Editor - /Users/pallavsingla/Documents/MATLAB/PCS_Assignment3.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m

```matlab
% Assignment 3
% Pallav Singla
% 2020225


[y, fs] = input_2020225();

% sound(y,Fs)
                           %
t = 0:(1/fs):(length(y)*(1/fs))-(1/fs);             % Time for ploting purpose
figure(1)
plot(t,y);
title('Msg Signal');                    % Plottingh the message signal
xlabel('Seconds');
ylabel('Amplitude of Msg Signal');

% figure
% plot(t,abs(y));
% title('Amplitude Plot');
% xlabel('Seconds');

figure(2)
plot(t,angle(y)*180/pi);
title('Phase Plot in time');        % plot of phase in time domain
xlabel('Time');
ylabel('Phase of Msg Signal');

len = length(y);
Y = abs(fftshift(fft(y)));              % frequency representation of message signal
F = (-(1-1/len)/2:1/len:(1-1/len)/2)*fs;
figure(3);
plot(F,Y);
title('Message in freq');
```

Editor – /Users/pallavsingla/Documents/MATLAB/PCS_Assignment3.m

+1 | PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m | +

```
title('Message in freq');
xlabel('Frequency');
ylabel('Phase of Msg Signal');

figure(4)
plot(F,angle(fft(y))*180/pi);           %phase in Frequency domain
title('Phase Plot in freq');
xlabel('Frequency');
ylabel('Phase of Msg Signal');

% used for displaying the frequency which is end point in the frequency
% plot

display_2020225();                    % Display Function for displaying the max freq

info = audioinfo('rec2.m4a');

f = 5000;     % max frequency of msg signal


% [k,n] = size(y);

%% for FS greater then 2FM

fs1 = 2*f*2;    % Sampling frequency
fac = 2;
% %
tr = zeros(size(t));     % Making Matrix and Assigning 0 to each value
tr(1:fs1/f:end) = 1;          % impulse train

trr = transpose(tr);        % taking transpose of the impulse train
Z = y.*trr;
ZZ = fftshift(fft(Z));        % sampled output
```

Editor – /Users/pallavsingla/Documents/MATLAB/PCS_Assignment3.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m

```
ZZ = fftshift(fft(Z));       % sampled output

freq1 = (-(1-1/len)/2:1/len:(1-1/len)/2)*fs1;

figure(5);

plot(freq1,abs(ZZ));        % plot of sampled output wrt to freq  %https://in.mathworks.com/
xlabel('Frequency');
ylabel('Amplitude');

%% For FS less then 2FM

fs2  =2*f*(1/10);       % Samplin g Freq

tr2 = zeros(size(t));       % Making Matrix and Assigning 0 to each Value
tr2(1:fs2/f:end) = 1;       % impulse train

tr2r = transpose(tr2);      % taking transpose of the impulse train
Z1 = y.*tr2r;

freq = (-(1-1/len)/2:1/len:(1-1/len)/2)*fs2;    % Frequency same as above

Z2 = fftshift(fft(Z1));             % Sampled Output

figure(6);

plot(freq,abs(Z2));
xlabel('Frequency');
ylabel('Amplitude');


%%part4 quantisation
```

Editor – /Users/pallavsingla/Documents/MATLAB/PCS_Assignment3.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m

```matlab

%%part4 quantisation

quantise_2020225();     %% quantise fuction made in function



L =32;  %% Because MSE is tending to zero( almost) at the end i have seen it from graph of M
          % code in quantise_2020225()
          % mse  = 3*1/32*32  it is very very samll almost to 0

mse_32 = 3*1/(32*32);       % for showing the value at 32
disp(mse_32);

%% Quantisation

% % s = quantisation_2020225(Z1);
% % plot(t,s*32/1.8);
% %
% % xlabel('Time');
% %
% % ylabel('Amplitude of a quantised signal');
% % title('Graph after quantisation');


L=32;                              % Number of Levels
[a,b] = quanta_2020225(Z1,L);    % using the function made in and output quantised signal is

figure(8)                      % plotting the quantised signal
plot(t,a)
xlabel('Time');
ylabel('Amplitude of a quantised signal');
title('Graph after quantisation');
```

ditor - /Users/pallavsingla/Documents/MATLAB/PCS_Assignment3.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m

```matlab
%% Quantisation

% % s = quantisation_2020225(Z1);
% % plot(t,s*32/1.8);
% %
% % xlabel('Time');
% %
% % ylabel('Amplitude of a quantised signal');
% % title('Graph after quantisation');


L=32;                           % Number of Levels
[a,b] = quanta_2020225(Z1,L);   % using the function made in and output quantised signal is

figure(8)                   % plotting the quantised signal
plot(t,a)
xlabel('Time');
ylabel('Amplitude of a quantised signal');
title('Graph after quantisation');

figure(9);
plot(t,(a*32/2)+11);            % Plotting the number of level vs time graph
xlabel('Time');
ylabel('Amplitude of a quantised signal');
title('Graph after quantisation');



%% part 5

enc = dec2bin((a*32/2)+11);   % COnverting decimal to binary using inbuild function
```

ditor – /Users/pallavsingla/Documents/MATLAB/quantise_2020225.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m | +

```
function [] = quantise_2020225()
%% MSE quantisation
n = (1:5);
L = 2.^n;       % No. of Levels by element wise power so no need of loop

mse = (3*1)./(L.*L);  % Here i have just used the Formulae that we learnt

figure(7);
plot(L,mse)
xlabel('Levels');
ylabel('MSE');
title("MSE Graph");
end
```

