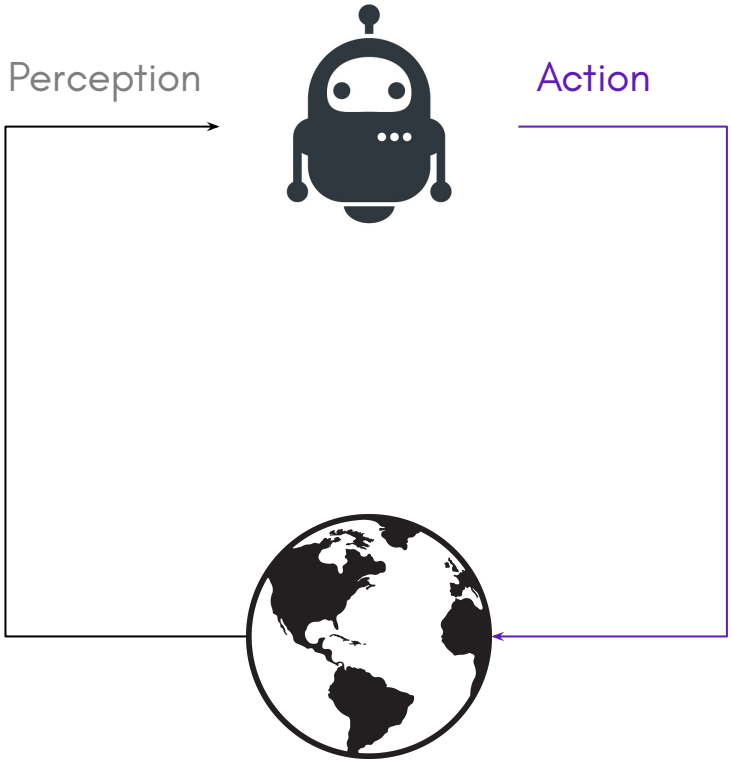
ENGR 3421: Robotics I

Motors Spin-Up

09/17/2024

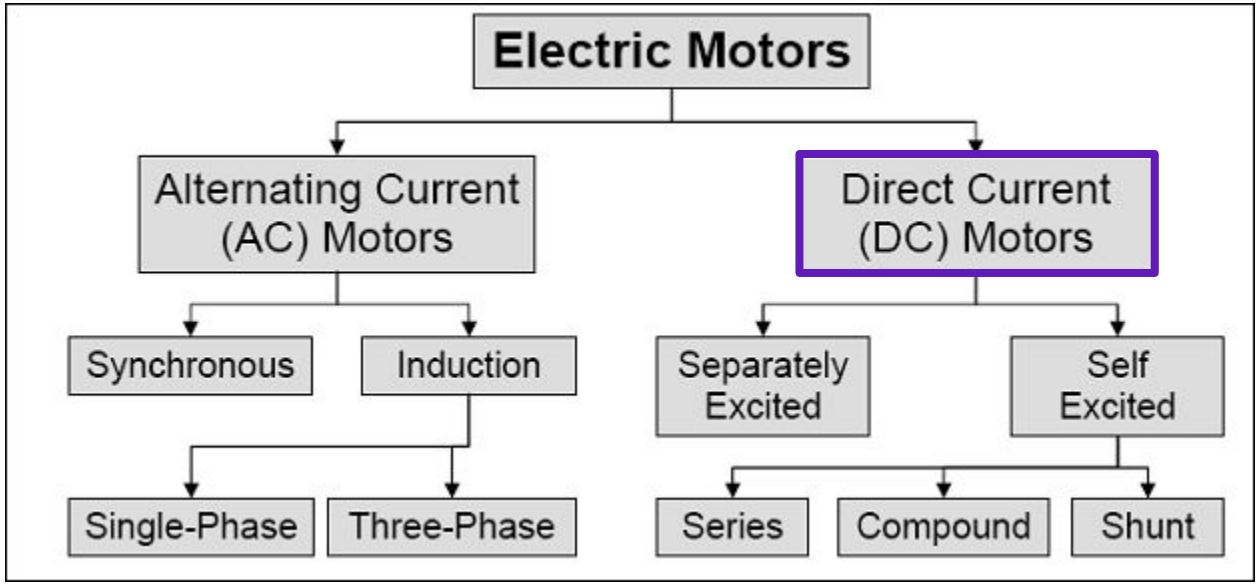
A Robot Needs to Move



