Continuous Time Modulation

1. Amplitude Modulation
2. Frequency Modulation

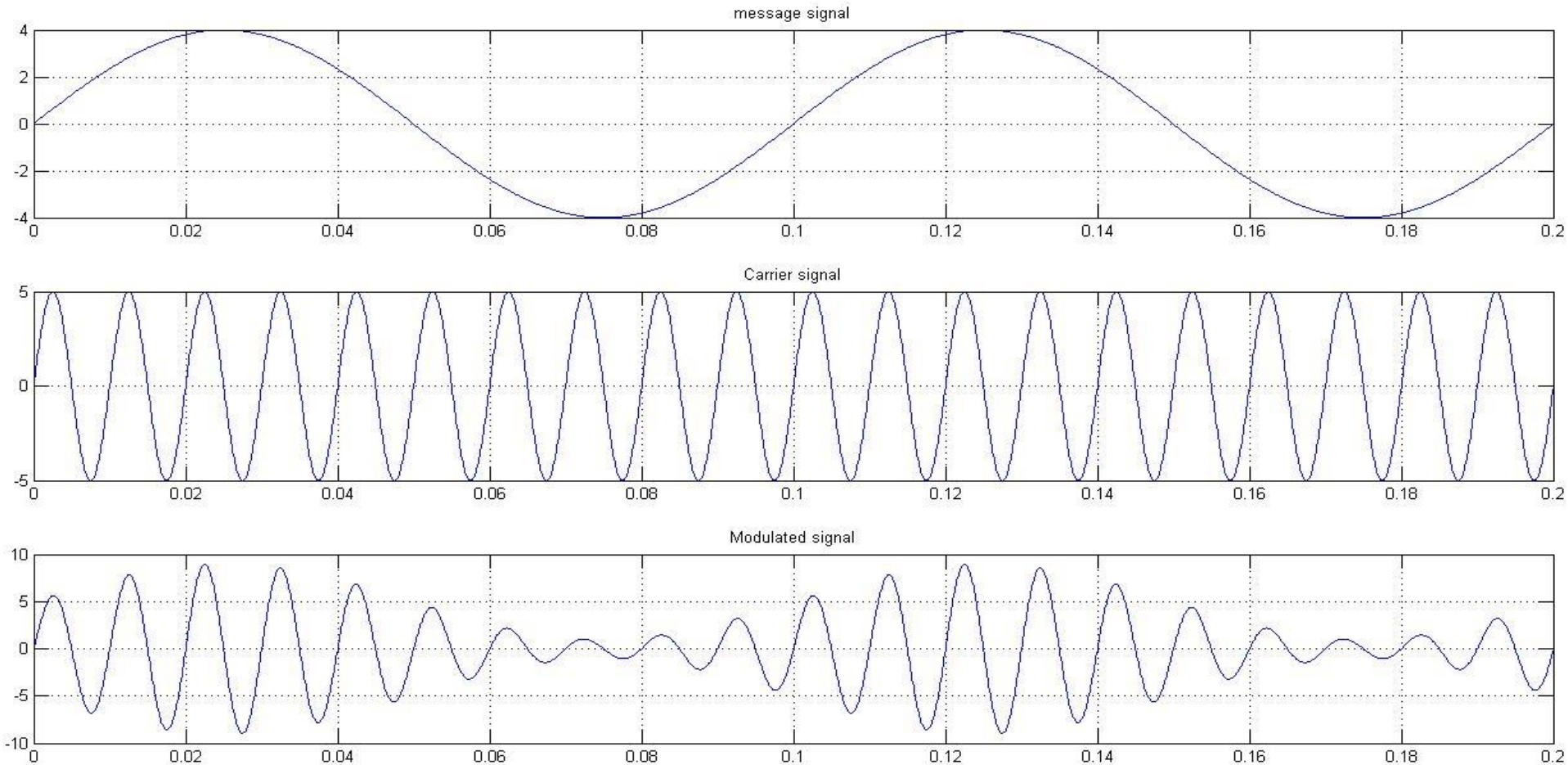
Experiment:2

Observation of Amplitude Modulated waveform using MATLAB

MATLAB CODE…….