ditor – /Users/pallavsingla/Documents/MATLAB/quanta_2020225.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m | +

```
function [a,b] = quanta_2020225(y,L)
Max = max(y);     % Here taking maximum of the sampled signal
Min = min(y);     % here finding minimum of the sampled signal
b = (Max-Min)/L;  % Calculating delta v

lev = Min+b/2:b:Max-b/2;

%lev = 0:b:Max;

ps = (y-Min)/b+1/2;

idx = round(ps);

idx = min(idx,L);

a =lev(idx);        % output of the level so

% Reference from the reference book 2
end
```

ditor – /Users/pallavsingla/Documents/MATLAB/display_2020225.m

PCS_Assignment3.m | quantise_2020225.m | quanta_2020225.m | display_2020225.m | +

```
function f = display_2020225()
    disp(5000)
end
```

Editor – /Users/pallavsingla/Documents/MATLAB/input_2020225.m

+1 | quantise_2020225.m | quanta_2020225.m | display_2020225.m | input_2020225.m | +

```
function [y,fs] = input_2020225()
[y,fs]=audioread('rec2.m4a');
end
```

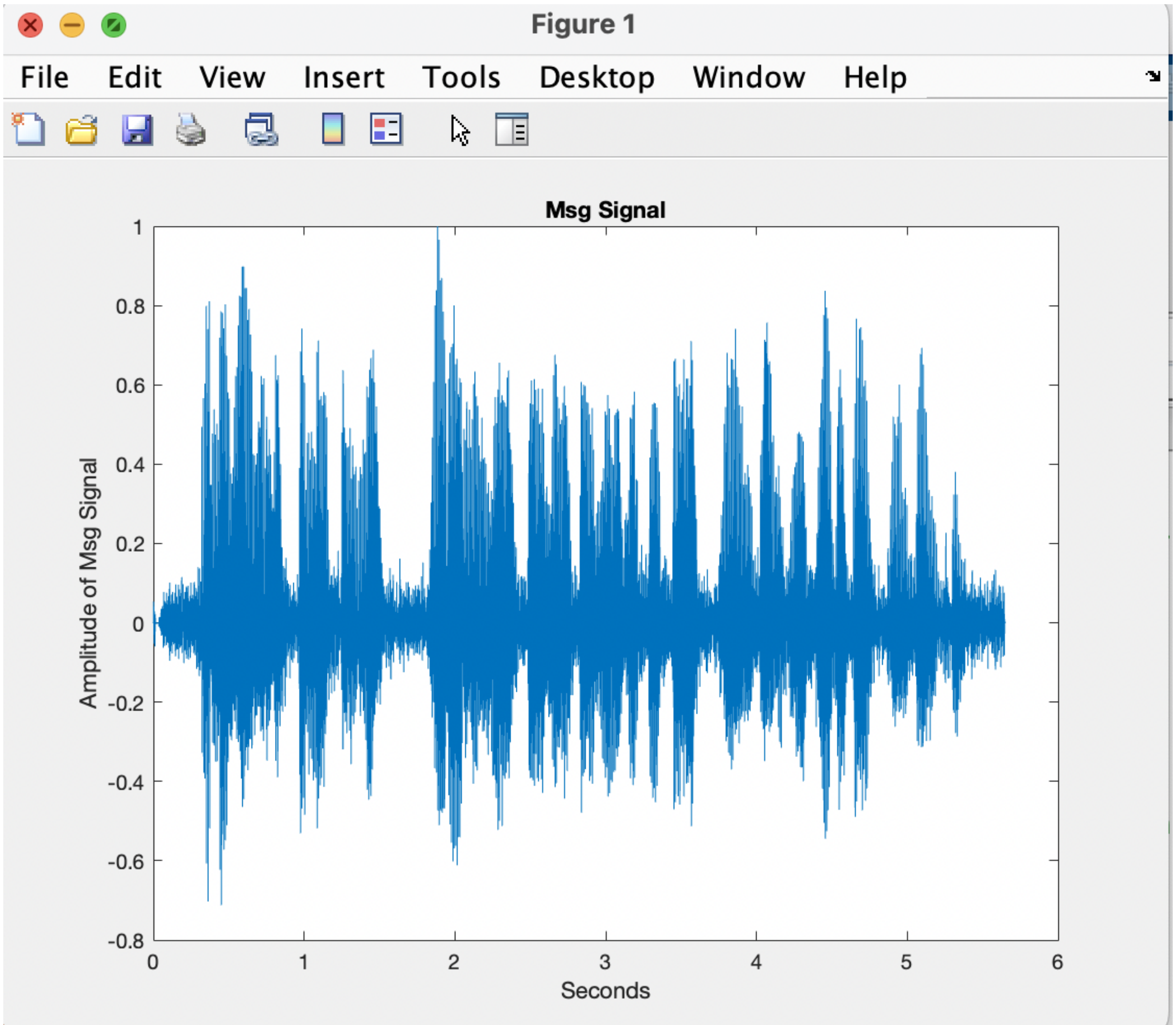
Figure 1
File Edit View Insert Tools Desktop Window Help
Msg Signal
Amplitude of Msg Signal
Seconds
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
1
2
3
4
5
6

