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Section-2

Lab-03

Analytical Part

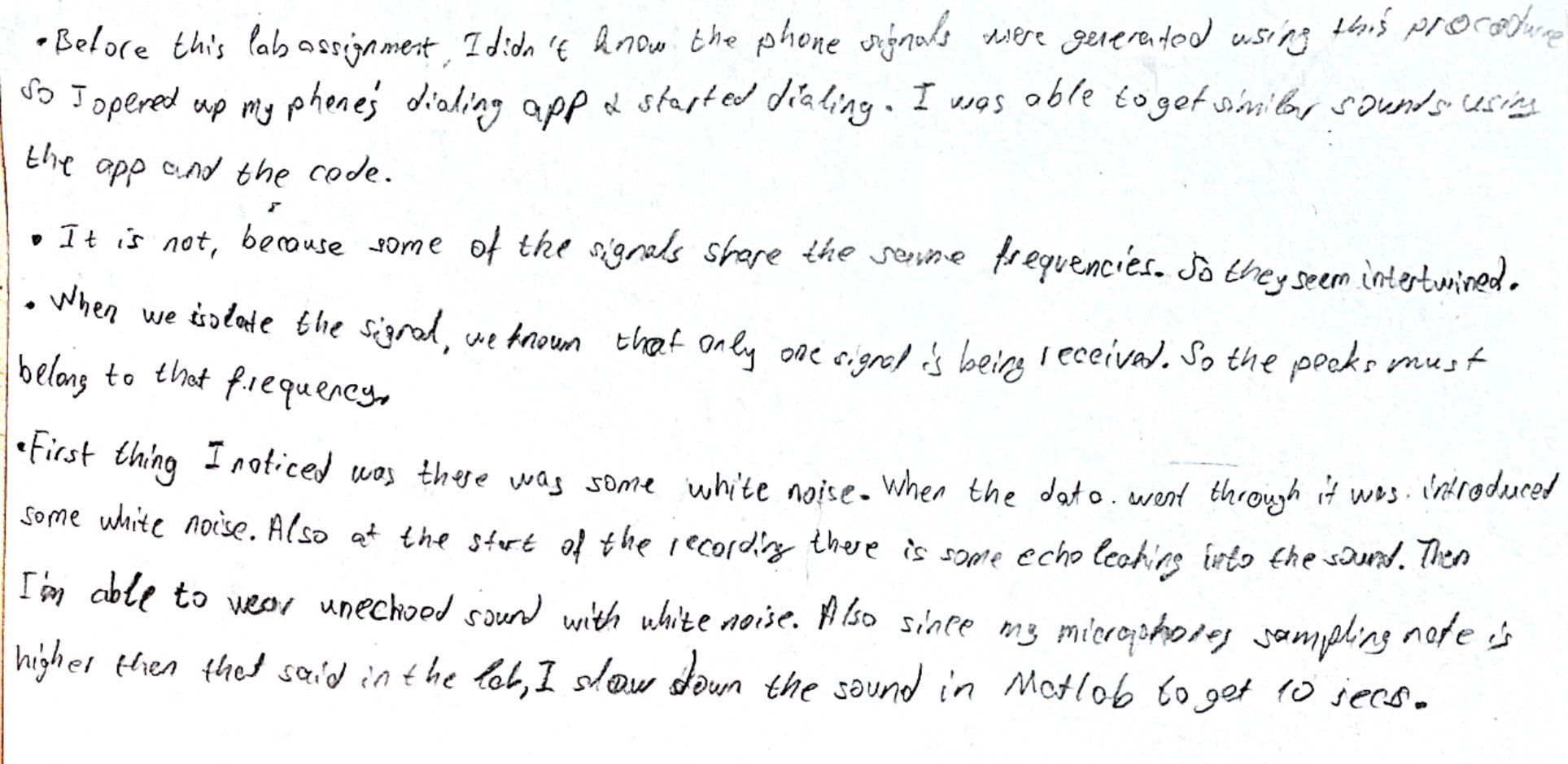


Figure 1- Written Answers

Analytical Part with Calculations

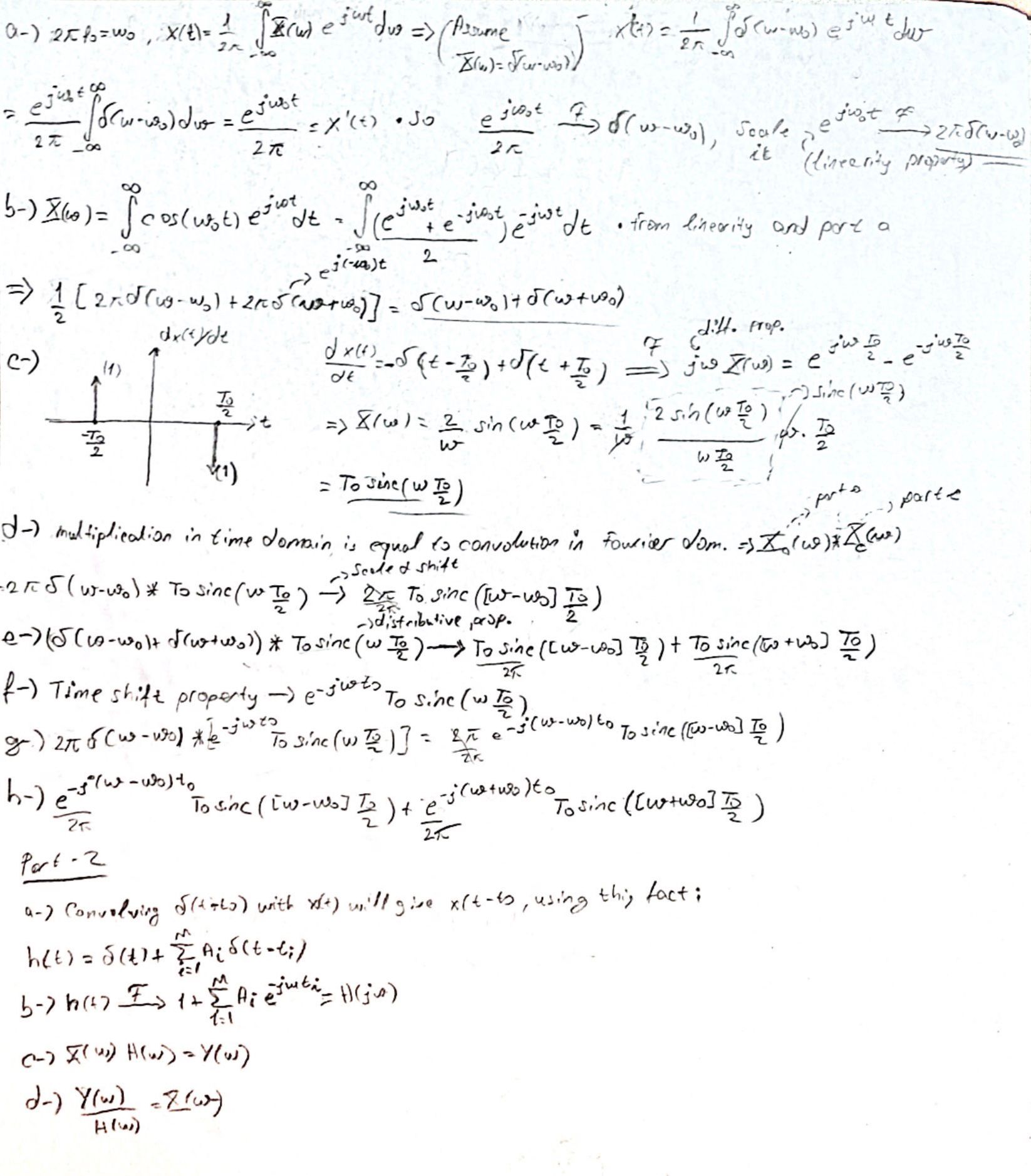


Figure 2- Calculated Answers

Plots