Actuators

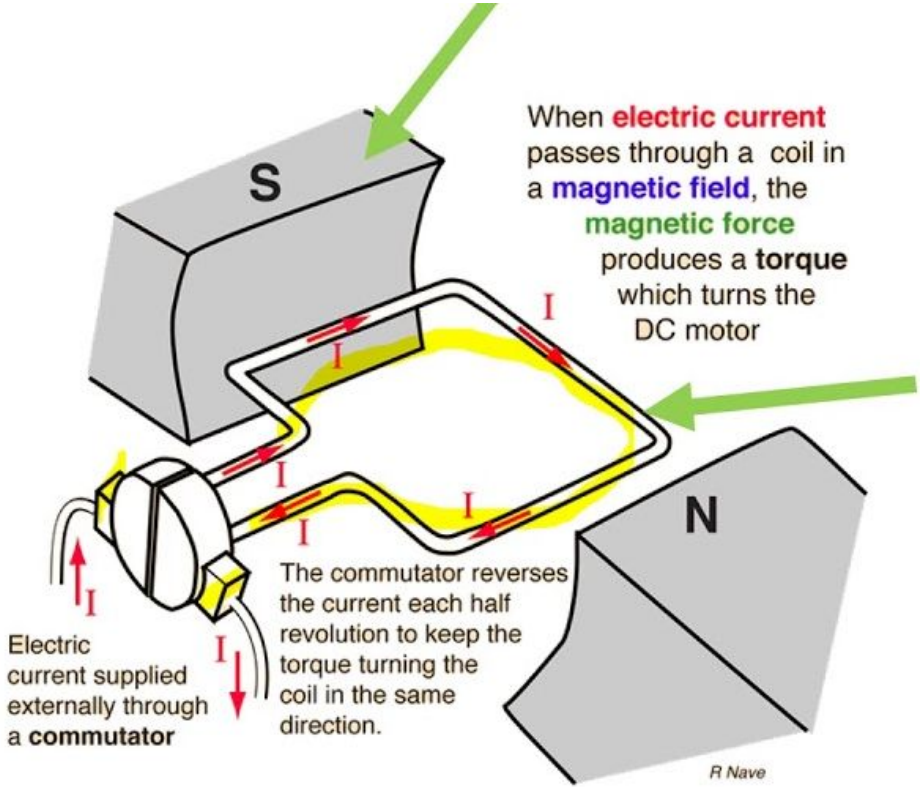
- Motors
- Hydraulic Actuators
- Pneumatic Actuators
- Solenoids
- Artificial Muscles
- ...

