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% MAE488_Nicholas_Hawse_HW4
% MAE 488 03 Analisis of ANALY ENGINEERING SYSTEMS
% Homework 4
% Nicholas Hawse
% 1/20/2025
% This code finds and plots solutions to the problems in HW 4

clear
clc
close all

fprintf('=====
\n')
fprintf('MAE 488, Homework # 5, Spring 2025\n')
fprintf('=====
\n')
fprintf('\n\n')

% =====
% Problem 8
% =====
%
%
fprintf('=====
\n')
fprintf('Problem 8 Part a\n')
fprintf('=====
\n')
fprintf('This code plots the transfer function of current and voltage
resopnce\n')
fprintf('responce see the figure below\n\n\n\n\n')

%given vals
r1 = 10^3;
c1 = 2*10^(-6);
l1 = 2*10^(-3);

% numerator and denominator for transfer fun
num1 = 1/(r1*l1*c1);
den1 = [1 1/(r1*c1) 1/(l1*c1)];

num2 = [1/l1 0];
den2 = [1 1/(r1*c1) 1/(l1*c1)];

%make the transfer funs
sys1 = tf(num1,den1);
sys2 = tf(num2,den2);

%make a time var
time1 = -0.00001:0.00001:4;
% build the two voltage inputs
input1 = zeros(length(time1),1);
input1 = input1+5;
input1(1) = 0;

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input2 = sin(60*(2*pi).*time1)*4;

%find the response to each voltage
response1 = lsim(sys1,input1,time1);

response2 = lsim(sys2,input2,time1);

figure(1)
%plot the combined response
plot(time1,(response2+response1))
xlim([0 0.2])
ylabel('current (A)')
title('MAE 488, Homework 5, Problem 8')
xlabel('time (s)')

% =====
% Problem 9
% =====
%
%

fprintf('=====\n')
fprintf('Problem 9 Part a\n')
fprintf('=====\n')
fprintf('This code plots the transfer of the armature controlled motor\n')
fprintf('resopnce\n')
fprintf('see the figure below\n\n\n\n\n')

% motor parameters
kt = 0.05;
kb = kt;
c = 0;
ra = 0.8;
la = 0.003;
I = 0.00008;

% transfer function definitions
numerator1 = [I c];
numerator2 = kt;
denominator = [la*I (ra*I) (kb*kt)];

sysi = tf(numerator1,denominator);

sysOmega = tf(numerator2,denominator);

trap = trapmf(time1,[0 0.5 2 2.5]).*30;

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i3 = lsim(sysi,trap,time1);

omega = lsim(sysOmega,trap,time1);
figure(2)
plot(time1,i3)
ylabel('current (A)')
title('MAE 488, Homework 5, Problem 9, Part a')
xlabel('time (s)')
xlim([0 4])
ylim([-2 2])

figure(3)
plot(time1,omega)
title('MAE 488, Homework 5, Problem 9, Part a')
t = '$\omega$ (Rad/s)';
ylabel(t,'interpreter','latex')
xlabel('time (s)')
xlim([0 4])
ylim([0 700])

fprintf('=====\n')
fprintf('Problem 8 Part a\n')
fprintf('=====\n')
fprintf('This code finds the motor performance paremeters\n\n')

currentvals = i3;
currentint = currentvals.^2;

energyPerCycle = ra^2*rms(i3)*4.69; % calc for the energy
imax = max(i3); % maximum value
Tmax = kt*imax; % fomula
irms = rms(i3);
Trms = irms*kt;

fprintf('energy per cycle: %f J\n',energyPerCycle)
fprintf('max current: %f A\n',imax)
fprintf('max tourqe: %f N*m\n',Tmax)
fprintf('RMS current: %f A\n',irms)
fprintf('RMS tourqe: %f N*m\n',Trms)

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Problem 8 Part a

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*This code plots the transfer function of current and voltage response
see the figure below*

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Problem 9 Part a

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*This code plots the transfer of the armature controlled motor response
see the figure below*

