Activity 5

3/25/21 Michael White Section 3 / Online

```
close all;
clear all;
clc;

% I created a simplified excel table that includes the times and averaged
% values as two, simple columns, and import it here with xlsread.
data = xlsread('SimplifiedData.xlsx');
time = data(:,1); voltage = data(:,2);

% Set parameters for simulation
Kt = 7.68e-3; % Nm/A
Kb = 7.68e-3; % V/(rad/sec)
L = 0.18e-3; % H
J = 3.9e-7; % kg*m^2
bm = 8.148e-7; % Nm/(rad/sec)
Ra = 2.6; % Ohm

% Run simulation file from Activity 2
simout = sim('DC_Motor_Simulation_Act2');

% Isolating the data to the first curve (contained in first 0.2 seconds)
calculationData = voltage(time <= 0.2);
calculationTime = time(time <= 0.2);

% Finding the time constant using the 63.2% method
maxValue = max(calculationData);
timeConstantValue = maxValue*0.632;
absDiffList = abs(calculationData-timeConstantValue);
timeConstantPoint = ...
    [calculationTime(absDiffList == min(absDiffList)),...
     calculationData(absDiffList == min(absDiffList))];

% Define parameters to be used
Kt = 7.68e-3; % Nm/A
Kb = 7.68e-3; % V/(rad/sec)
L = 0.18e-3; % H
J = 3.9e-7; % kg*m^2
bm = 8.148e-7; % Nm/(rad/sec)
Ra = 2.6; % Ohm
Va = 4; % V

% Import data from other activities
w = 397.1749;
timeConstant_Act2 = 0.016463;
timeConstant_Act3 = 0.0177;

% Calculate beq from derived equation
beq = (1-exp(-1))*(Kt/(Ra*w));

% Calculate jeqs using time constant - beq relationship
jeq2 = timeConstant_Act2*beq;
jeq3 = timeConstant_Act3*beq;
jeqLab = timeConstantPoint(1)*beq;
```

```
% Display results
disp(strcat("The value of Beq is ",num2str(beq)));
disp(strcat("The value of Jeq for Activity 2 is ",num2str(jeq2)));
disp(strcat("The value of Jeq for Activity 3 is ",num2str(jeq3)));
disp(strcat("The value of Jeq from the lab data is ",num2str(jeqLab)));

% Graph voltage data from lab
subplot(2,1,1);
plot(time, voltage);
xlabel('Time (ms)');
ylabel('Voltage (V)');
title('Lab Data');

% Graph data from simulations
subplot(2,1,2);
plot(simout.Speed.Data(simout.Speed.Time <= 0.2));
xlabel('Time (sec)');
ylabel('Angular Velocity (rad/sec)');
title('Simulation Data');

% WRITTEN RESPONSES:
% The simulated plot looks similar in shape to the experimental data,
% though obviously there is some difference mathematically due to the
% difference in time constants.

% The calculated values are clearly different from the lab results. This
% arises obviously from the difference in time constants. The time
% constant from the lab is obviously greater than the calculated values.
% This makes since as the lab setup is not going to be ideal and will
% ultimately operate slower for potentially many different reasons. The
% torque on the motor could have been greater than calculated. The friction
% on the motor could have affected this, or the weight of the rod. Many
% things could have affected this outcome.
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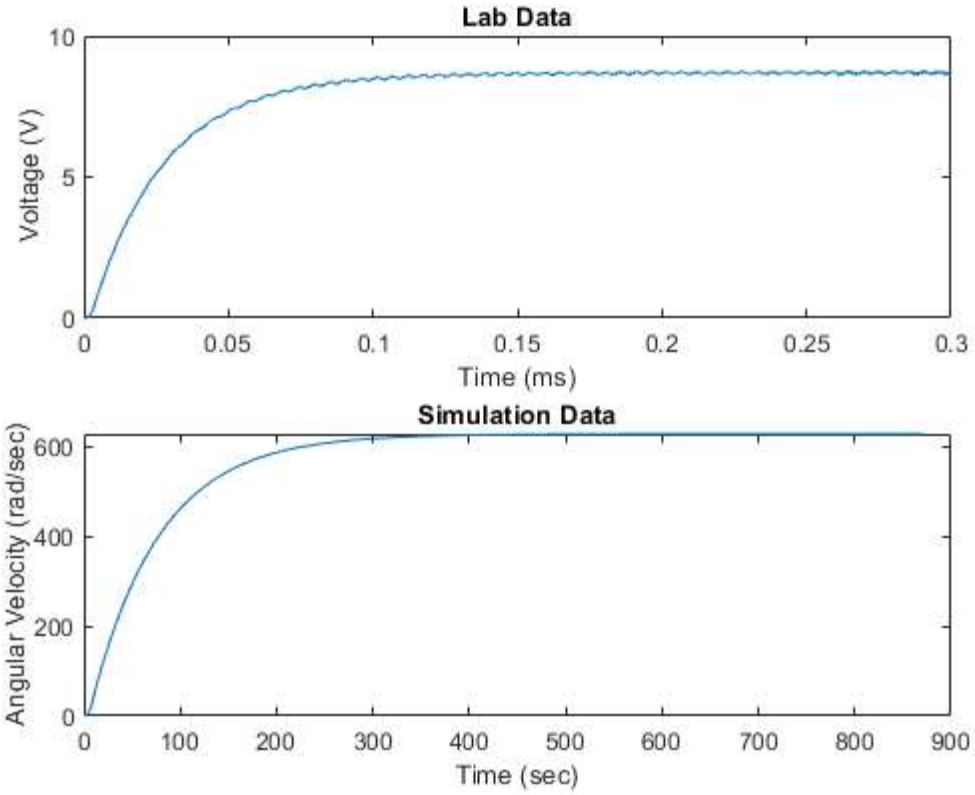
```
The value of Beq is 4.7012e-06
The value of Jeq for Activity 2 is 7.7395e-08
The value of Jeq for Activity 3 is 8.3211e-08
The value of Jeq from the lab data is 1.3398e-07
```



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