Types of Motors



DC Motors

How does a DC Motor Work

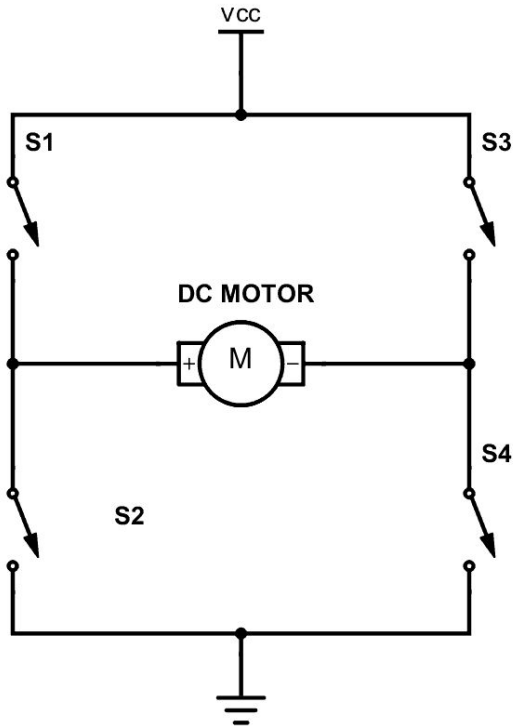


Gearmotor

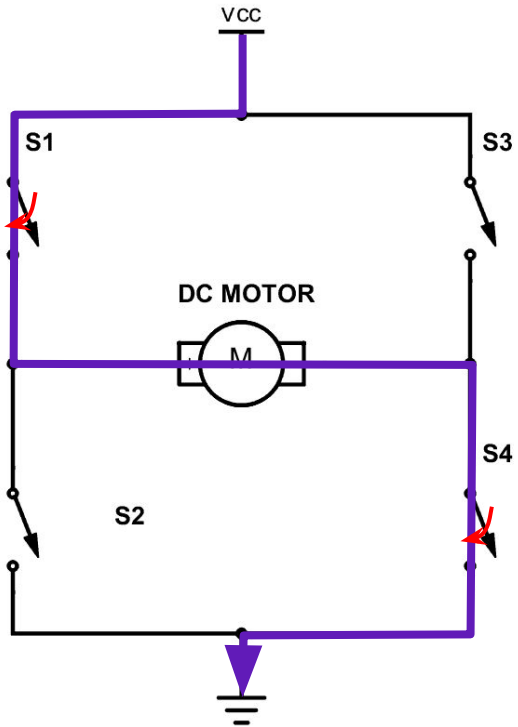
voltage	no-load performance	stall extrapolation
6 V	210 RPM, 500 mA	9.1 kg·cm (130 oz·in), 6.0 A

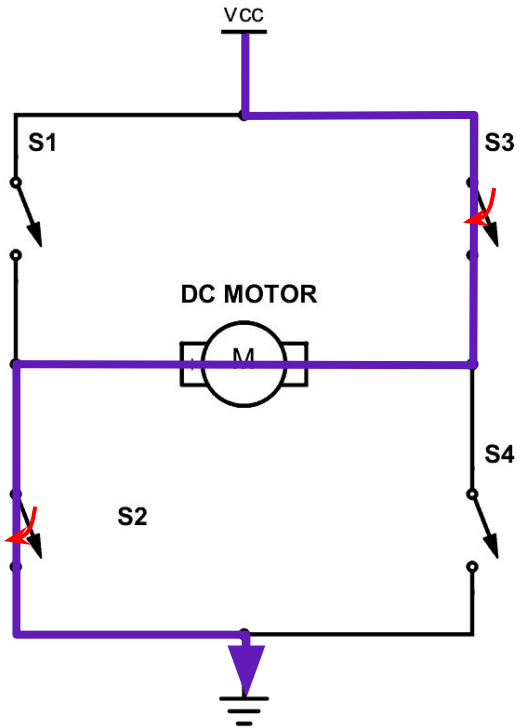
Gear ratio:	**46.85:1**
No-load speed @ 6V:	210 rpm
No-load current @ 6V:	0.50 A
Stall current @ 6V:	**6.0 A**
Stall torque @ 6V:	9.1 kg·cm
Max output power @ 6V:	4.9 W
Motor type:	6V, 6.0A stall (HP 6V)

H-bridge Driving Circuit

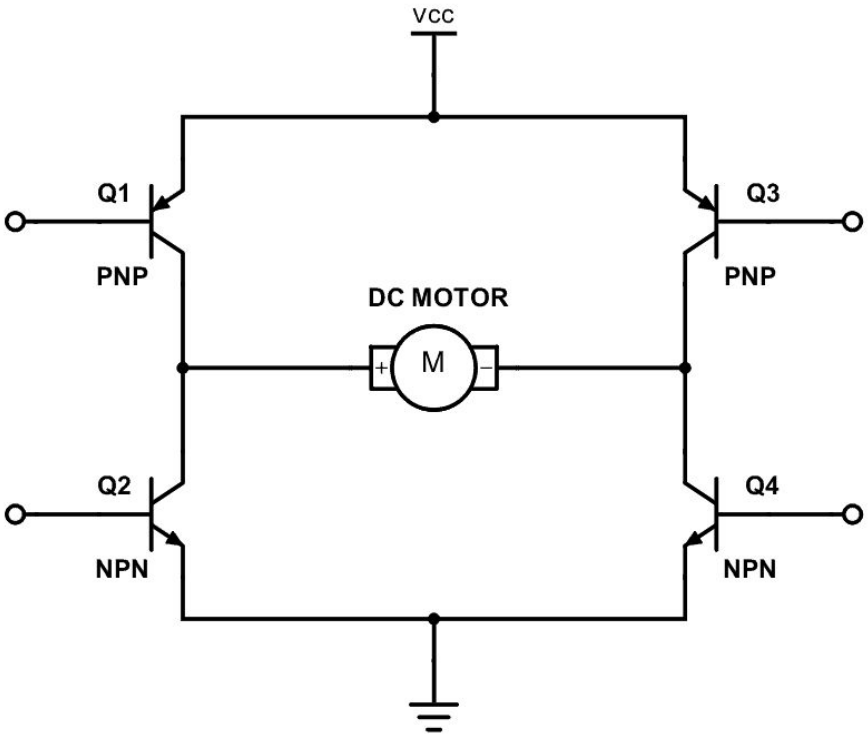


H-bridge Driving Circuit





Transistor H-bridge



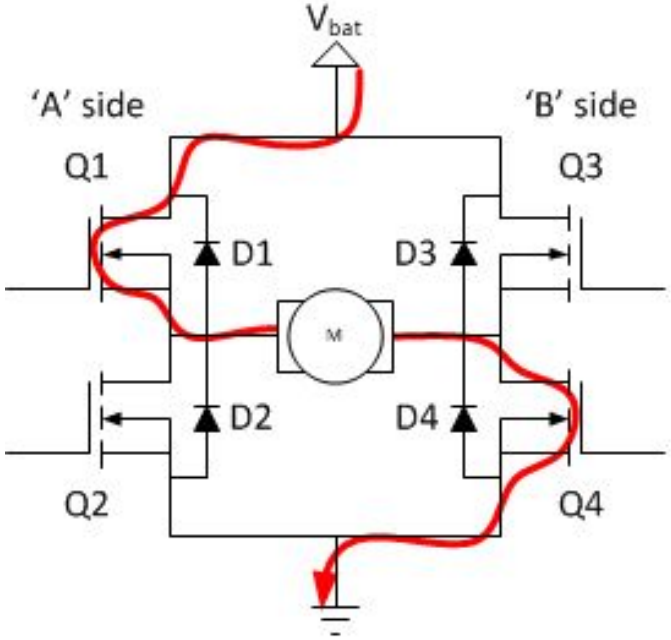
Transistors drop = 0.7 V

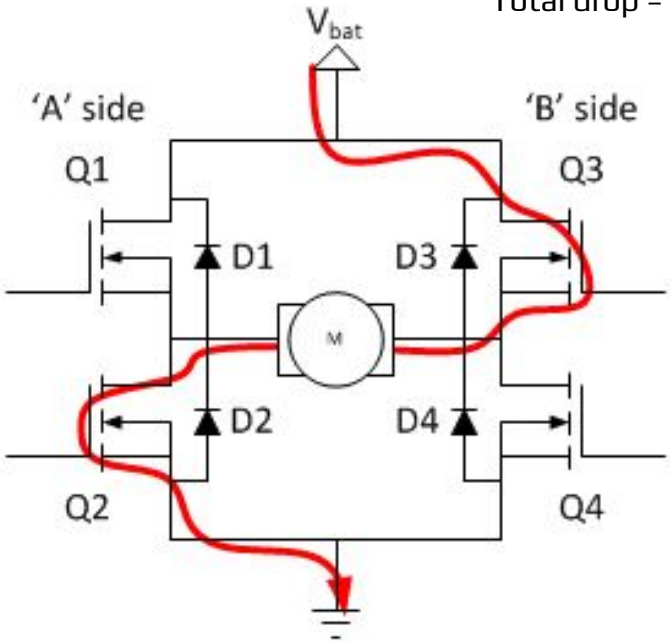
Total drop = 1.4 V

MOSFET H-bridge

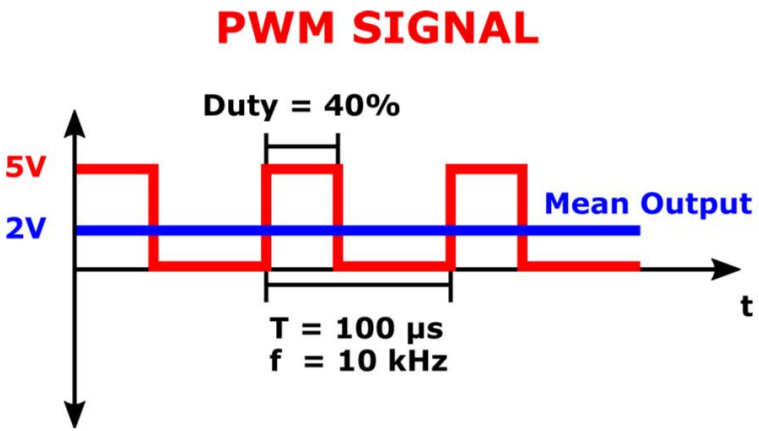
MOSFET drop = 0.1 V

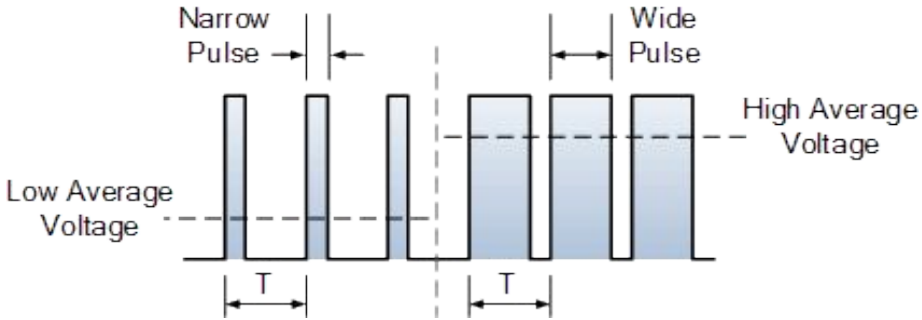
Total drop = 0.2 V



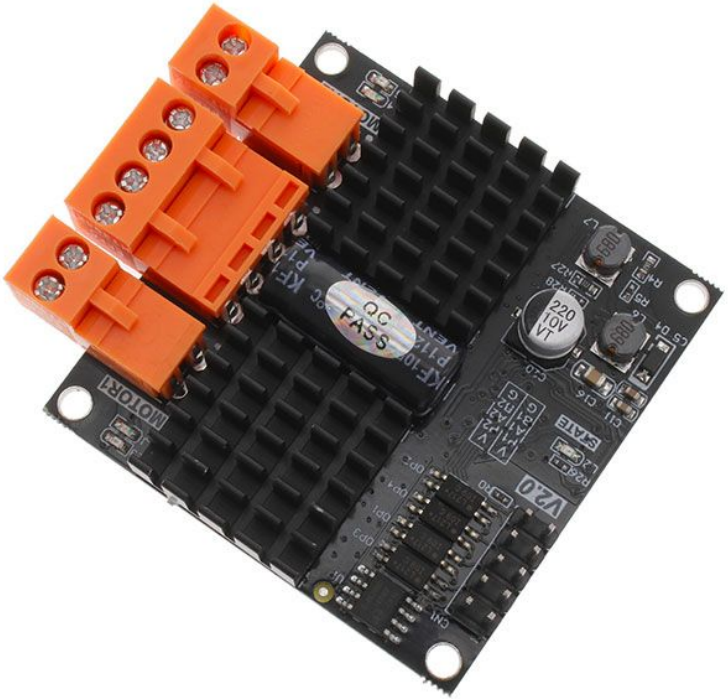


Pulse Width Modulation (PWM)

