

Reaction Wheel Control Code Description

1. Microcontroller

The control code is written for the **Arduino Nano** microcontroller. It communicates with the IMU over I²C and generates PWM signals to drive the motor through a DRV8833 H-bridge motor driver.

2. Sensors and Actuators

- **Sensor:** MPU9250 (9-axis IMU), using only the gyroscope's Z-axis angular velocity for control feedback.
- **Actuator:** DC motor connected to a flywheel via an internal gear. The motor is controlled using the DRV8833 dual H-bridge motor driver, with PWM signals applied directly to the IN1 and IN2 pins.

3. Control System Behavior

The control system implements a PID controller to reduce angular velocity about the Z-axis. The current angular velocity is measured from the MPU9250 and compared to a small target threshold (approximately $0.5^\circ/\text{s}$, or 0.0087 rad/s). The resulting error is processed through the PID controller to determine the motor's speed and direction.

Behavior Under Different Conditions

- When the system starts with high angular velocity, the motor spins the flywheel in the opposite direction to apply counter-torque and reduce spin.
- As the angular velocity approaches the target value, the PWM duty cycle decreases and the motor slows down.
- Once the target is nearly reached, the system stabilizes and stops applying further corrections.