LABSHEET 3
Stationary and Non Stationary Signals
AI in Speech Processing

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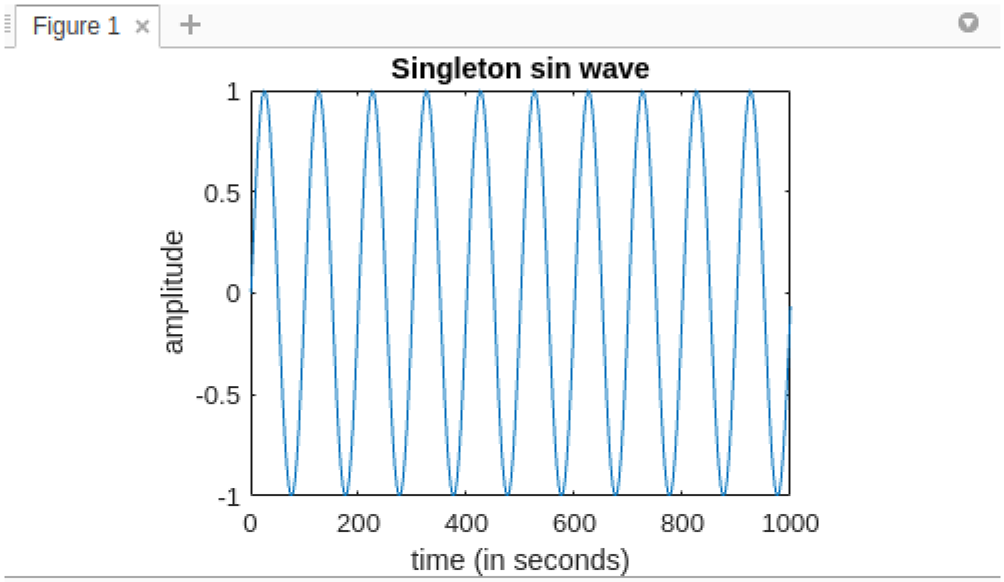
Experiment 1

Part I

%code

```
clear;
fprintf('Experiment 1\n')
fprintf('Part 1 : Generate a 10 Hz sine wave sampled at 1000 Hz sampling
frequency and for a duration of 1 sec.\n')
t=0:1/1000:1;
y=sin(2*pi*10*t);
x=[1:1000];
figure;
plot(x,y(1:1000));
xlabel('time (in seconds)');
ylabel('amplitude')
title('Singleton sin wave');
```

%Output

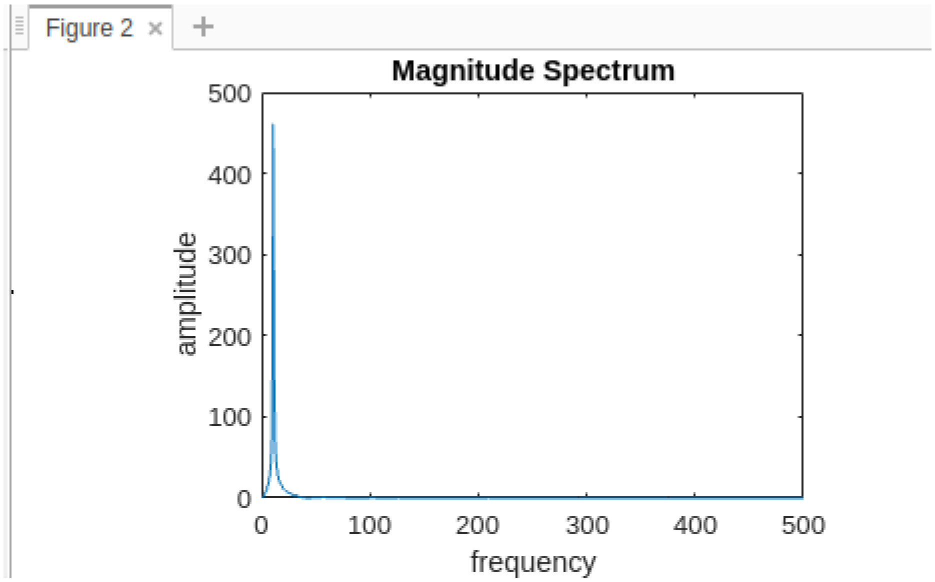


Part II

%code

```
clear;
fprintf('Part 2 : Compute the spectrum. The spectrum will be shown only for
half portion, since the magnitude spectrum is symmetric with respect to
origin\n')
t=0:1/1000:1;
y=sin(2*pi*10*t);
Y=abs(fft(y,1024));
x=[1:1024]*(1000/1024);
figure;
plot(x(1:512),Y(1:512));
xlabel('frequency');
ylabel('amplitude')
title('Magnitude Spectrum');
fprintf('What is the frequency corresponding to the peak in the spectrum??\n')
fprintf('The peak at 10 Hz frequency corresponding to the peak in the
spectrum\n')
```