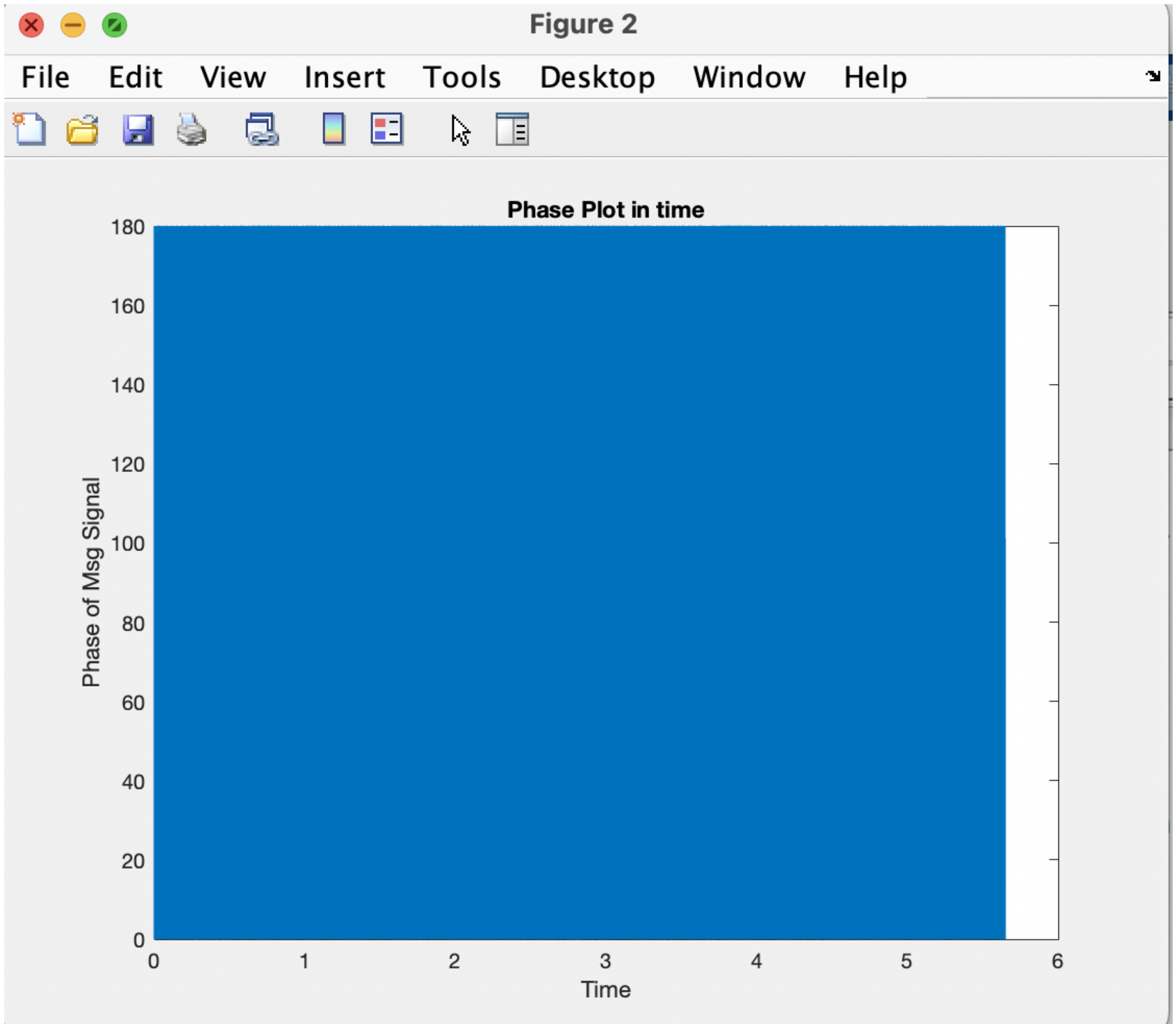
Figure 2
File
Edit
View
Insert
Tools
Desktop
Window
Help
Phase Plot in time
Phase of Msg Signal
Time
0
20
40
60
80
100
120
140
160
180
0
1
2
3
4
5
6