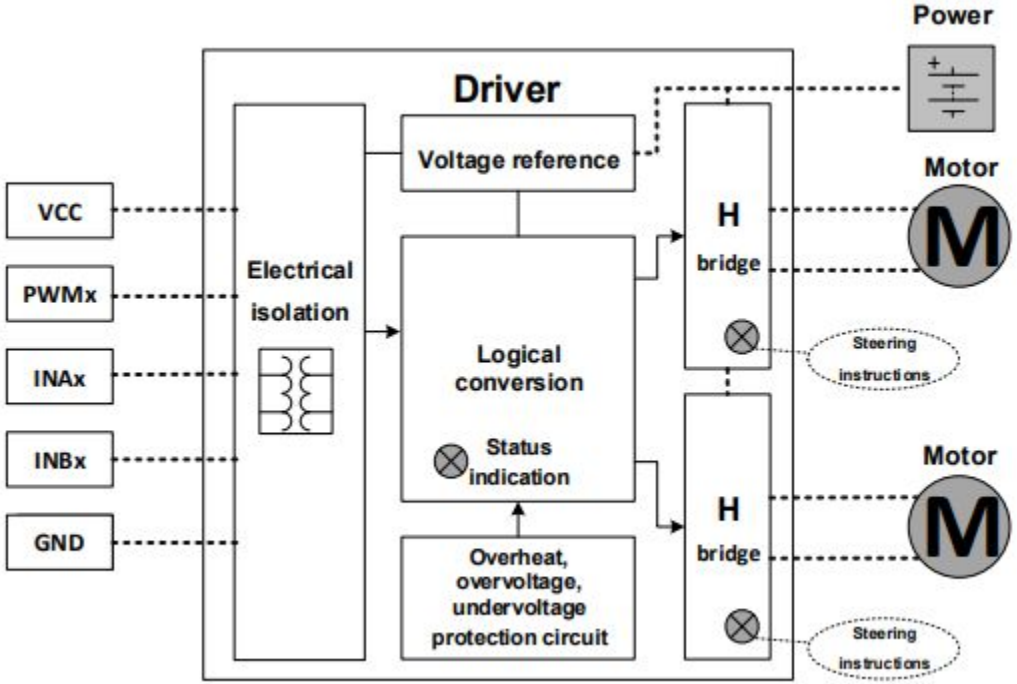




Motor Driver Board - DFR0601



Motor Driver Wiring



Drive DC Motors

```
from machine import Pin, PWM
from time import sleep

# Config pins
INA_LEFT = Pin(11, Pin.OUT)
INB_LEFT = Pin(12, Pin.OUT)
INA_LEFT.off()  # INA_LEFT.value(0)
INB_LEFT.off()
PWM_LEFT = PWM(Pin(13))
PWM_LEFT.freq(1000)
```

```
# Spin motor
INB_LEFT.on()  # forward
PWM_LEFT.duty_u16(int(65025 / 3))  # 1/3 max
speed
sleep(4)  # spin 4 sec
# Stop
PWM_LEFT.duty_u16(0)
INA_LEFT.off()
INB_LEFT.off()
sleep(1)
INA_LEFT.on()  # backward
PWM_LEFT.duty_u16(int(65025 / 3))
sleep(4)
PWM_LEFT.duty_u16(0)
INA_LEFT.off()
INB_LEFT.off()
```

Can you ramp up and down motor speed?

Can you drive both motors?