%Output



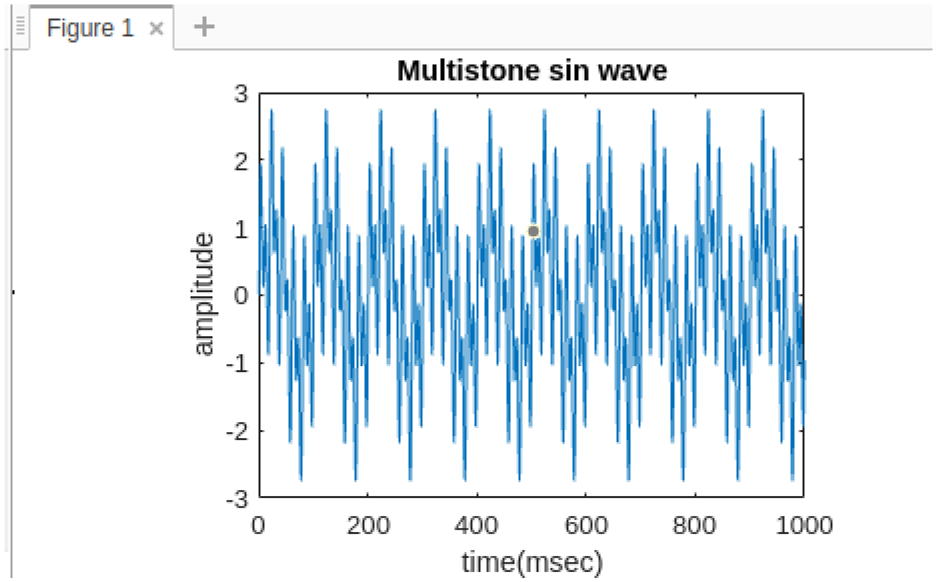
Experiment 2

Part I

%code

```
clear;
fprintf('Experiment 2\n')
t=0:1/1000:1;
y1=sin(2*pi*10*t);
y2=sin(2*pi*50*t);
y3=sin(2*pi*100*t);
y=y1+y2+y3;
x=[1:1000];
figure;
plot(x,y(1:1000));
xlabel('time(msec)');
ylabel('amplitude')
title('Multistone sin wave');
```

