3-1-2015

**Test Results**

PID tuned for differential drive – tested in forward orientation with a weight attached above drive wheels – total weight was 7.2 lbs

Optimal Parameters:

Flat ground - P = 2, I = .8, D = .014

Free Spinning – P = 1.5, I = .55, D = 0.15

Works best between 0.2 m/s and 0.8 m/s.

**Motor Differences**

* Slight difference between motors in open loop
* No consistence difference in motors when robot is on flat ground using PID.

**Speed Range**

Above 0.8 m/s, there is a high frequency oscillation with amplitude .1 m/s ONLY when both motors are running. This is likely caused due to interrupt collision. AVR systems by default turn off global interrupts when an interrupt is running so interrupts are being missed, which affects the encoder readings.

Possible solutions:

* Reenable interrupts at the start of every interrupts (potentially risks)
* Optimize interrupts
* Bigger wheels and slower higher torque motor
* Faster Board

Below .2 m/s, there is a lot of instability. Possibly due to non linear behavior of motors at low velocities? Might need a variable PID for lower velocities.

**Steady State Oscillations**

Probably need to filter encoder readings – encoder isn’t actually noisy, it is likely that the velocity is unsteady when on flat ground due to motor quality/weight added to top/wheels.