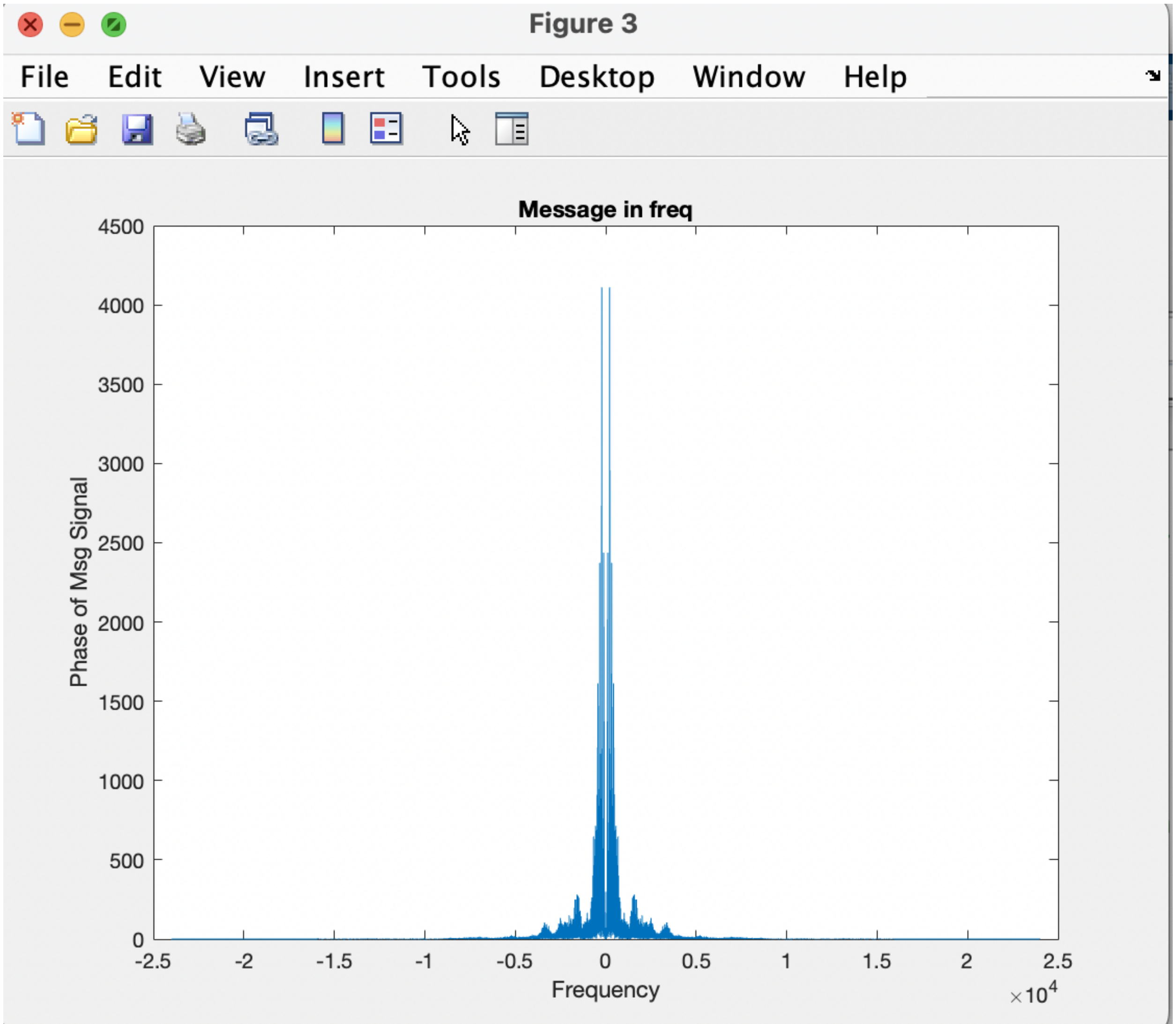
Figure 3
File
Edit
View
Insert
Tools
Desktop
Window
Help
Message in freq
Phase of Msg Signal
Frequency
×10^4
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

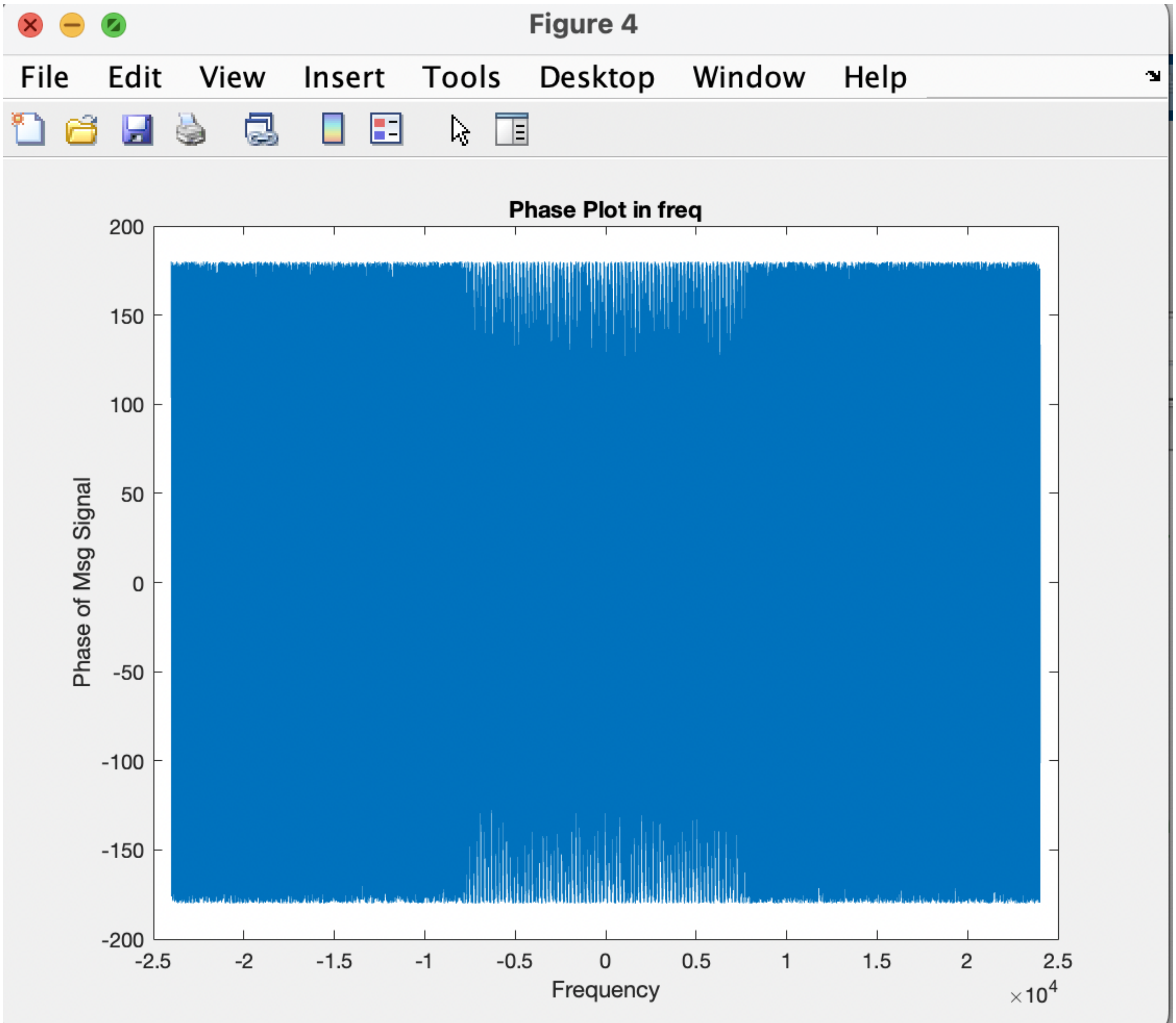

Figure 4
File
Edit
View
Insert
Tools
Desktop
Window
Help
Phase Plot in freq
Phase of Msg Signal
Frequency
×10^4
200
150
100
50
0
-50
-100
-150
-200
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

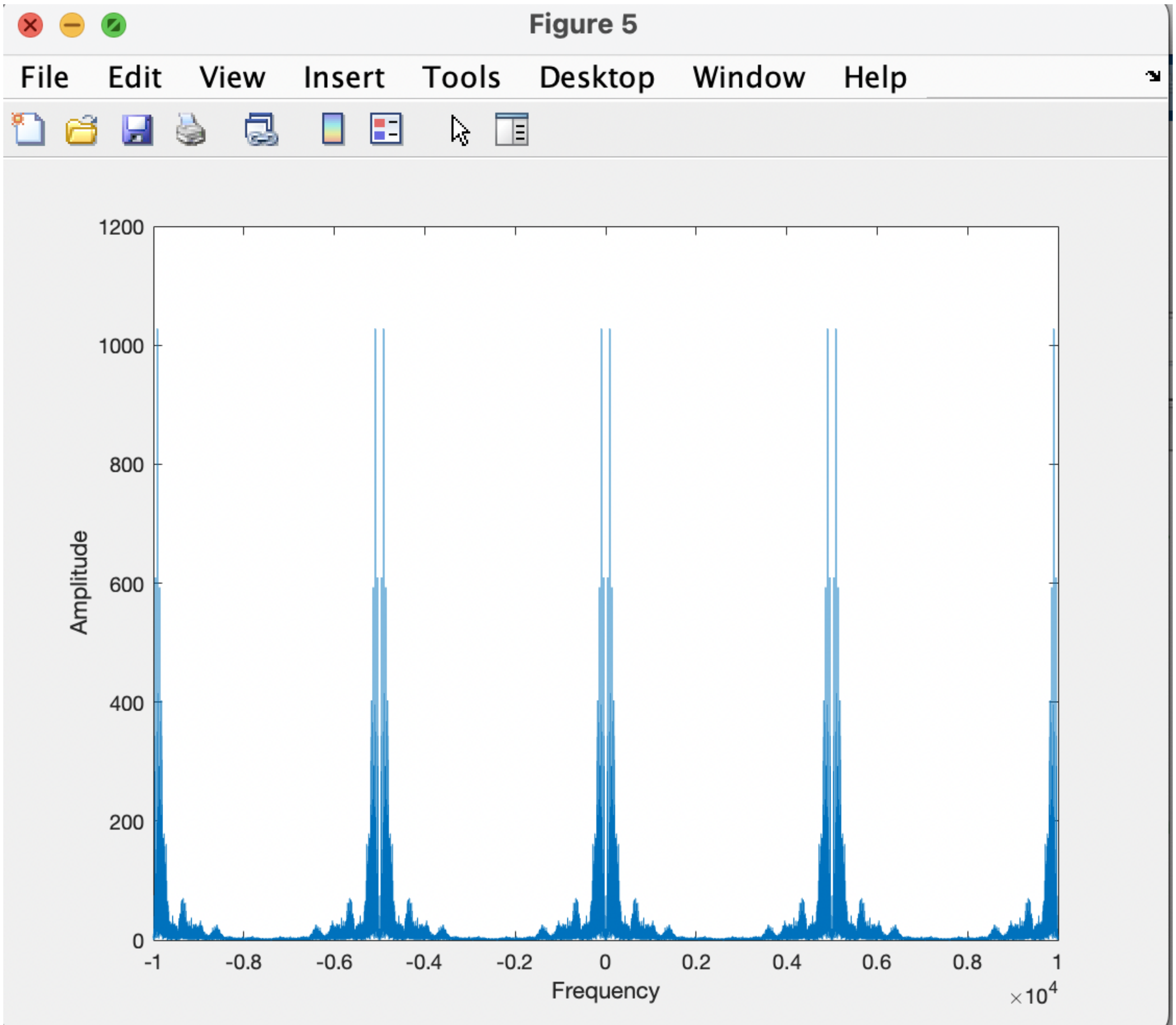
Figure 5
File Edit View Insert Tools Desktop Window Help
1200
1000
800
600
400
200
0
Amplitude
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Frequency
$\times 10^4$