%Output

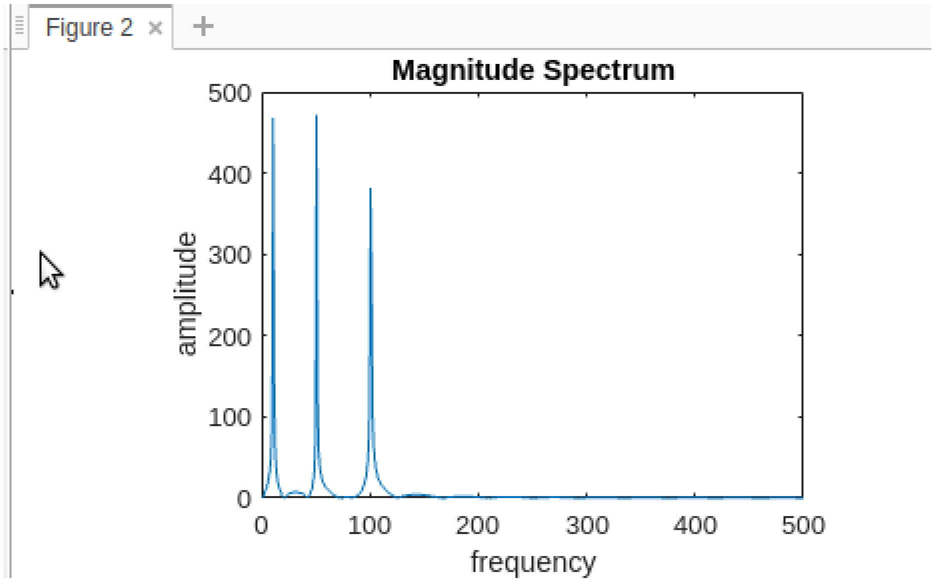


Part II

%code

```
clear;
fprintf('magnitude spectrum\n');
t=0:1/1000:1;
y1=sin(2*pi*10*t);
y2=sin(2*pi*50*t);
y3=sin(2*pi*100*t);
y=y1+y2+y3;
x=[1:1000]*(1000/1024);
Y=abs(fft(y,1024));
figure;
plot(x(1:512),Y(1:512));
xlabel('frequency');
ylabel('amplitude')
title('Magnitude Spectrum');
fprintf('Can you find the frequency components by direct measurement in the
time domain?')
fprintf('The shape of the signal that is generated is relatively more
complicated compared to the single tone case. Hence it becomes difficult to
find the frequency components by direct measurement in the time domain.\n')
fprintf('Is the multitone sine wave a stationary signal? Why?')
fprintf('Yes because all the frequency components are present at all instants
of time.')
```

%Output



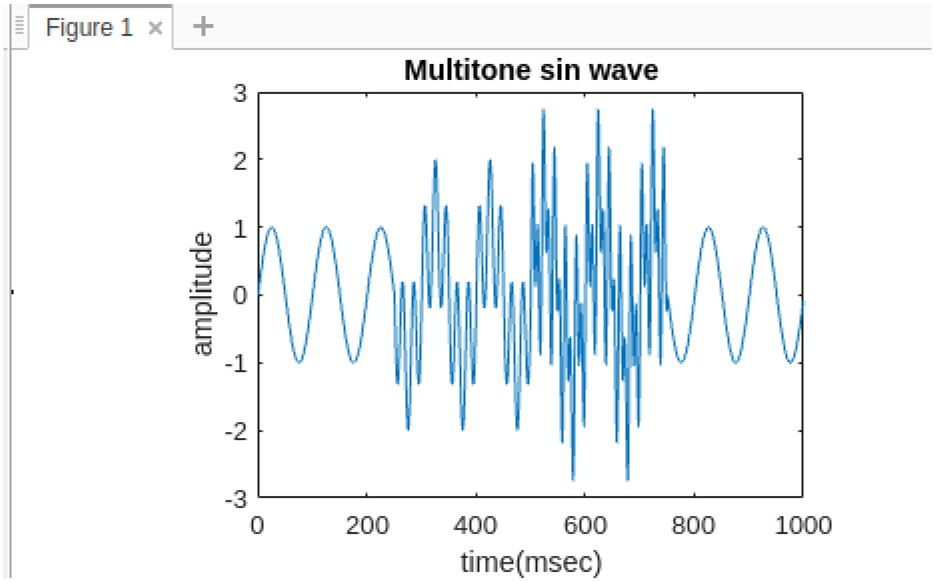
Experiment 3

Part I

%code

```
clear;
fprintf('Experiment 3\n')
fprintf('Part I')
t=0:1/1000:1;
y1=sin(2*pi*10*t);
y2=sin(2*pi*50*t);
y3=sin(2*pi*100*t);
z1=y1+y2;
z2=y1+y2+y3;
y=[y1(1:250), z1(251:500), z2(501:750), y1(751:1000)];
x=[1:1000];
figure;
plot(x,y(1:1000));
xlabel('time(msec)');
ylabel('amplitude')
title('Multitone sin wave');
```

%Output



Part II

%code

```
clear;
fprintf('Part II')
fprintf('magnitude spectrum\n');
t=0:1/1000:1;
y1=sin(2*pi*10*t);
y2=sin(2*pi*50*t);
y3=sin(2*pi*100*t);
z1=y1+y2;
z2=y1+y2+y3;
y=[y1(1:250), z1(251:500), z2(501:750), y1(751:1000)];
Y1=abs(fft(y1(1:250),256));
z11=z1(251:500);
z1=abs(fft(z11,256));
z21=z2(501:750);
z2=abs(fft(z21,256));
y11=y1(751:1000);
Y11=abs(fft(y11,256));
x1=[1:256]*(1000/256);
figure;
subplot(2,2,1);plot(x1(1:128),Y1(1:128));
xlabel('frequency');
```

```
ylabel('amplitude')
title('Spectrum of 10 Hz component')
subplot(2,2,2);plot(x1(1:128),z1(1:128));
xlabel('frequency');
ylabel('amplitude')
title('Spectrum of 50 Hz component')
subplot(2,2,3);plot(x1(1:128),z2(1:128));
xlabel('frequency');
ylabel('amplitude')
title('Spectrum of 100 Hz component')
subplot(2,2,4);plot(x1(1:128),Y11(1:128));
xlabel('frequency');
ylabel('amplitude')
title('Spectrum of 10 Hz component')
```

%Output