ENGR 4421: Robotics II

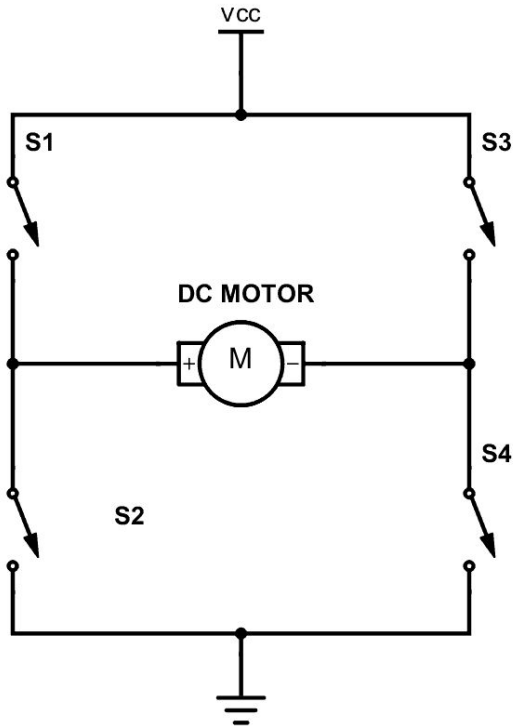
Low-Level Motor Control

01/20/2022

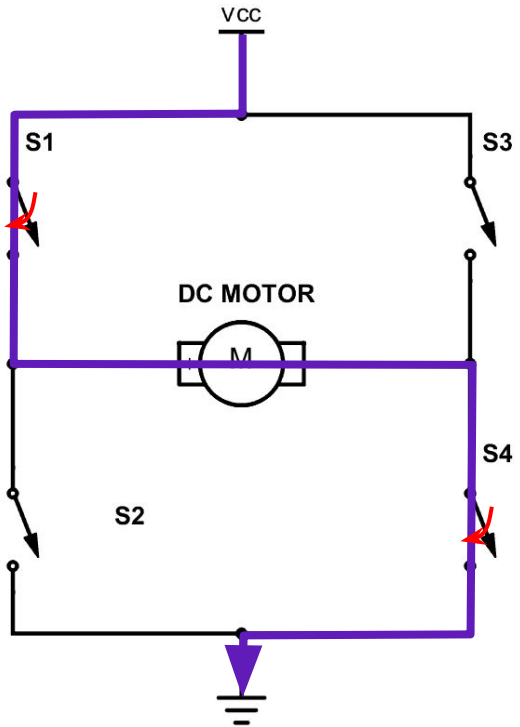
Outline

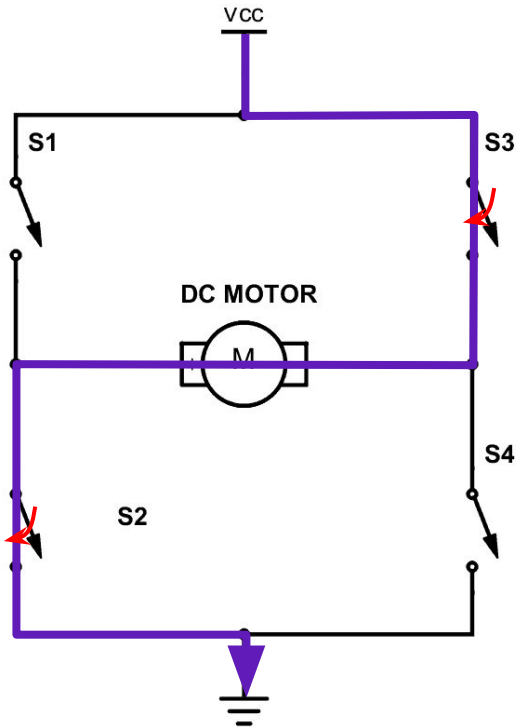
- Review: H-bridge motor driving circuit
- Review: quadrature encoder
- Review: velocity measurement
- Motor Control using Arduino
- Communication

