Motors

ME122, Portland State University

Objective and Reference

- Learn about three main motor types
  - DC motor
  - Servo motor
  - Stepper motor
- References:
  - http://www.modmypi.com/blog/whats-the-difference-between-dc-servo-stepper-motors
  - https://learn.sparkfun.com/tutorials/motors-and-selecting-the-right-one/all
  - http://www.tigoe.net/pcomp/code/circuits/motors/stepper-motors/

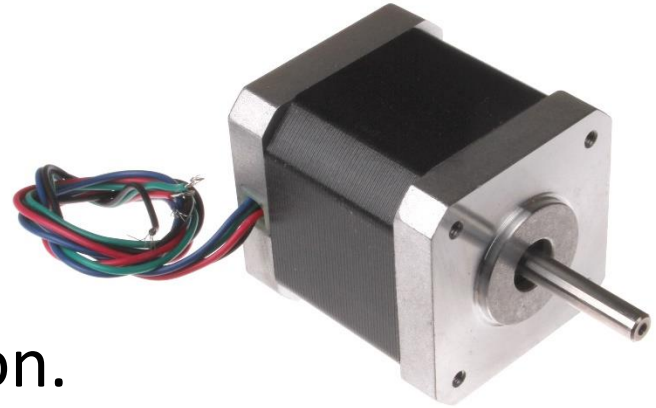
DC (Direct Current) Motors

- 2 wires: power & ground
- Continuous rotation
- Starts / stops when power is supplied / removed
- Speed controlled by PWM signal
- Most DC motors run at a high RPM (revolutions per minute)
- Examples
  - computer cooling fans
  - radio controlled car wheels

Servo Motors

- 3 wires: power, ground & control
- Assembly of :
  - DC motor,
  - gearing set,
  - control circuit
  - position-sensor (usually a potentiometer)
- Power to servo motor is constantly applied
- Angle of rotation is limited to 180^{o} back and forth (some have 360^{o} capability)
- PWM signal controls position (not speed) of servo shaft
- Control is sent continuously. If same position, same PWM signal is sent.
- Examples: Servo motors are designed for more specific tasks where position needs to be defined accurately such as controlling the rudder on a boat or moving a robotic arm or robot leg within a certain range.

Stepper Motors



= servo motor that uses a different method of motorization.

- servo motor uses a continuous rotation DC motor and integrated controller circuit,
- stepper motor uses multiple toothed electromagnets arranged around a central gear to define position.

- Requires an external control circuit or micro controller (e.g. Arduino) to individually energize each electromagnet and make the motor shaft turn.
- Shaft turned by precise pre-defined step angles through a full 360^{o} rotation (positioning errors don't occur)
- Constant holding torque without the need for the motor to be powered
- Two varieties: bipolar or unipolar
- Examples: 3D printer, or other device with high positioning accuracy

Summary

- **DC Motors**
  - Fast, continuous rotation motors
  - Used for anything that needs to spin at a high RPM
- **Servo Motors**
  - Fast, high torque, accurate rotation within a limited angle
  - Generally a high performance alternative to stepper motors, but more complicated setup with PWM tuning.
- **Stepper Motors**
  - Slow, precise rotation, easy set up & control
  - Advantage over servo motors in positional control.