motor_function.m - Real system PI tuning

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Sript to read in CSV data from controls experiment, and determine system first order step response. The accuracy of the controller is shown, and a simulink model is used to create the PI tuned system response.

Author: Josiah Smith (jsmith2@mines.edu) required files: real_motor_model.slx, control_revised.csv

Parse Experimental Data

Read input CSV to two vectors, calculate time vector

```
array = csvread('control_revised.csv');
voltage = array(:,1);
velocity = array(:,2);

disp(size(velocity))
r_time = (1:size(velocity,1))/100;
```

```
   400     1
```

Define motor parameters

```
Ra=1; % armaature resistance [Ohms]
Kt=.5; % motor torque constant [Nm/A]
Ke=.5; % back emf constant [Vs/rad]
J=.05; % Load inertia [Nm^2]
b=.5; % damping [Nm/s]

% Find transfer function approximation parameters
% Find K from motor's averaged final value
K = 13.45;
% Find sigma from motor model rise time, determined manually from CSV
% plots.
rise_time = 1.17 - 1.01;
sigma = 2.2 / rise_time;
```

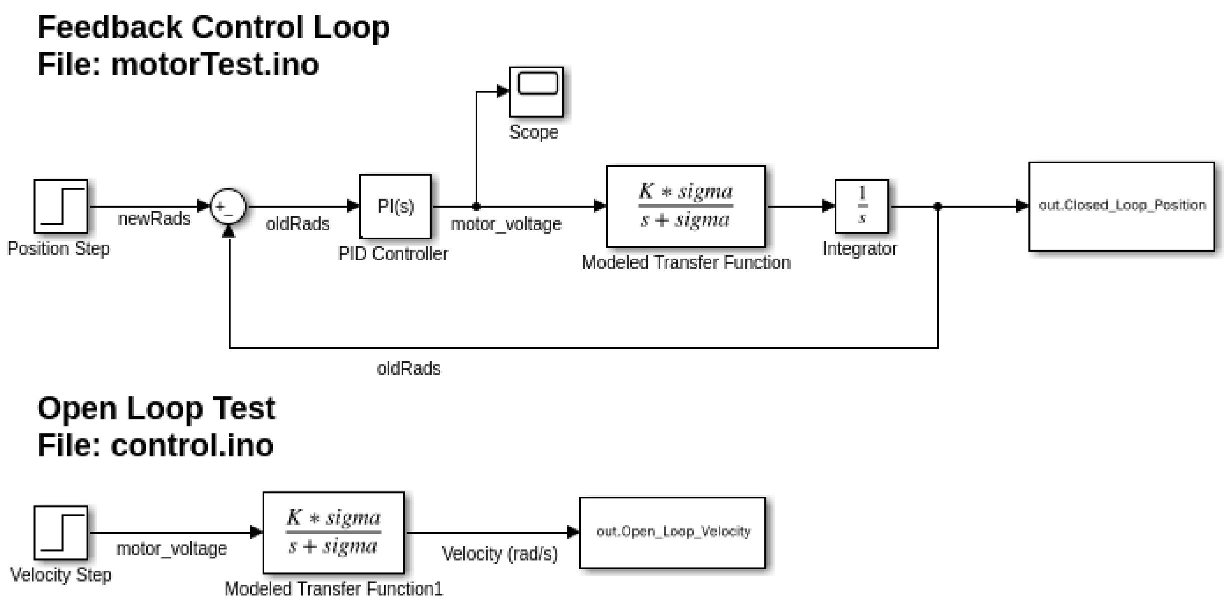
Simulate Model

Simulate the selected model, showing the block diagram to display in the documentation. This model is used to compare our approximated step response with the real one, as well as to create a PI controller model

```
model = 'real_motor_model';
info = 'Simulating model: ';
disp(append(info, model))
```

```
open_system(model)
%
% run the simulation
%
out=sim(model);
```

Simulating model: real_motor_model



A Plot of the results

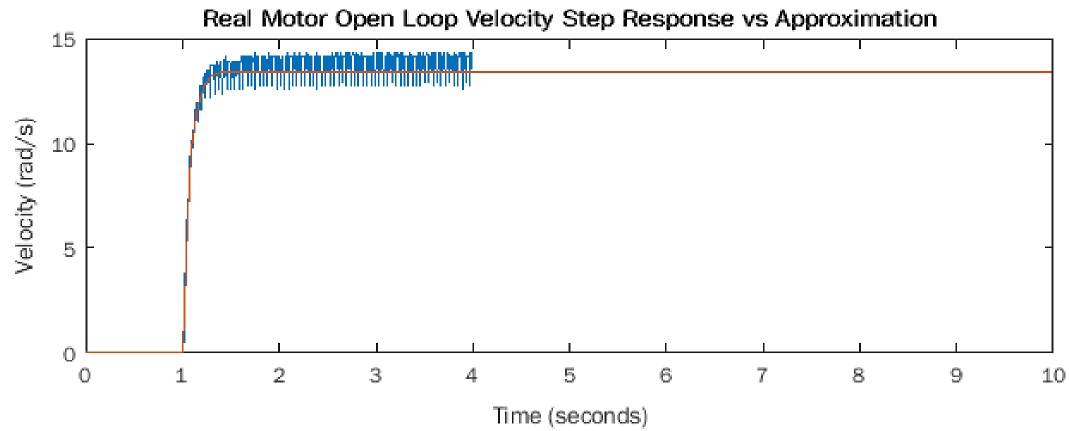
Plot measured step response (blue), and approximated transfer function's step response.

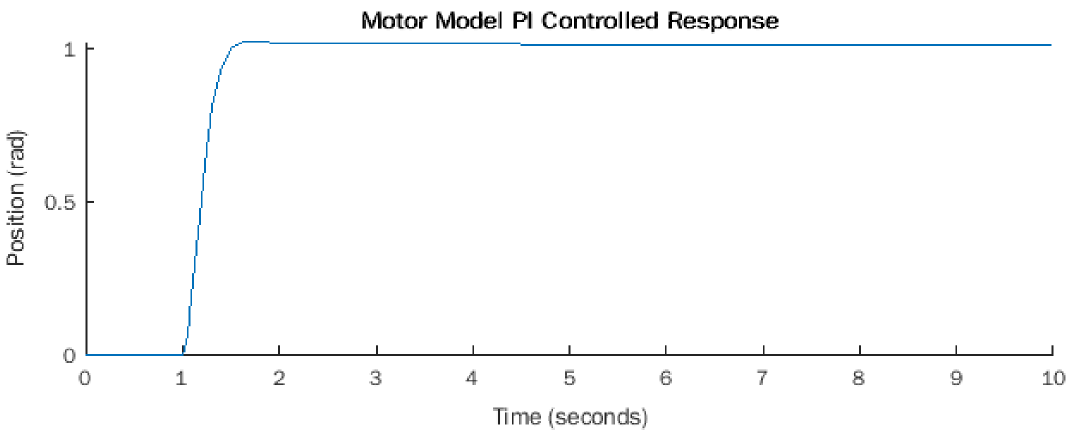
```
figure
subplot(2,1,1);
plot(r_time,velocity);
hold on;
plot(out.Open_Loop_Velocity)
title('Real Motor Open Loop Velocity Step Response vs Approximation');

xlabel('Time (seconds)')
ylabel('Velocity (rad/s)')
hold off;

subplot(2,1,2);
hold on;
plot(out.Closed_Loop_Position);
title('Motor Model PI Controlled Response');

xlabel('Time (seconds)')
ylabel('Position (rad)')
hold off;
```





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