H-bridge and DC Motor Control

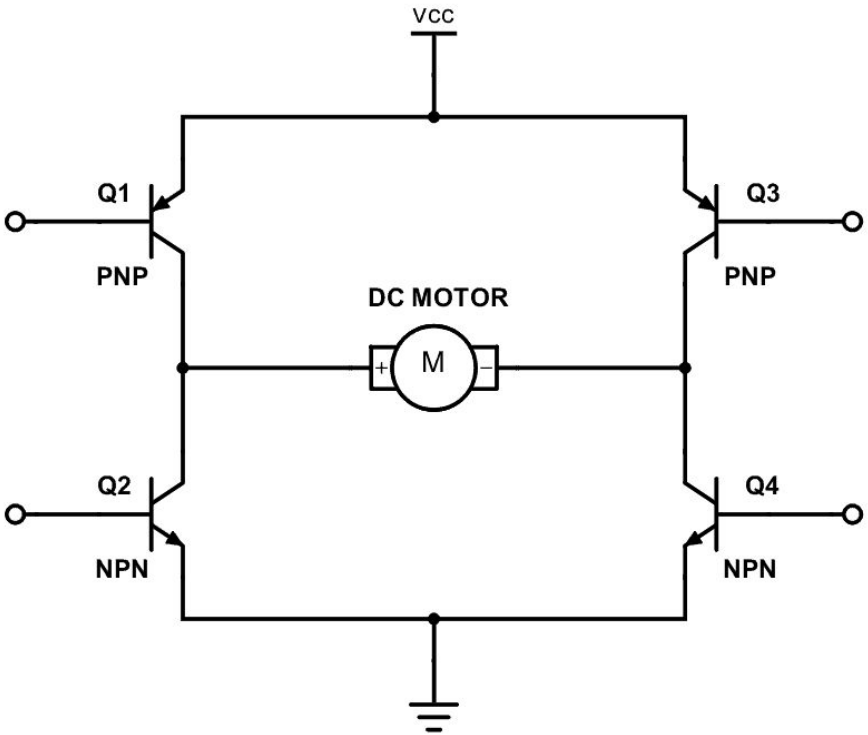


H-bridge





Transistor H-bridge



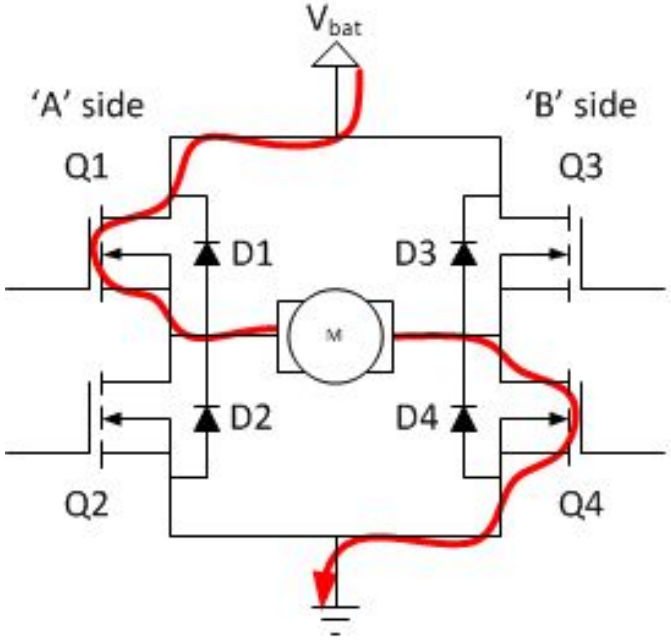
Transistors drop = 0.7 V

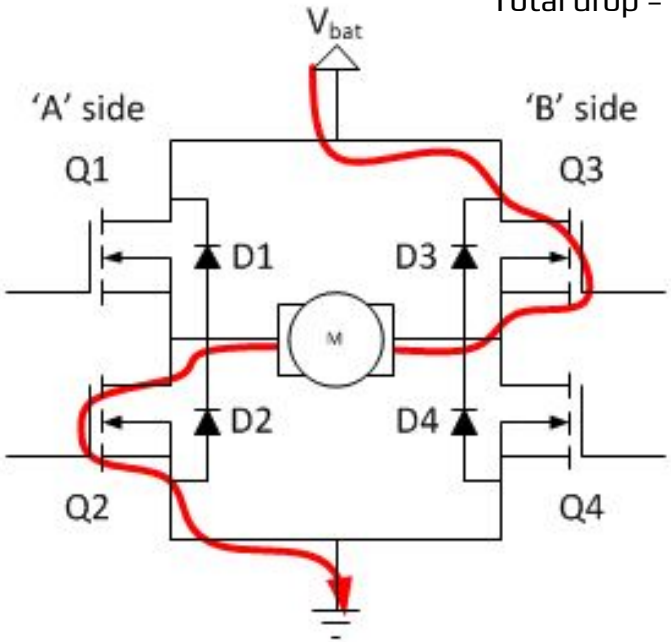
Total drop = 1.4 V

MOSFET H-bridge

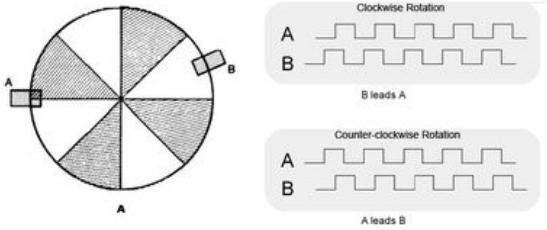
MOSFET drop = 0.1 V

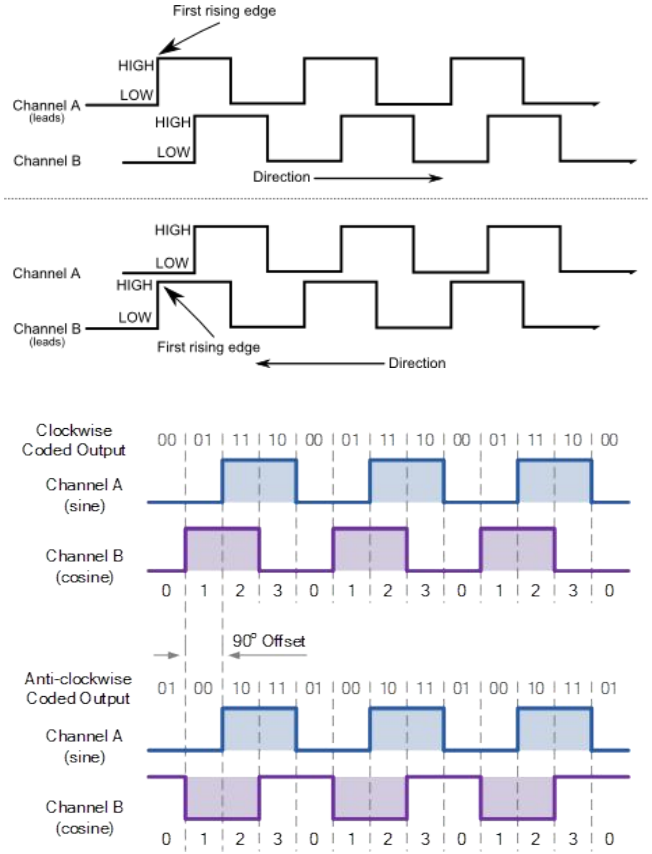
