Model Development for the Control of the motor

The motor control method was fairly straightforward. The model of an open loop and a closed loop was created with a 7 volt step input in mind. This once implimented in the arduino was tuned and the final values of kp and ki where found.

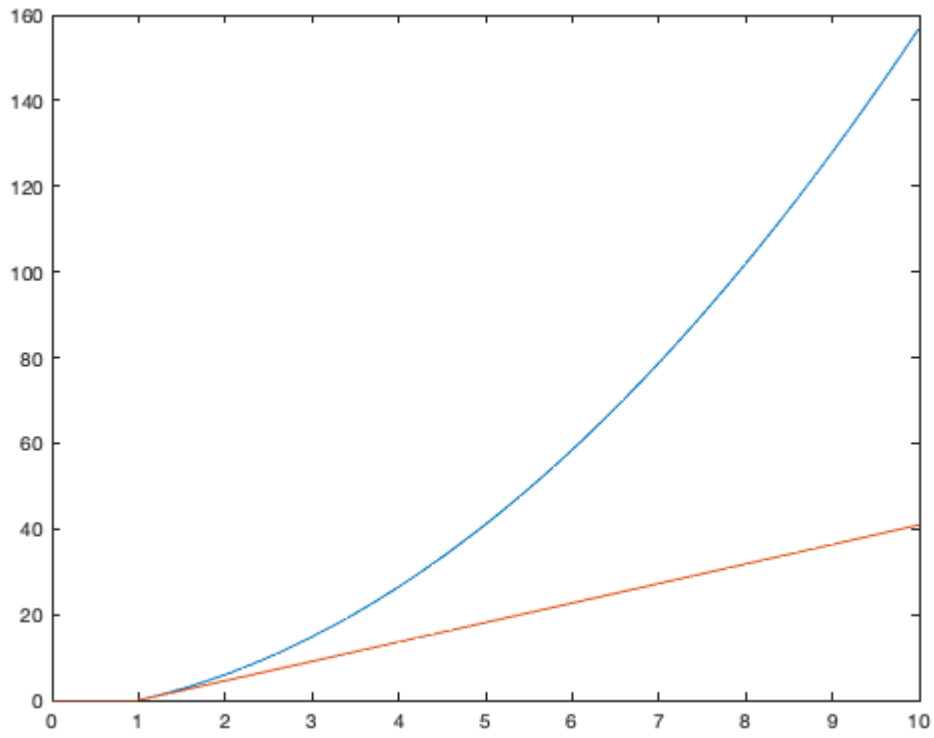
Contents

- The Following is the ouput of the open loop response
- The following is the output of the closed loop response

The Following is the ouput of the open loop response

The open loop stem can be used when a voltage is needed as an input. However this is not increadibly useful in this prject as we ulitmately need the output from the input of a rasberry pi command . Blue = simulated . Orange = real tuned controller

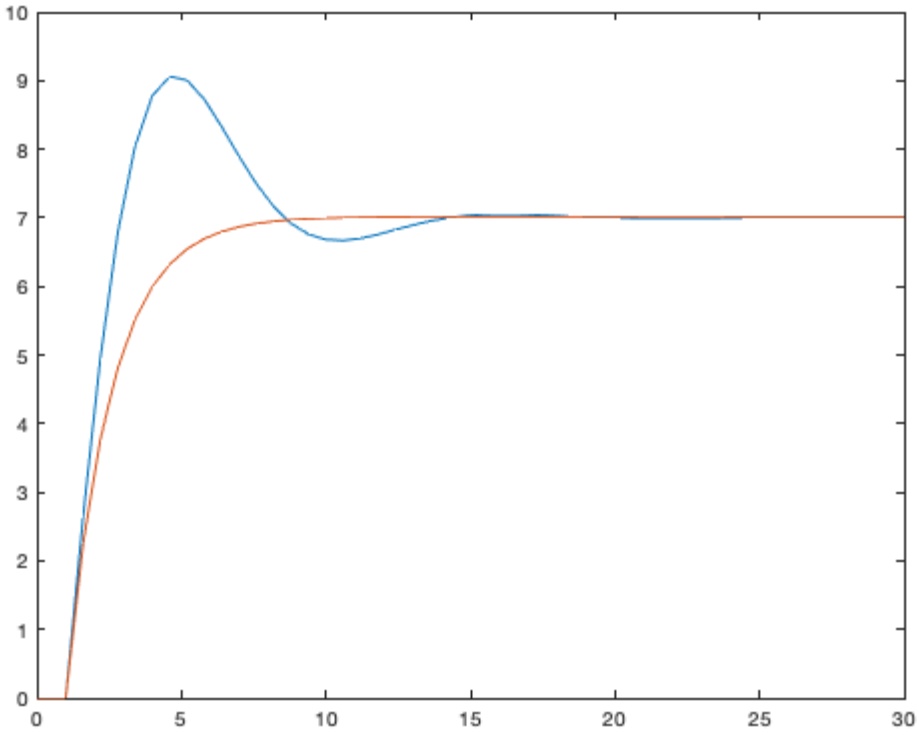
```
run('openloop.m')
```



The following is the output of the closed loop response

The closed loop response was ultimatly used as it was neccesary to impliment given the input of the rasberry pi. . Blue = final simulated value . Orange = final experimental

```
run('parameters.m')
```



Published with MATLAB® R2019a

The output of an open loop function is useful if a voltage is given as the step response. The output of the closed loop function is useful when a destination is needed. After tuning the controller best fitting values of Ki and Kp were found in order to achieve a low overshoot rate. It was found that A large Kp to Ki value was needed in order to reduce oscillations and overshoot of the wheel. As seen in the closed loop model, the controller has a somewhat slower rise time but has much less overshoot. The open loop controller closer represents the a Kp controller as the value of Ki was made to be very small to reduce windup.

Furthermore upon final implementation, the Ki controller aspect was only engaged when the wheel was within 0.2 radians of the desired angle. This essentially reduced windup to zero and allowed the controller to accurately reach its final destination, when the effect of the Kp began to fade.