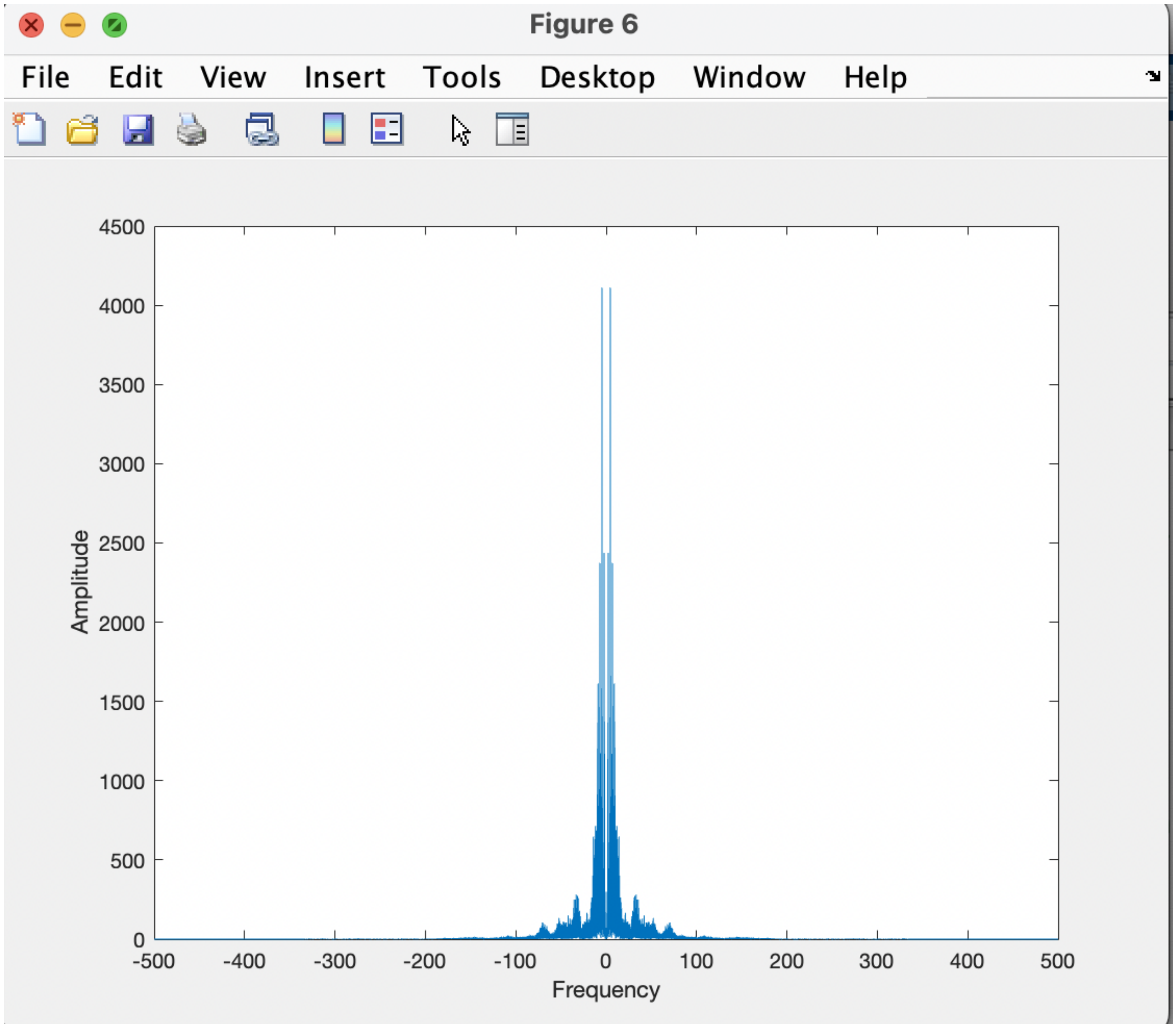
Figure 6
File Edit View Insert Tools Desktop Window Help
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Amplitude
-500 -400 -300 -200 -100 0 100 200 300 400 500
Frequency