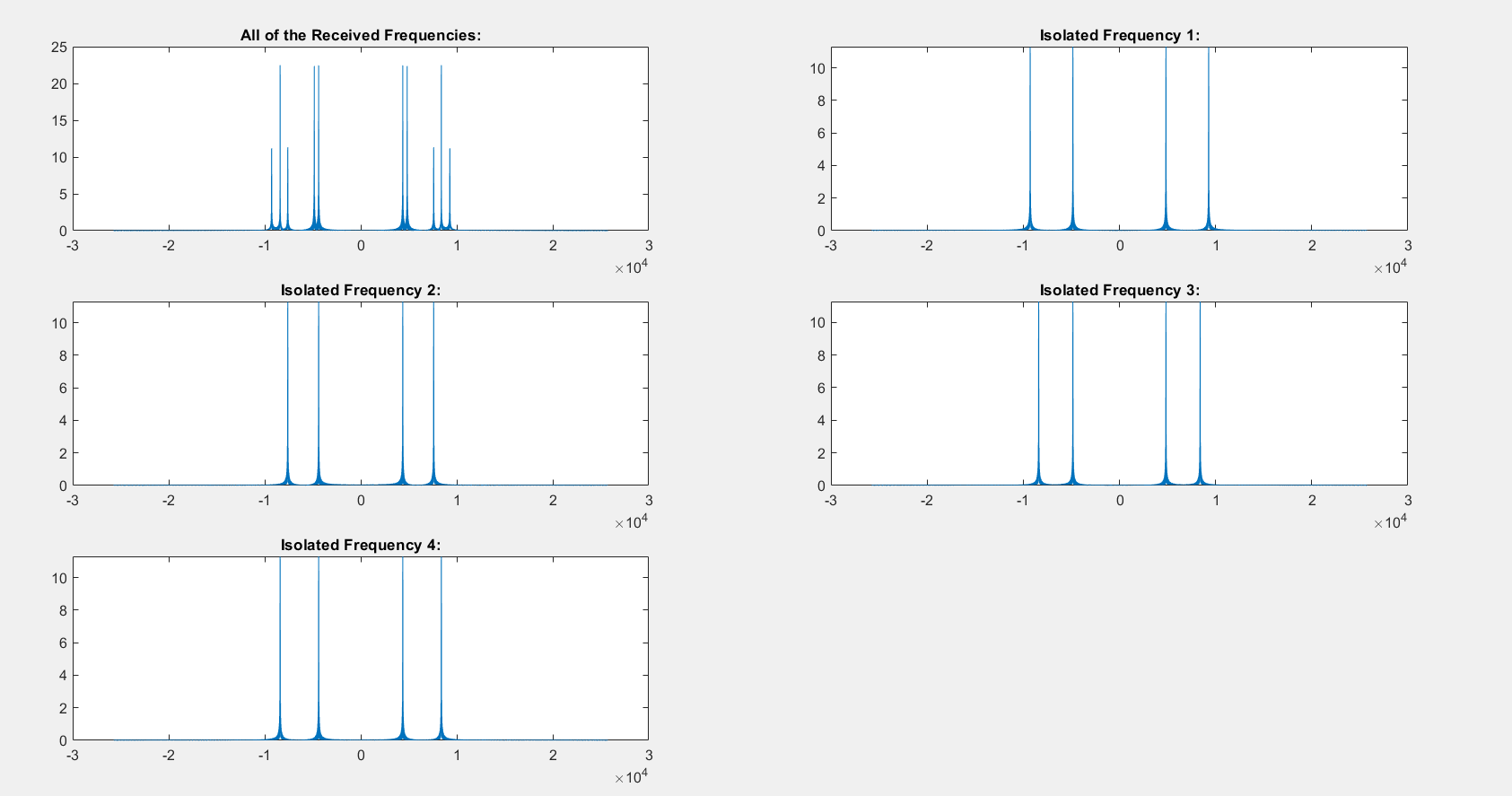


Figure 3- Frequency Plots

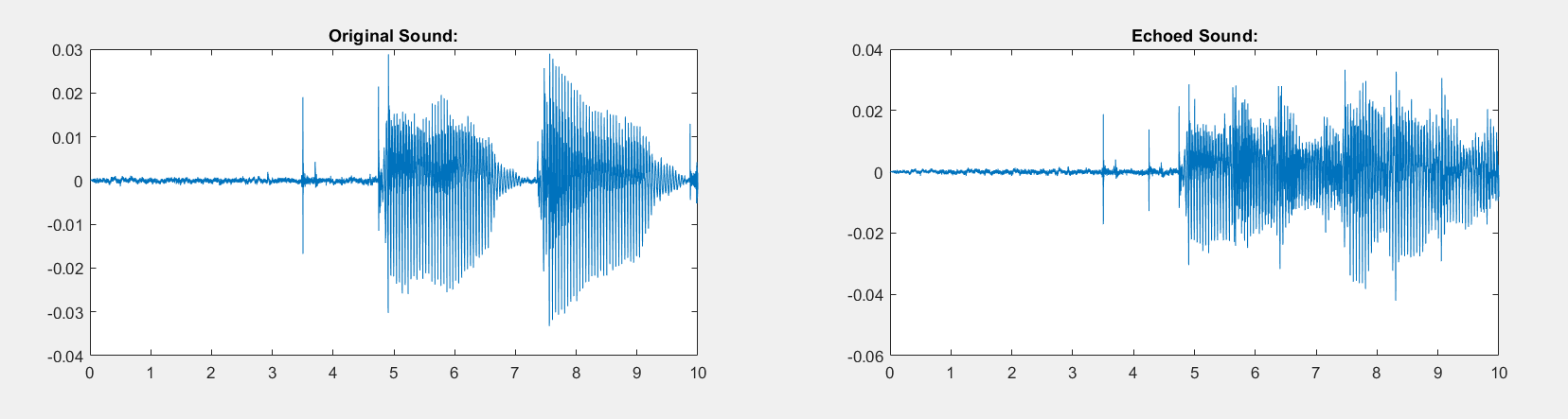


Figure 4- Sound Plots

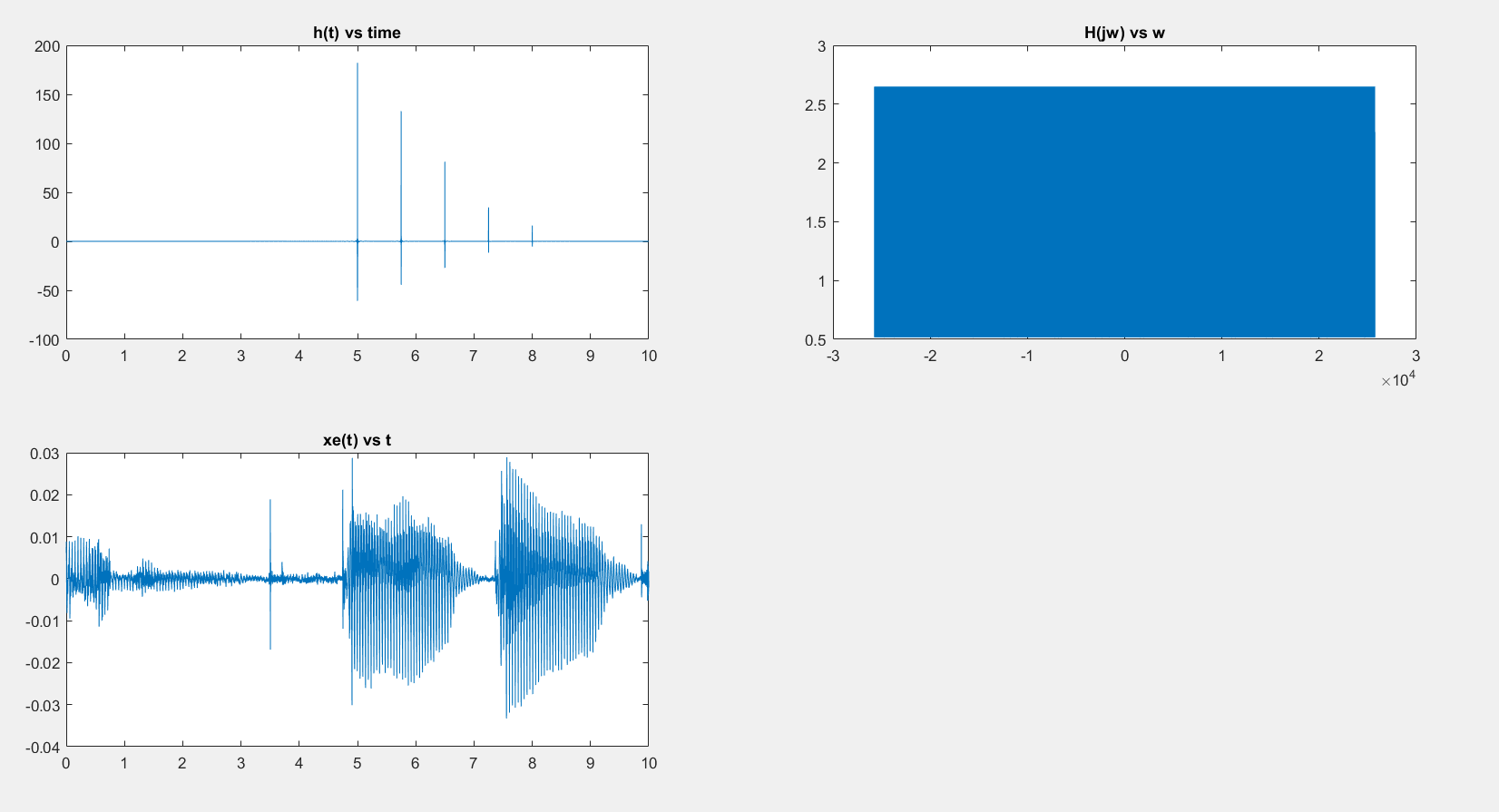


Figure 5- Transform Plots

MATLAB Code

Number=[6 1 5 2];

y=DTMFTRA(Number);

%soundsc(y);

figure(1)

X1=FT(y);

omega=linspace(-8192\*pi,8192\*pi,8193);

omega=omega(1:8193);

subplot(3,2,1)

plot(omega,abs(X1))

title('All of the Received Frequencies:')

kek1=ones(1,2049);

kek2=zeros(1,6144);

rect1=horzcat(kek1,kek2);

x1a=y.\*rect1;

X1A=FT(x1a);

subplot(3,2,2)

plot(omega,abs(X1A))

title('Isolated Frequency 1:')

kek1=ones(1,2049);

kek3=zeros(1,2048);

rect2=horzcat(kek3,kek1,kek3,kek3);

x2a=y.\*rect2;

X2A=FT(x2a);

subplot(3,2,3)

plot(omega,abs(X2A))

title('Isolated Frequency 2:')

rect3=horzcat(kek3,kek3,kek1,kek3);

x3a=y.\*rect3;

X3A=FT(x3a);

subplot(3,2,4)

plot(omega,abs(X3A))

title('Isolated Frequency 3:')

rect4=horzcat(kek3,kek3,kek3,kek1);

x4a=y.\*rect4;

X4A=FT(x4a);

subplot(3,2,5)

plot(omega,abs(X4A))

title('Isolated Frequency 4:')

%part2

sample=[1,(8192/4800)\*Fs];

[y\_sound,Fs] = audioread('alphabet.wav',sample);

y\_sound\_original=y\_sound;

%soundsc(y\_sound,Fs/6)

syms k

t=0:1/8192:10-1/8192;

M=4;

A\_i=[0.75 0.5 0.25 0.15];

t\_i=[0.75 1.5 2.25 3];

t\_i=t\_i.\*8192;

z1=zeros(6144,1);

y1\_sound=vertcat(z1,y\_sound);

y1\_sound=(0.75).\*y1\_sound(1:81920);

z2=zeros(12288,1);

y2\_sound=vertcat(z2,y\_sound);

y2\_sound=(0.5).\*y2\_sound(1:81920);

z3=zeros(18432,1);

y3\_sound=vertcat(z3,y\_sound);

y3\_sound=(0.25).\*y3\_sound(1:81920);

z4=zeros(24576,1);

y4\_sound=vertcat(z4,y\_sound);

y4\_sound=(0.15).\*y4\_sound(1:81920);

y\_sound=y\_sound+y1\_sound+y2\_sound+y3\_sound+y4\_sound;

%soundsc(y\_sound,Fs)

figure(2)

subplot(2,2,1)

plot(t,y\_sound\_original)

title('Original Sound:')

subplot(2,2,2)

plot(t,y\_sound)

title('Echoed Sound:')

sound\_fourier=FT(y\_sound);

omega=linspace(-8192\*pi,8192\*pi,81921);

omega=omega(1:81920);

H\_jw=1+0.75\*exp(-1i\*omega\*0.75)+0.5\*exp(-1i\*omega\*1.5)+0.25\*exp(-1i\*omega\*2.25)+0.15\*exp(-1i\*omega\*3);

h\_time=IFT(H\_jw);

figure(3)

subplot(2,2,1)

plot(t,h\_time)

title('h(t) vs time')

subplot(2,2,2)

plot(omega,abs(H\_jw))

title('H(jw) vs w')

H\_jw=transpose(H\_jw);

X\_jw=rdivide(sound\_fourier,H\_jw);

x\_e=IFT(X\_jw);

soundsc(x\_e,Fs/6)

subplot(2,2,3)

plot(t,x\_e)

title('xe(t) vs t')

function x=DTMFTRA(Number)

N=(0.25).\*[0:4/8192:length(Number)];

x=zeros(1,length(N));

for a= [1:length(Number)]

T=((a-1)\*0.25<=N & N<=(0.25)\*a);

if Number(a)==0

x(T)=x(T)+cos(2\*pi\*941\*N(T))+cos(2\*pi\*1336\*N(T));

elseif Number(a)== 1

x(T)=x(T)+cos(2\*pi\*697\*N(T))+cos(2\*pi\*1209\*N(T));

elseif Number(a)== 2

x(T)=x(T)+cos(2\*pi\*697\*N(T))+cos(2\*pi\*1336\*N(T));

elseif Number(a)== 3

x(T)=x(T)+cos(2\*pi\*697\*N(T))+cos(2\*pi\*1477\*N(T));

elseif Number(a)== 4

x(T)=x(T)+cos(2\*pi\*770\*N(T))+cos(2\*pi\*1209\*N(T));

elseif Number(a)== 5

x(T)=x(T)+cos(2\*pi\*770\*N(T))+cos(2\*pi\*1336\*N(T));

elseif Number(a)== 6

x(T)=x(T)+cos(2\*pi\*770\*N(T))+cos(2\*pi\*1477\*N(T));

elseif Number(a)== 7

x(T)=x(T)+cos(2\*pi\*852\*N(T))+cos(2\*pi\*1209\*N(T));

elseif Number(a)== 8

x(T)=x(T)+cos(2\*pi\*852\*N(T))+cos(2\*pi\*1336\*N(T));

elseif Number(a)== 9

x(T)=x(T)+cos(2\*pi\*852\*N(T))+cos(2\*pi\*1477\*N(T));

else

x(T)=x(T)+0;

end

end

end