Runmotorsim.m

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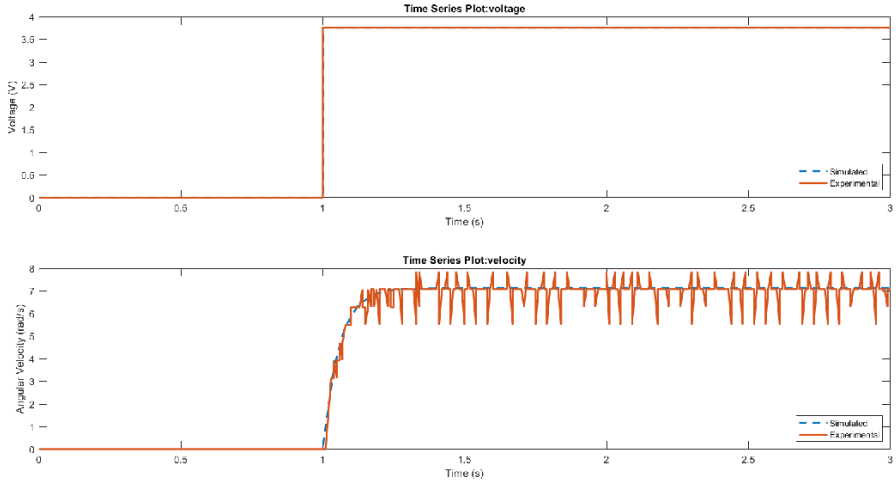
This script runs a simulation of a motor and plots the results alongside real data from motors

required file: motor_control.slx

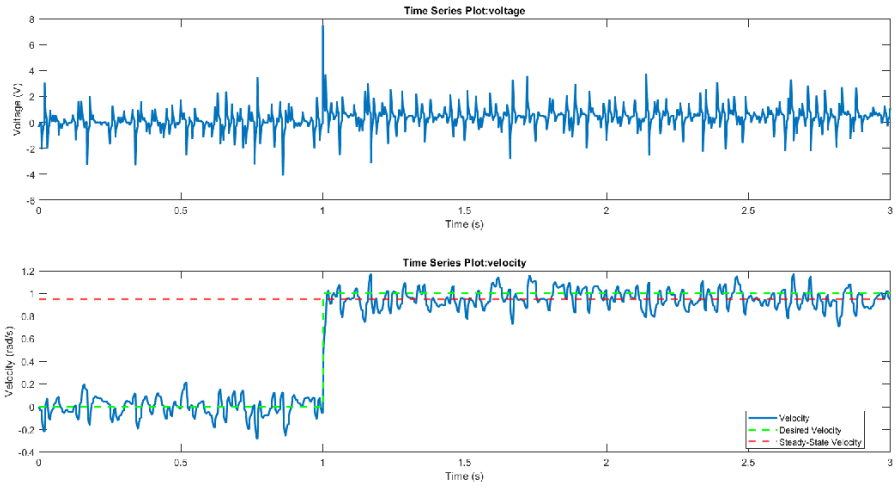
Define motor parameters

```
%k and sigma chosen such that simulation matches motors as much as possible
%

k=1.9; % DC gain [rad/Vs]
sigma=18; % time constant reciprocal [1/s]

%
%The image below depicts the results from simulating setting the motor
%voltage to 3.76V using the above parameters, compared with the actual real
%world data of doing the same. The big idea is that the parameters above
%allow the simulation to be as close to the real world system as possible,
%give or take some noise.
%

imshow('comparison.png')
```



Define control system gain

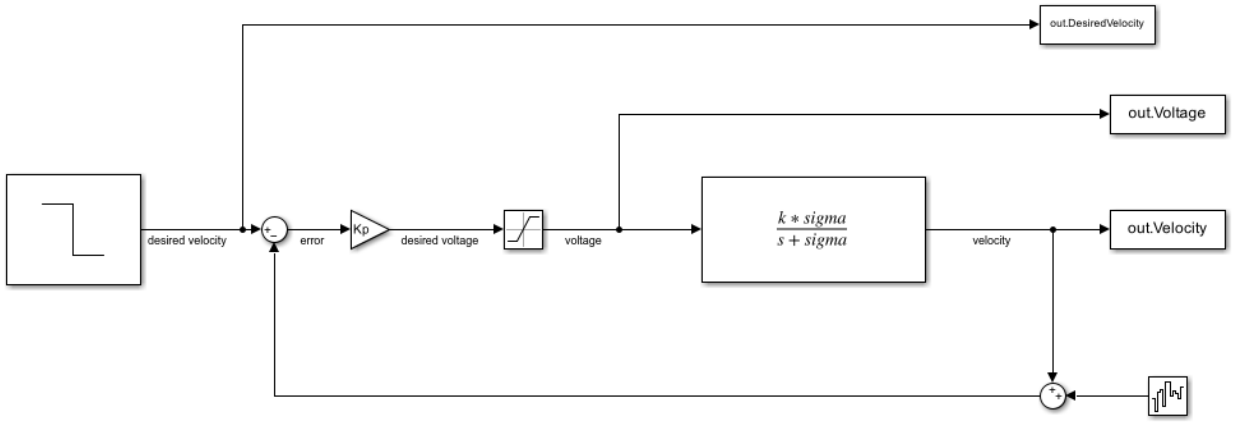
```
%Gain Kp chosen such that simulated steady state velocity is within 20% of
%desired, without allowing system to be affected by noise too much
%

Kp = 10;

%
%The image below depicts the control simulation being set to 1 rad/s, with
%a gain of 10. The big idea is that the steady state velocity is able to
%get within 20% of the set value of 1 rad/s.
%

imshow('Kpsimulation.png')

%
%load 3 second control data from file (run motorControlAdvanced.ino and
%copy serial data to controlData.mat)
%

load('controlData.mat');
```



Run a Simulation

```
open_system('motor_control')

%
% run the simulation
%

out=sim('motor_control');
```

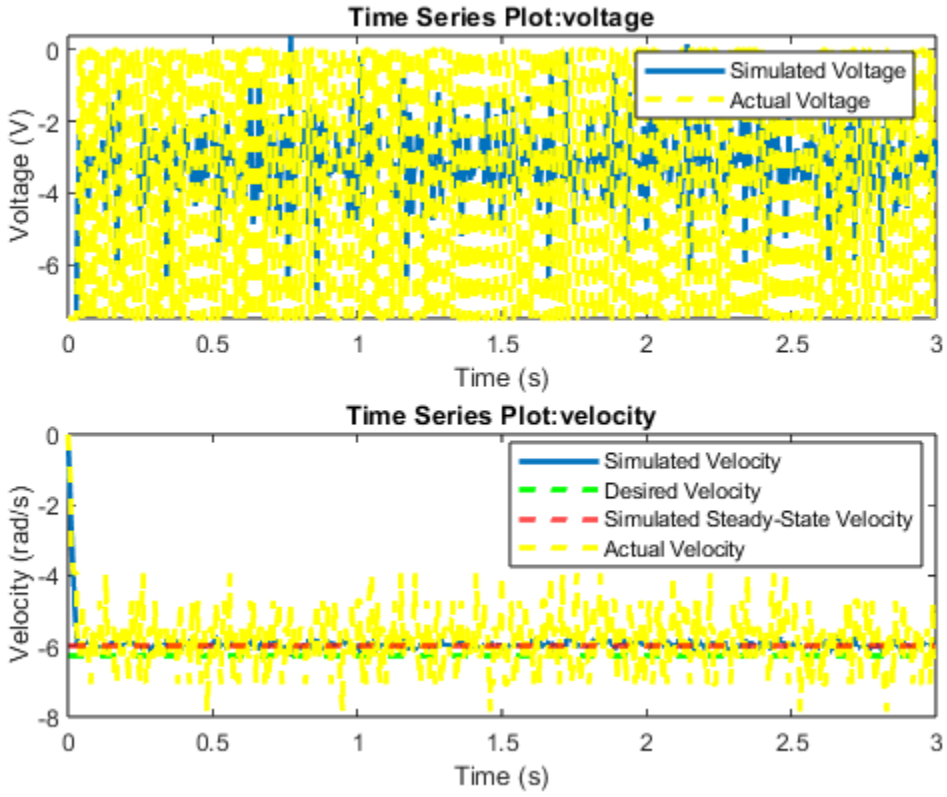
```
%
% The below image  shows the control simulation mentioned earlier that is
% going to be run once again.
%
```



A Plot of the results

```
%The plot below shows the same control simulation as before being
%run with gain Kp set to 10. However, the set velocity is -6.28 (-2PI)
%rad/s, and data taken from the real world motor with the same setup is
%shown on top of it. The big idea is that the real world motor is able to
%reasonable achieve our set value in a similar fashion as our simulation,
%albeit with some noise in the mix.
%

figure
subplot(2,1,1)
plot(out.Voltage,'LineWidth',2)
hold on
plot(data3(:,1),data3(:,2),'y--','linewidth',2)

hold off
xlabel('Time (s)')
ylabel('Voltage (V)')
legend('Simulated Voltage', 'Actual Voltage')


subplot(2,1,2)
plot(out.Velocity,'linewidth',2)
hold on
plot(out.DesiredVelocity,'g--','linewidth',2)
% Compute steady-state velocity (final value of the sim)
v_ss = out.Velocity.Data(end);

% Add a horizontal line for steady-state velocity
yline(v_ss,'r--','LineWidth',2)
```

```
plot(data3(:,1),data3(:,3),'y--','linewidth',2)
hold off
xlabel('Time (s)')
ylabel('Velocity (rad/s)')
legend('Simulated Velocity','Desired Velocity','Simulated Steady-State
Velocity', 'Actual Velocity','Location','best')
```



Published with MATLAB® R2024b