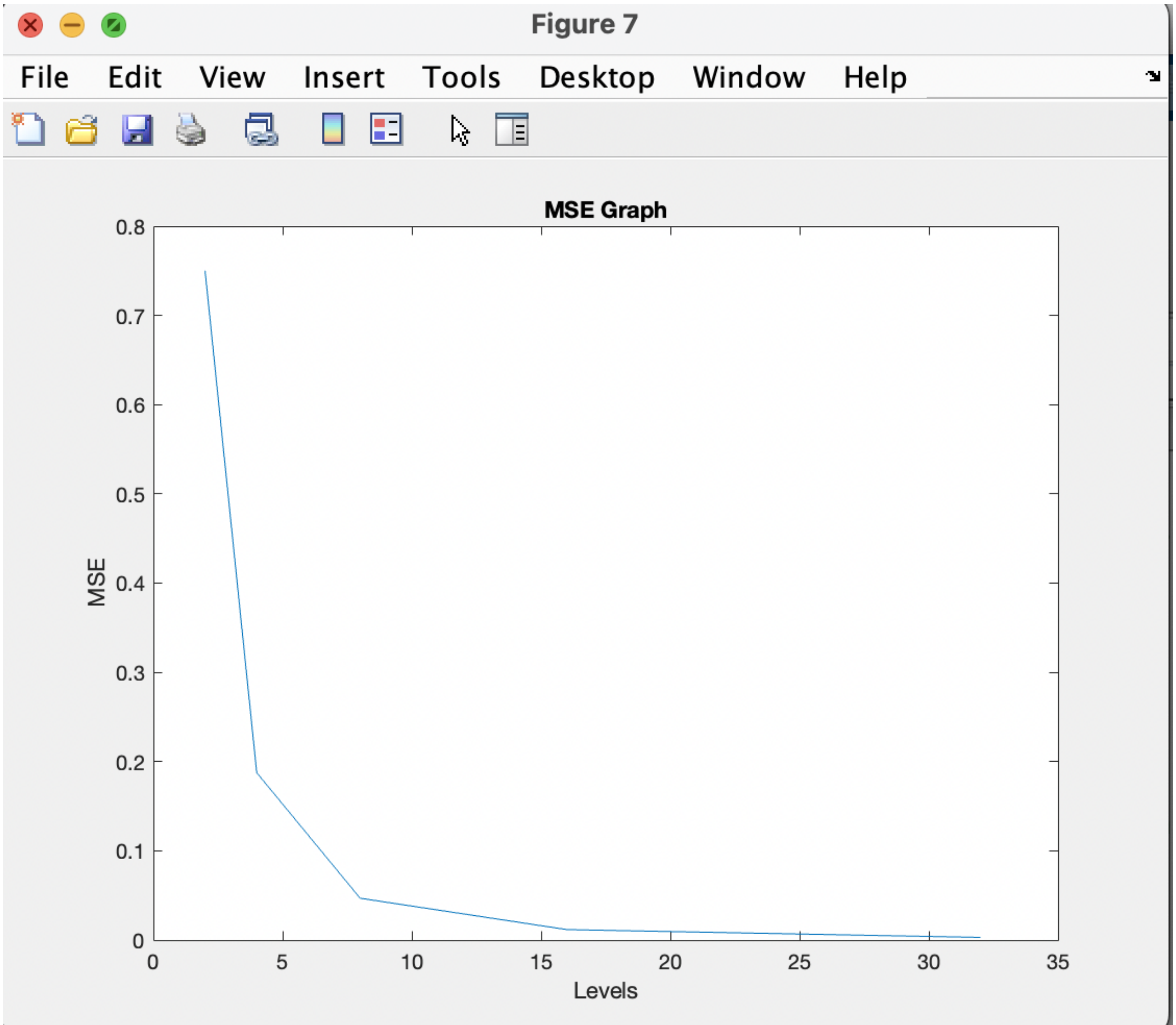
Figure 7
File
Edit
View
Insert
Tools
Desktop
Window
Help
MSE Graph
MSE
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
5
10
15
20
25
30
35
Levels

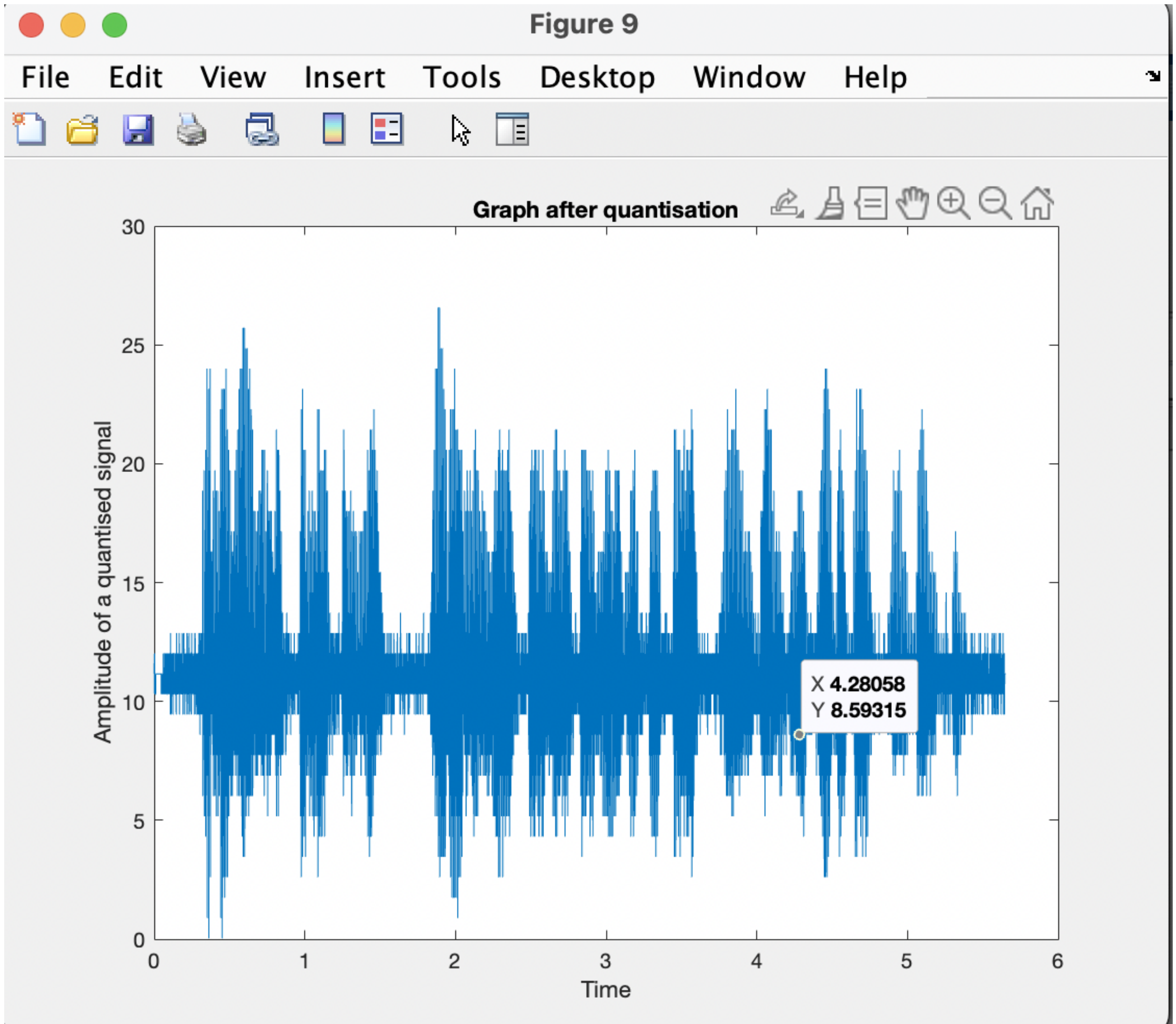
Figure 9
File
Edit
View
Insert
Tools
Desktop
Window
Help
Graph after quantisation
Amplitude of a quantised signal
Time
X 4.28058
Y 8.59315
0
5
10
15
20
25
30
0
1
2
3
4
5
6

