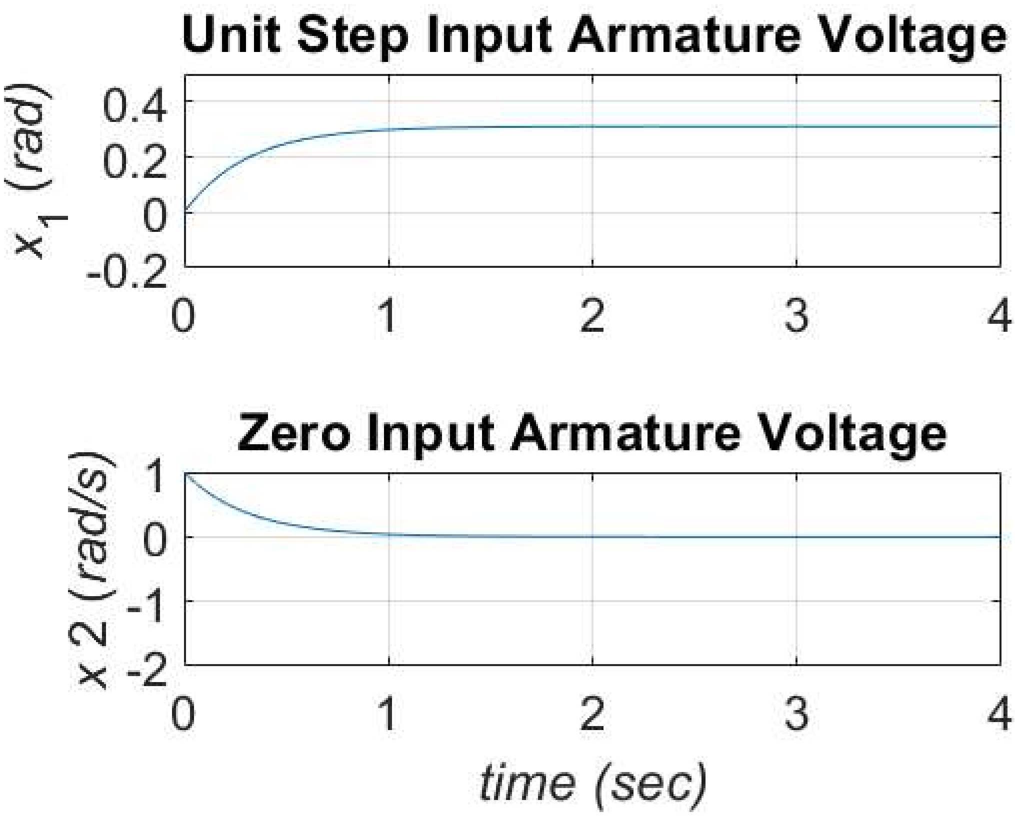
```
%Project Part 2
% Aly Khater
%Lawrence Lai
%Leroy Joseph


clc;
clear;
close all;

%------------------------------------%
%Chapter 1. State-Space
%------------------------------------%
%Initial Variables
L = 0.0006;
R = 1.40;
Kb = .00867;
Jm = .00844;
Bm = .00013;
Kt = 4.375;
n = 200;
Jl = 1;
Bl = 0.5;
%Concatenated Variables
J = Jm + Jl/(n^2);
b = Bm + Bl/(n^2);

%Matrices in State-Space
A = [0 1 0;0 0 1;0 -(R*b+Kt*Kb)/(L*J) -(L*b+R*J)/(L*J)];
B = [0;0;Kt/(L*J*n)];
C = [1 0 0];
D = [0];

%State-Space representation
Rbt = ss(A,B,C,D);

%Transfer Function
Rbttf = tf(Rbt);
%Zero-Pole
Rbtzpk = zpk(Rbt);

[num,den] = tfdata(Rbt, 'v');
[z,p,k] = zpkdata(Rbt,'v');
Rbtss = ss(Rbttf);

%------------------------------------%
%Chapter 2. Simulation of State-Space
%------------------------------------%
%time
t = [0:.01:4];
U = [zeros(size(t))];
%Initial State Variables
X0 = [0;1;0];

%Characteristic Polynomial
CharPoly = poly(A)
```

```
%Poles
Poles = roots(CharPoly)
%Eigenvalues
Eigs0 = eig(A)

damp(A);
%Open Loop Response
[Yo,t,Xo] = lsim(Rbt,U,t,X0);
Xo(101,:);

X1 = expm(A*1)*X0;

%Open loop plots
figure;
subplot(2,1,1), plot(t,Xo(:,1));grid;
title('Unit Step Input Armature Voltage');
axis([0 4 -0.2 0.5]);
set(gca,'FontSize',18);
ylabel('{\itx}_1 (\itrad)')
subplot(2,1,2), plot(t,Xo(:,2)); grid; axis([0 4 -2 1]);
title('Zero Input Armature Voltage');
set(gca,'FontSize',18);
xlabel('\ittime (sec)'); ylabel('{\itx} 2 (\itrad/s)');
```

```
CharPoly =

   1.0e+03 *

    0.0010    2.3334    7.5075         0


Poles =

   1.0e+03 *

         0
   -2.3301
   -0.0032


Eigs0 =

   1.0e+03 *

         0
   -0.0032
   -2.3301


   Pole        Damping       Frequency       Time Constant
                           (rad/TimeUnit)     (TimeUnit)

  0.00e+00    -1.00e+00       0.00e+00              Inf
 -3.22e+00     1.00e+00       3.22e+00           3.10e-01
 -2.33e+03     1.00e+00       2.33e+03           4.29e-04
```



Published with MATLAB® R2022b