Total drop = 0.2 V



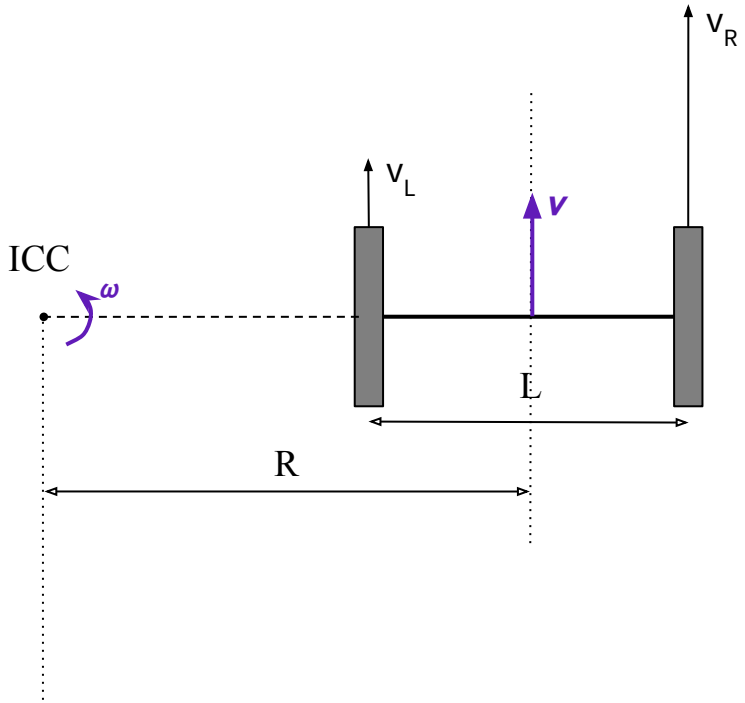


Quadrature Encoder





Calculate Vehicle Velocity



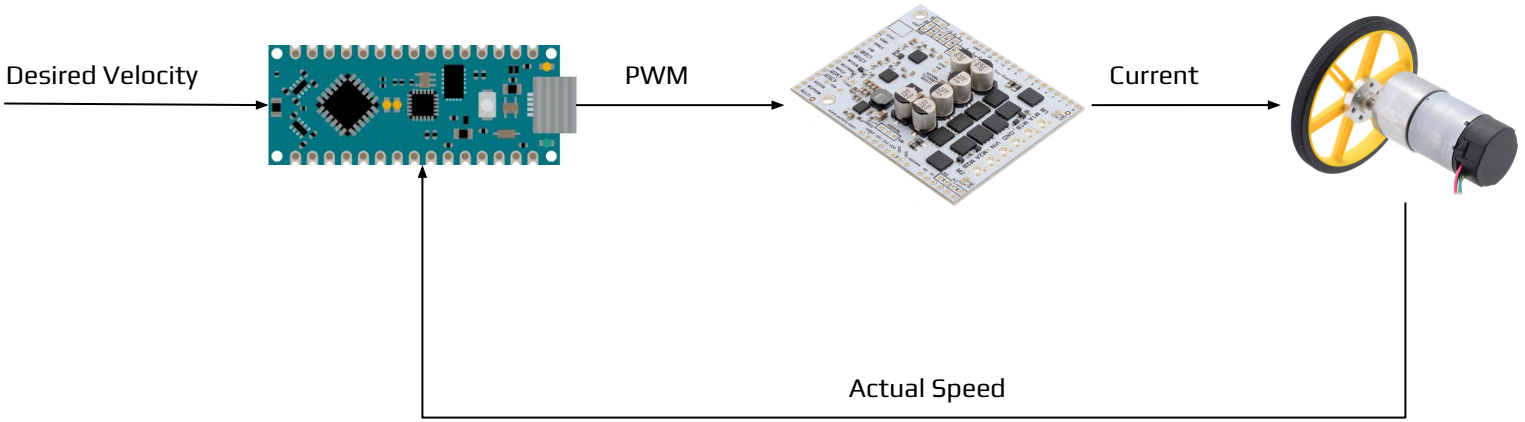
Linear x: $$v = \frac{V_R + V_L}{2}$$

Angular z: $$\omega = \frac{V_R - V_L}{L}$$

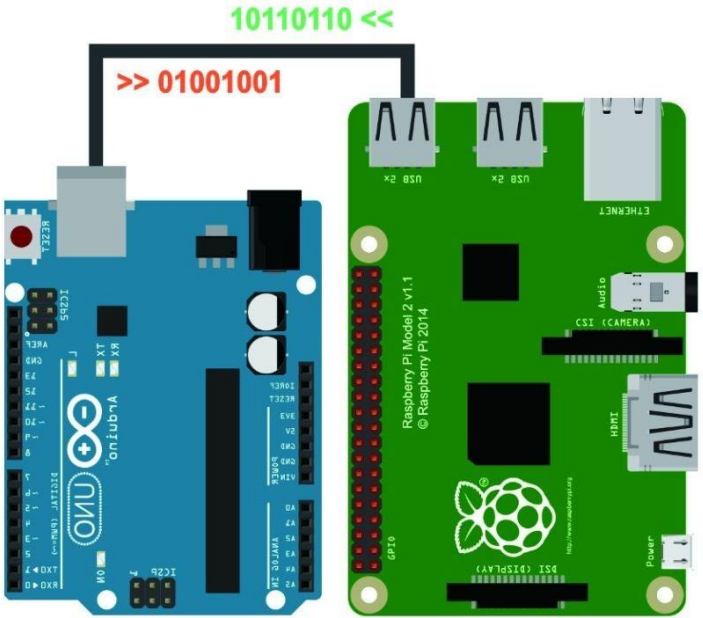
$$V_L = \dot{\theta}_L r$$

$$V_R = \dot{\theta}_R r$$

Arduino Motor Control



Communication



1. ROS orders “linear x” and “angular z”.
2. RPi computes desired motor speed.
3. Desired motor speed transmitted from RPi to Arduino via serial communication (UART).
4. Arduino monitors encoder readings (actual motor speed), then adjust PWM duty cycles.
5. Actual speed reported back to RPi via UART