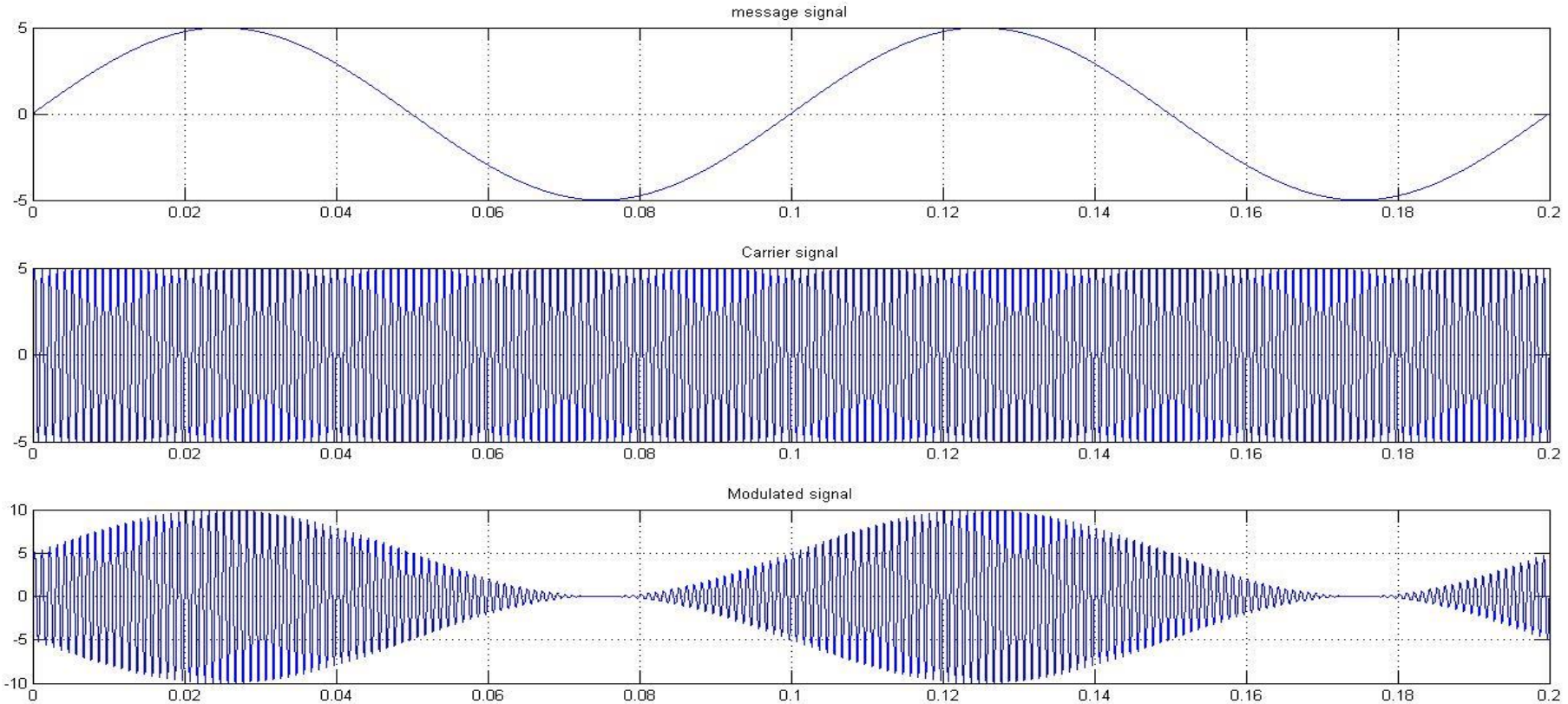
```
fm=10;
fc=100;
am=4;
ac=5;
t=0:1/(100*fc):2/fm;
mt=am.*sin(2*pi*fm*t);
ct=ac.*sin(2*pi*fc*t);
c=(ac+mt);
ca=c.*sin(2*pi*fc*t);
subplot(3,1,1);
plot(t,mt);
title('message signal');
grid;
subplot(3,1,2);
plot(t,ct);
title('Carrier signal')
grid;
subplot(3,1,3);
plot(t,ca);
title('Modulated signal');
grid;
```

Waveforms……


message signal
4
2
0
-2
-4
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Carrier signal
5
0
-5
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Modulated signal
10
5
0
-5
-10
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2