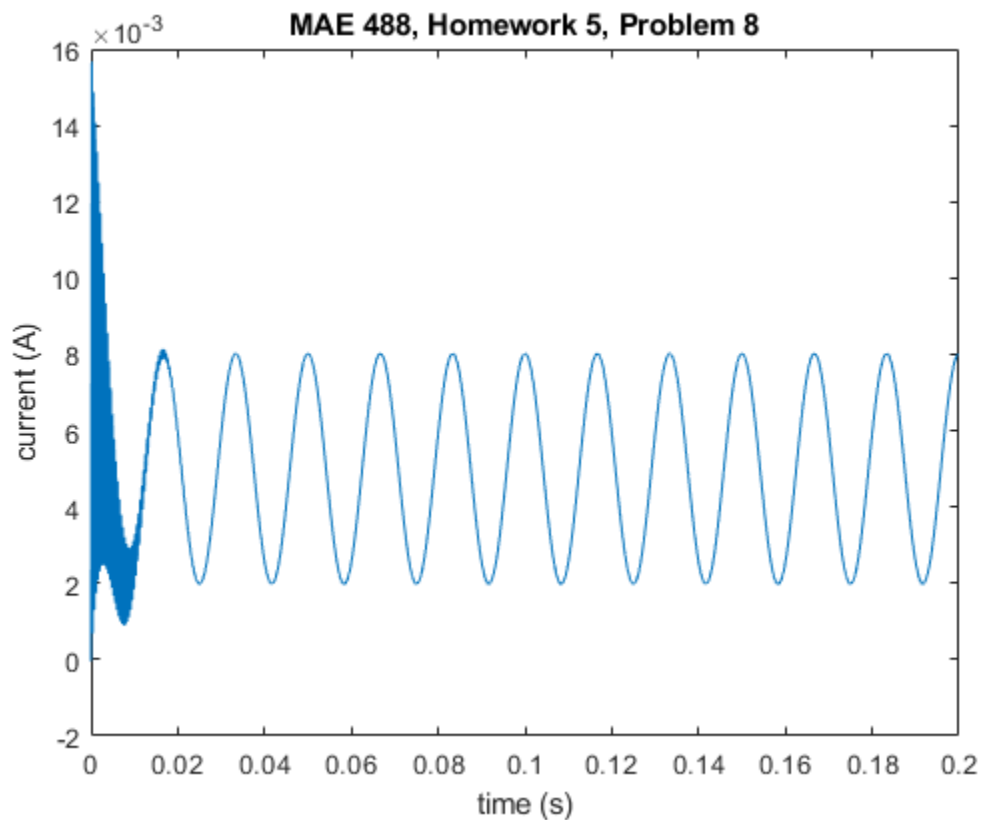
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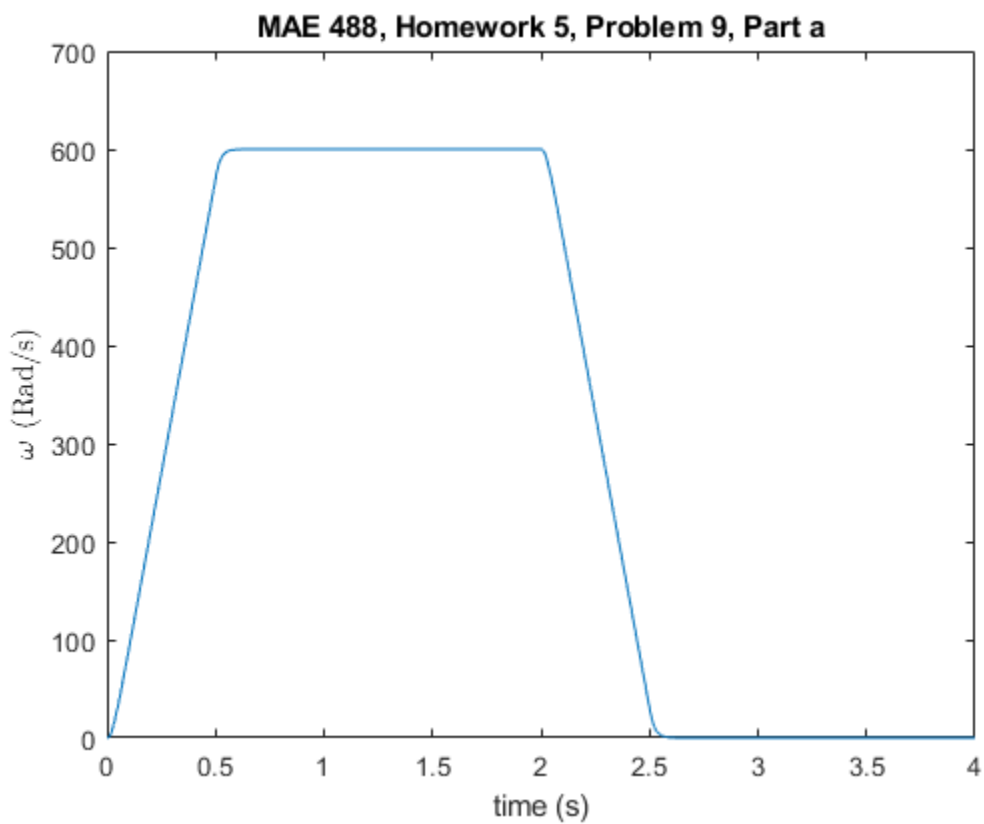
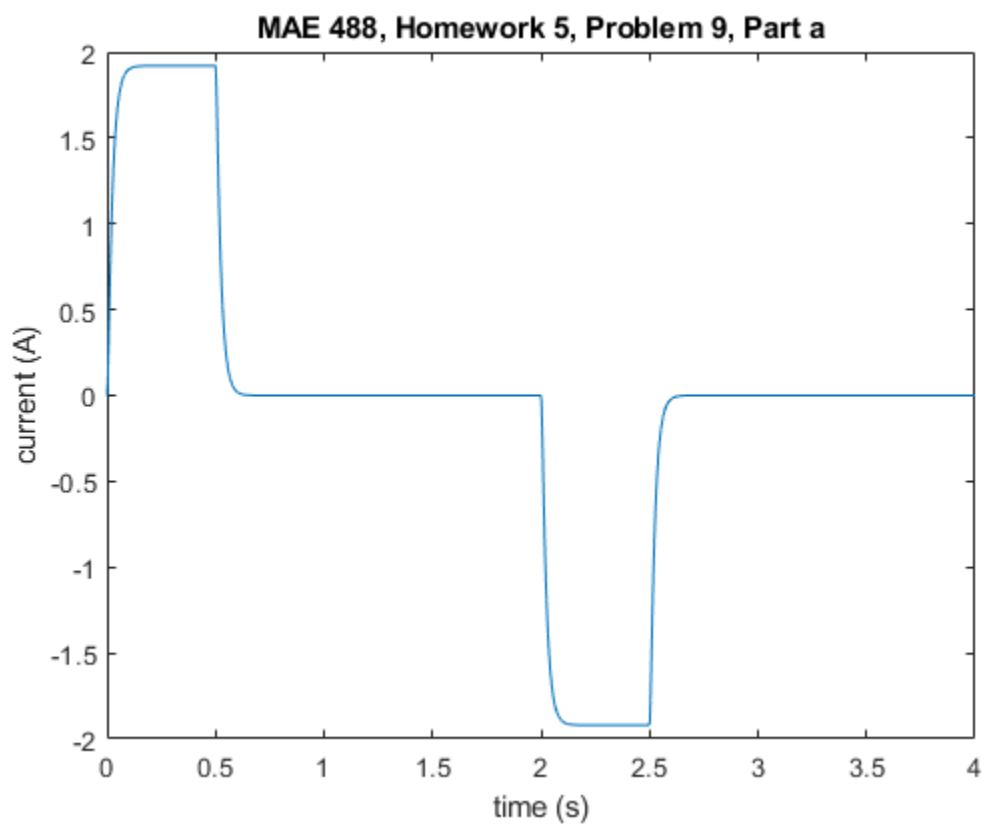
Problem 8 Part a

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This code finds the motor performance parameters

energy per cycle: 2.817864 J
max current: 1.920000 A
*max torque: 0.096000 N*m*
RMS current: 0.938787 A
*RMS torque: 0.046939 N*m*





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