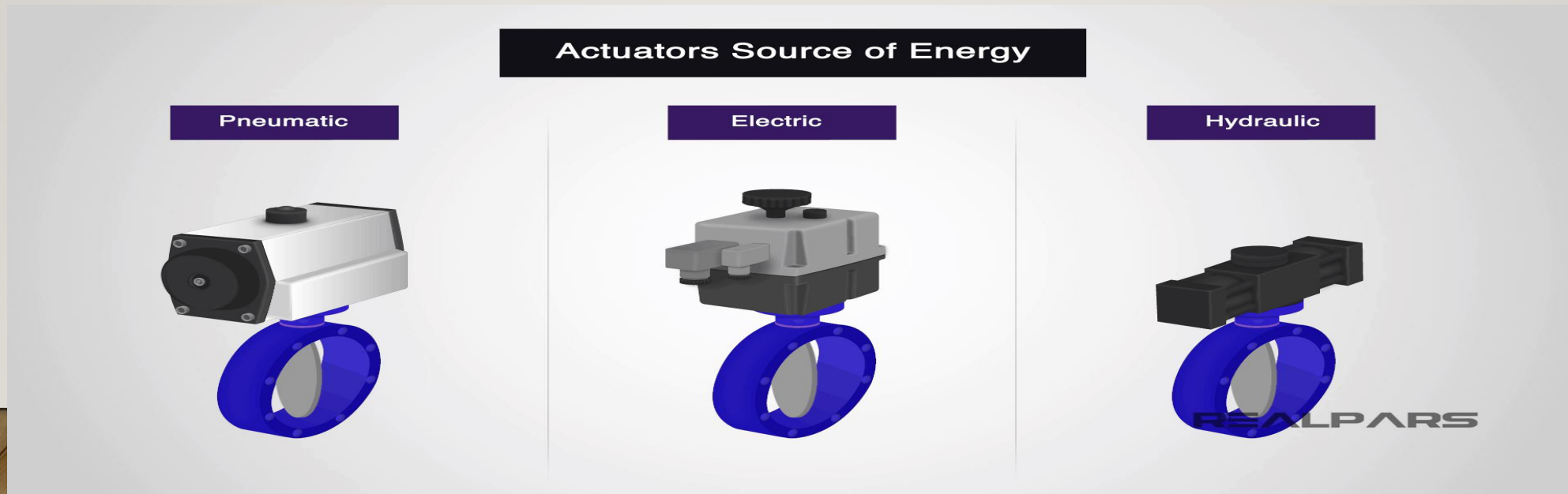


ACTUATORS

Pneumatically powered: Pneumatic robots are inexpensive and simple, but cannot be controlled precisely. As a result, pneumatic robots are limited in their range of applications and popularity.

Electrically powered: Robots driven by DC- or AC-servo motors are increasingly popular since they are cheap, clean and quiet.

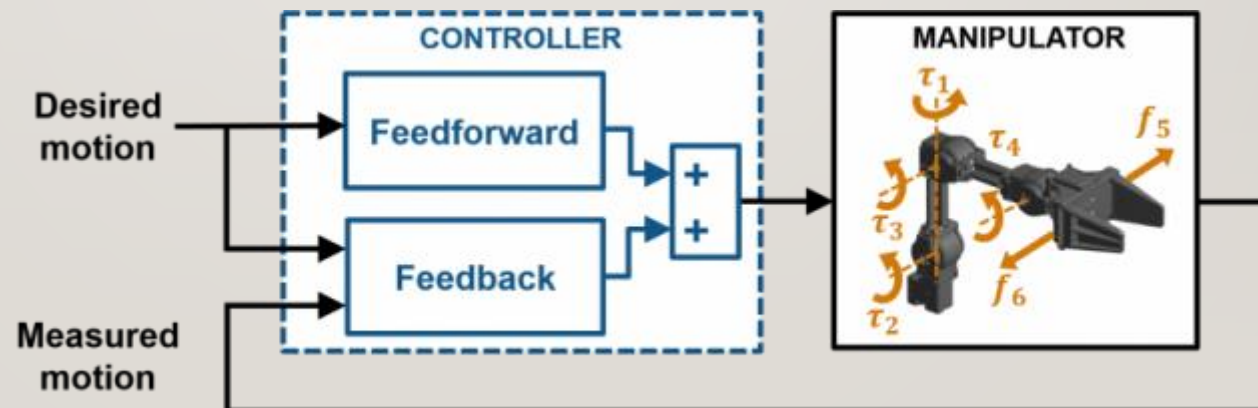
Hydraulically powered: Hydraulic actuators are unrivalled in their speed response and torque, and usually used to lift heavy loads. However, they require much more peripheral equipment and maintenance, and they are noisy.



MANIPULATOR CONTROL

Robot manipulator controller can contain the following component:.

- **Feedback:** Uses desired and measured motion to compute joint inputs. This usually involves a control law that minimizes the error between the desired and measured motion.
- **Feedforward:** Uses desired motion only to compute joint inputs. This often – but not necessarily – involves a model of the manipulator mechanics to calculate an open-loop input.



COMMUNICATION SYSTEM

- There are different number of communication modes which include controller link mode (CL), data link mode (DL) and real-time external control mode (RTEC).

Controller communication mode (CL):

- it is used to set parameters, send robot control commands and read the robot status. Getting the status information during movement of the robot and controlling the robot in real time is not possible in this mode.
- The data sent over Ethernet is not encoded and can be read in plain text. Thus, it is possible to listen to the Ethernet communication between the controller and the personal computer

COMMUNICATION SYSTEM

Data link mode (DL):

- The data link mode connects a controller with a personal computer or vice versa. Usually, it is used to send robot status information from internal robot sensors or other data to its receiver.

Real-time external control mode (RTEC):

- Real-time external control of the robot is useful for direct robot control, where the trajectory is calculated manually. The real-time external control mode is based on the UDP networking protocol.

POWER MANAGEMENT

- Most of the industrial robots use electric drive system, in the form of either DC stepper motor drive (open loop control), or, DC servo motor drive (closed loop control).
- The power consumption is mostly from the joints actuators. For example in case of servo motors, the number of servo used and their consumption determine the total amount of power needed.



