E4: Primer on actuators

An actuator is a mechanism that puts something into automatic action. It is a type of motor for moving or controlling a mechanism or system. It is operated by a source of energy.

Modern actuators

There are various types of actuators used today and they can be largely classified as Electrical, Pneumatic, and Hydraulic. Hydraulic and pneumatic actuators are used if there is a need for very high torque. Here, we will focus only on electrical devices as a source of actuators.

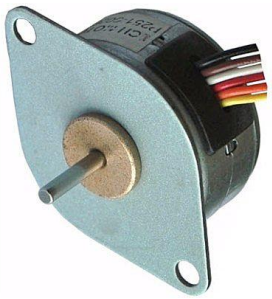
Example of electrical driven actuators

DC motor

AC motor

Servo motor

Stepper motor



Describe the purpose of each of the actuators above, and the scenario where the choice of actuator is preferred.

E4: Primer on Servo

Servo motors are nothing but DC motors with built in control electronics. Unlike DC motors they are not meant for continuous rotation, but used for a fixed angular rotation. The built-in electronics provides the means of controlling angular position by using a feedback mechanism and they are all encased as a part of the motor body.

There are three wires connected to the motor, usually colour coded as red for motor power supply line, black for ground line and white for control signal line. Figure below shows control signal for an example servomotor Hitec 422 (Hitec 2012). The control signal is a series of square pulses with a frequency of 50 to 100 Hz, or a period of 10 ms to 20 ms. When the 'ON' period is 1.5 ms, the load flange is in the neutral position. When the pulse width is reduced to a lower value of 1.0 ms, the wheel rotates through a $90°$ in one direction and stops. If the pulse width is increased to 2.0 ms), the flange wheel rotates in the opposite direction through $90°$ degrees and stops. These actions are repeatable and the range of the angular rotation is from $-90°$ to $90°$ which is $180°$.

Apparently controlling of a servo motor with computers is very straightforward. If the train of pulse stops, the angular position may drift due to the load. Hence for achieving and holding a certain angular position, the computer has to continue providing the required pulse width periodically.