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

```
% Rho system step response
array = csvread('robot_crawl_v4.csv');
rho_dot = array(:,2)./2;

disp(size(rho_dot))
real_time = (1:size(rho_dot,1))/100;

% Phi system step response
array = csvread('robot_turn_v4.csv')./2;
phi_dot = array(:,3);
```

```
   250     1
```

Define motor parameters

Find transfer function approximation parameters Find K from motor's averaged final value

```
rho_K = 0.0039724/2;
% Find sigma from motor model rise time, determined manually from CSV
% plots.
rho_rise_time = 1.15 - 1;
rho_sigma = 2.2 / rho_rise_time;

% Find phi response
phi_K = 0.0124314/2;
phi_rise_time = 1.15 - 1;
phi_sigma = 2.2 / phi_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 = 'robot_tuning';
info = 'Simulating model: ';
disp(append(info, model))

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

```
Simulating model: robot_tuning
```

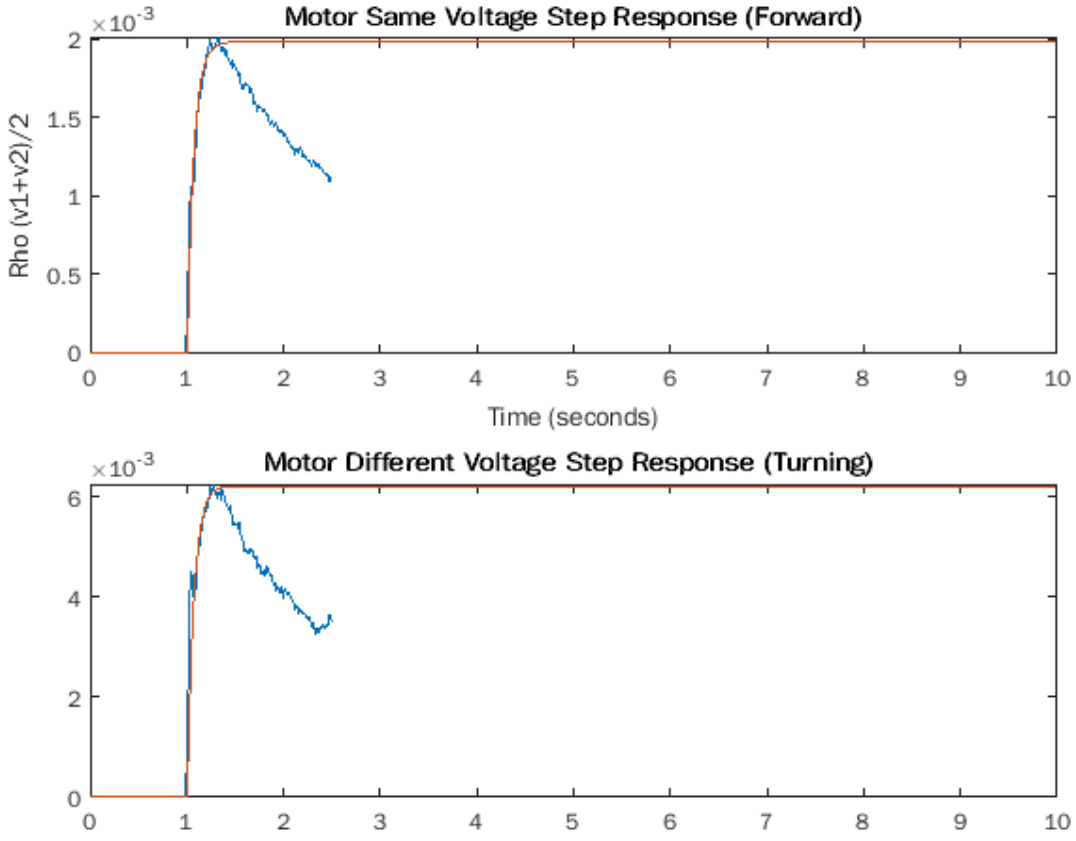
A Plot of the results

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

```
figure
subplot(2,1,1);
plot(real_time, smooth(rho_dot));
hold on;
plot(out.Open_Vel_Forward);
title('Motor Same Voltage Step Response (Forward)');

xlabel('Time (seconds)')
ylabel('Rho (v1+v2)/2')
hold off;

subplot(2,1,2);
plot(real_time, -1.*smooth(phi_dot));
hold on;
plot(out.Open_Vel_Turn);
title('Motor Different Voltage Step Response (Turning) ');
hold off;
```



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