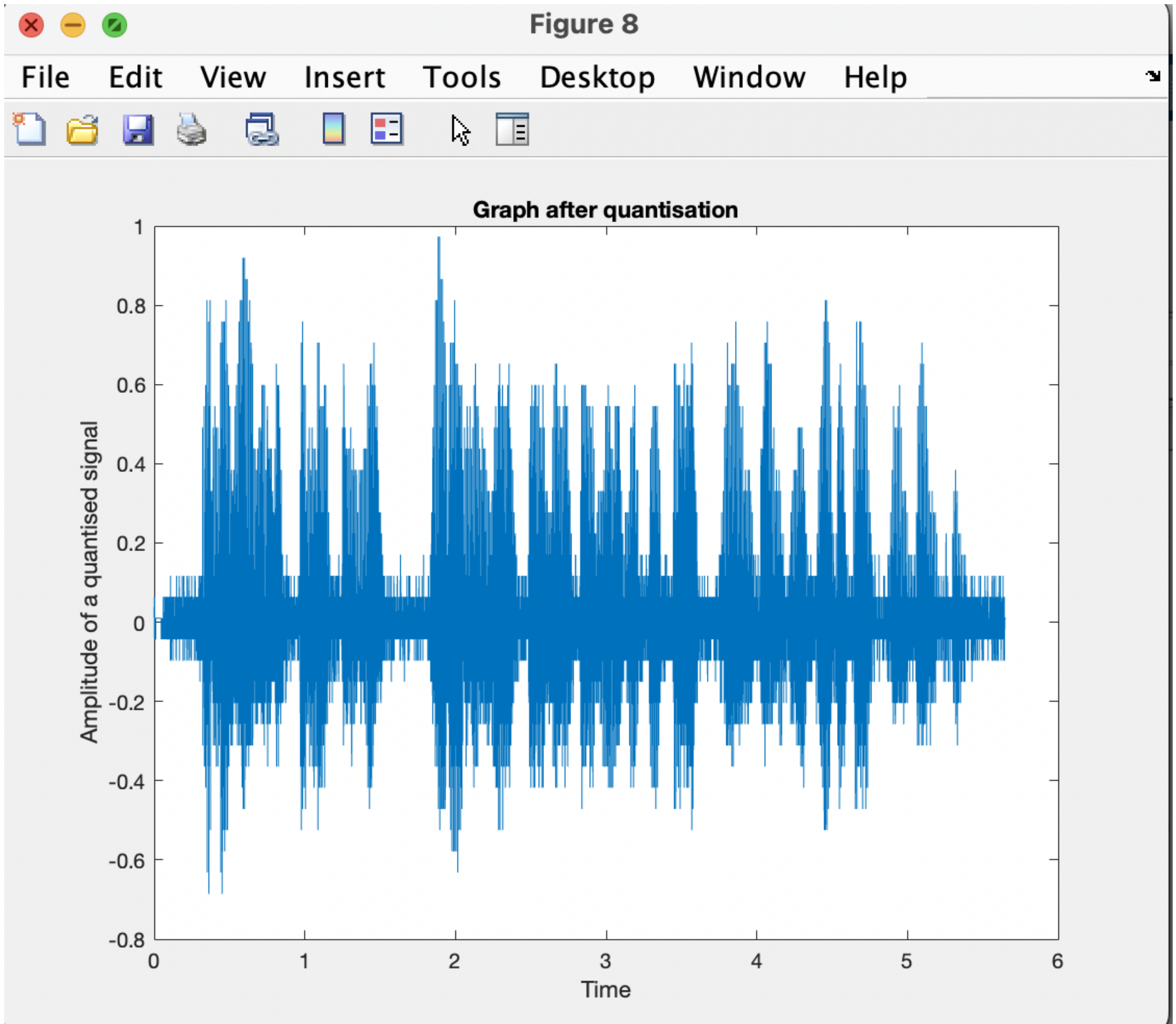
Figure 8
File
Edit
View
Insert
Tools
Desktop
Window
Help
Graph after quantisation
Amplitude of a quantised signal
Time
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
1
2
3
4
5
6