HW1

Part A code:

% Zhiwei Wen

% EE102A HW1

% Problem 1

clear all; close all;

%% 1a

n = 0:10;

Omega0 = -pi/4;

xn = sin(Omega0\*n);

figure;

stem (n,xn);

xlabel('Time n');

ylabel('x[n] = sin(\Omega\_{0}n)');

title('Task 1, Part (a), \Omega\_{0} = -\pi/4');

t = 0:.01:10;

xn\_ct = sin(Omega0 \* t);

figure;

hold on;

set(gca,'FontName','times','FontSize',16);

plot(t, xn\_ct,'k--', 'LineWidth', 3);

stem(n, xn, 'b', 'LineWidth', 2);

xlabel('Time \itn');

ylabel('\itx\rm[\itn\rm] = sin(\Omega\_{0}\itn\rm)');

title('Task 1, Part (a) with discrete and continuous n, \Omega\_{0} = -\pi/4')

grid on;

%% 1b

Omega1 = 7\*pi/4;

yn = sin(Omega1\*n);

yn\_ct = sin(Omega1 \* t);

figure; hold on;

set(gca,'FontName','times','FontSize',16);

plot(t, xn\_ct,'r--', 'LineWidth', 2.5, 'DisplayName', '\Omega = -\pi/4');

plot(t, yn\_ct,'k--', 'LineWidth', 2.5, 'DisplayName', '\Omega =7\pi/4');

stem(n, xn, 'r', 'LineWidth', 4, 'DisplayName', '\Omega = -\pi/4');

stem(n, yn, 'b', 'LineWidth', 4, 'DisplayName', '\Omega = 7\pi/4');

xlabel('Time \itn');

ylabel('\itx\rm(\itt\rm) = sin(\Omega\itn\rm)');

title('Task 1, Part (b) with discrete and continuous n')

legend('show');

grid on;

%% 1c

wn = xn.\*xn;

figure;

set(gca, 'FontName', 'times','FontSize',16);

stem(n, wn, 'LineWidth', 3);

xlabel('Time n');

ylabel('w[n]= x^{2}[n]');

grid on;

%periodic signal: T = 4.

%% 1d

t = 0:.005:5;

zt = exp(-t+1j\*2\*pi\*t);

re\_zt = real(zt);

im\_zt = imag(zt);

envel1 = exp(-1\*t);

envel2 = -exp(-1\*t);

figure;

hold on;

set(gca,'FontName','times','FontSize',16);

plot(t,re\_zt,'r','LineWidth',2.5,'DisplayName','Real Part');

plot(t,im\_zt,'k','LineWidth',2.5,'DisplayName','Imaginary Part');

plot(t,envel1,'b--','LineWidth',1.5,'DisplayName','Envelop e^{-t}');

plot(t,envel2,'g--','LineWidth',1.5,'DisplayName','Envelop -e^{-t}');

xlabel('Time t');

title('Real and Imaginary parts of e^{-t+j2\pit}');

legend('show');

grid on;

% as can be seen in the figure, the real part and imaginary part oscillate

% within the envelop defined by +-e^(-t). They are decaying sinusoids.

figure; hold on;

set(gca,'FontName','times','FontSize',16);

plot(re\_zt, im\_zt,'b', 'LineWidth', 4);

xlabel('Re(\itz\rm(\itt\rm))');

ylabel('Im(\itz\rm(\itt\rm))');

title('Task 1, Part (d), \itz\rm(\itt\rm) = exp(-\itt + j2\pit\rm)');

grid on;

% e^{-t+1j\*2\*pi\*t}=e^{-t}\*e^{1j\*2\*pi\*t};

% the real part and imaginary part oscillate

% within the envelop defined by +-e^(-t).

% They are decaying sinusoids.

Part A figures:











As can be seen in the figure of real and imaginary part, the real part and imaginary part oscillate within the envelop defined by +-e^(-t). They are decaying sinusoids. This is because in e^{-t+1j\*2\*pi\*t} = e^{-t}\*e^{1j\*2\*pi\*t}, the coefficient of t in e^{-t+1} is -1. This shows that the signal is decaying its module. the real part and imaginary part oscillate within the envelop defined by +-e^(-t). They are decaying sinusoids.

Part B codes:

% Zhiwei Wen

% EE102A HW1

% Problem 2

clear all; close all;

load guitar\_note.mat;

t = (1:length(note))\*dt;

figure; hold on;

plot(t(1:8:end),note(1:8:end),'DisplayName','Guitar Sound');

xlabel('time (s)');

ylabel('Amplitude');

title('Guitar note waveform');

alpha = 1.2;

sigma = -1;

t0 = 0.5;

% alpha is set to 1.2, sigma -1, t0 to 0.5.

envelope = alpha\*exp(sigma\*t).\*double(t>=t0);

plot(t,envelope,'r','LineWidth',1.5,'DisplayName','envelop');

plot(t,-envelope,'r','LineWidth',1.5,'DisplayName','-envelop');

legend('show');grid on;

index\_sample = 1\*fs:round((1+1/16)\*fs);

t\_sample = t(index\_sample);

note\_sample = note(index\_sample);

figure;

plot(t\_sample,note\_sample);

xlabel('sampled time(s)');

ylabel('Amplitude');

title('Sampled note waveform');

grid on;

% the cycle should be approximately 16.2 rounds. So the frequency

% should be 16.2 x 16 = 259.2 hz, which is very close to the real

% frequency of middle C : 261.62 hz.

f\_note = 259.2;

simulated\_note = envelope.\*sin(2\*pi\*f\_note\*t);

figure;hold on;

plot(t(1:16:end),simulated\_note(1:16:end),'DisplayName','Simulated Sound');

xlabel('time (s)');

ylabel('Amplitude');

title('Simulated note waveform');

envelope = alpha\*exp(sigma\*t).\*double(t>=t0);

plot(t,envelope,'r','LineWidth',1.5,'DisplayName','envelop');

plot(t,-envelope,'r','LineWidth',1.5,'DisplayName','-envelop');

legend('show');grid on;

% By playing this sound with(simulated\_note,fs) command in the command

% line, it is found that they are the same note with same fading rate.

Part B Figures:





