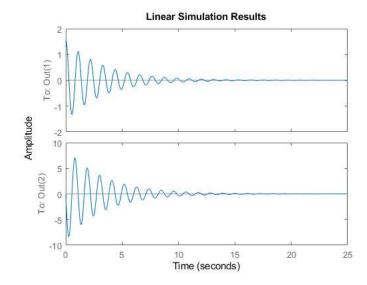
```
% Info
% Author: Taylor Smith, Christian Williams
% Version: 1.0
% Created: 5/3/2023
% Description
\% \; Script to model the hanging down of a pendulum
\frac{0}{6} \frac{1}{6} \frac{1}
 clear all;
 close all;
 %pkg load control
%pkg load signal
% Measured Parameters
mass_of_copter = 0.0132;
 mass_of_rod = 0.0234;
 length_of_rod = 0.5021;
length_of_rod_to_pivot = 0.29;
radius_of_copter = 0.01;
% Damping Coefficient
b = 0.60;
% Constants and Basic Calculated Parameters
g = 9.81;
density_of_rod = mass_of_rod/length_of_rod;
length_of_back_rod = length_of_rod - length_of_rod_to_pivot;
mass_of_rod_to_pivot = density_of_rod * length_of_rod_to_pivot;
total_mass_of_rod = density_of_rod * length_of_rod;
mass_of_back_rod = density_of_rod * length_of_back_rod;
% Moment of Inertia
inertia = 1/3*mass\_of\_rod\_to\_pivot*length\_of\_rod\_to\_pivot^2 + 1/3*mass\_of\_back\_rod*length\_of\_back\_rod^2 + 2/5 * mass\_of\_copter * radius\_of\_copter^2 + mass\_of\_copter * radius\_of\_copter * radius\_of\_copter^2 + mass\_of\_copter * radius\_of\_copter * radius\_of\_copte
% State Space Model
A = \hbox{\tt [[0,1];[-(g*length\_of\_rod\_to\_pivot*(mass\_of\_copter+mass\_of\_rod\_to\_pivot/2))/inertia,-b]];}
B = [[0];[length_of_rod_to_pivot/inertia]];
C = eye(2);
D = [0];
% Create State Space Model
model = ss(A,B,C,D);
% Simulate results
t=0:0.05:25;
 forcing = zeros(size(t));
 angle = pi/2;
 omega = 0;
 figure('Name','Angle vs Time');
lsim(model,forcing,t,[angle;omega]);
% Display Eigenvectors and Eigenvalues
disp('Eigenvectors and Eigenvalues:')
[eigenvectors, eigenvalues] = eig(model.a)
% Observability
observability = obsv(A,C);
rank_of_observability = rank(observability)
% Check controlability
controlabilty = ctrb(A,B);
 rank_of_controlability = rank(controlability)
Eigenvectors and Eigenvalues:
eigenvectors =
        -0.0089 - 0.1710i -0.0089 + 0.1710i
          0.9852 + 0.0000i 0.9852 + 0.0000i
 eigenvalues =
        -0.3000 + 5.7449i 0.0000 + 0.0000i
          0.0000 + 0.0000i -0.3000 - 5.7449i
 rank_of_observability =
                  2
 rank_of_controlability =
                   2
```



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