Modulation index m=1

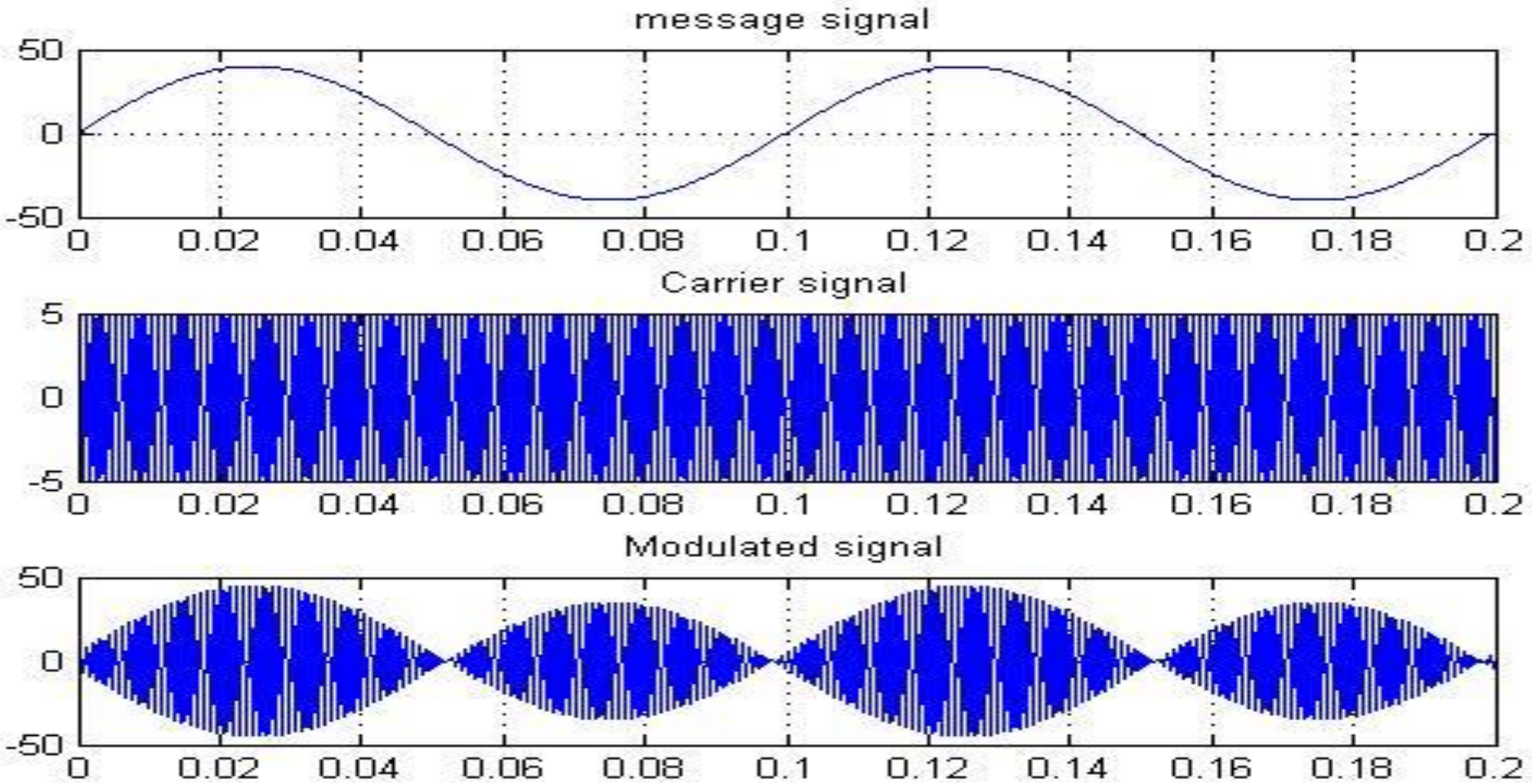
- Make `am=ac`. Increase carrier frequency for better realization



When Amplitude of Message is higher than Carrier

```
fm=10;
fc=1000;
am=40;
ac=5;
t=0:1/(100*fc):2/fm;
mt=am.*sin(2*pi*fm*t);
ct=ac.*sin(2*pi*fc*t);
c=(ac+mt);
ca=c.*sin(2*pi*fc*t);
subplot(3,1,1);
plot(t,mt);
title('message signal');
grid;
subplot(3,1,2);
plot(t,ct);
title('Carrier signal')
grid;
subplot(3,1,3);
plot(t,ca);
title('Modulated
signal');
grid;
```

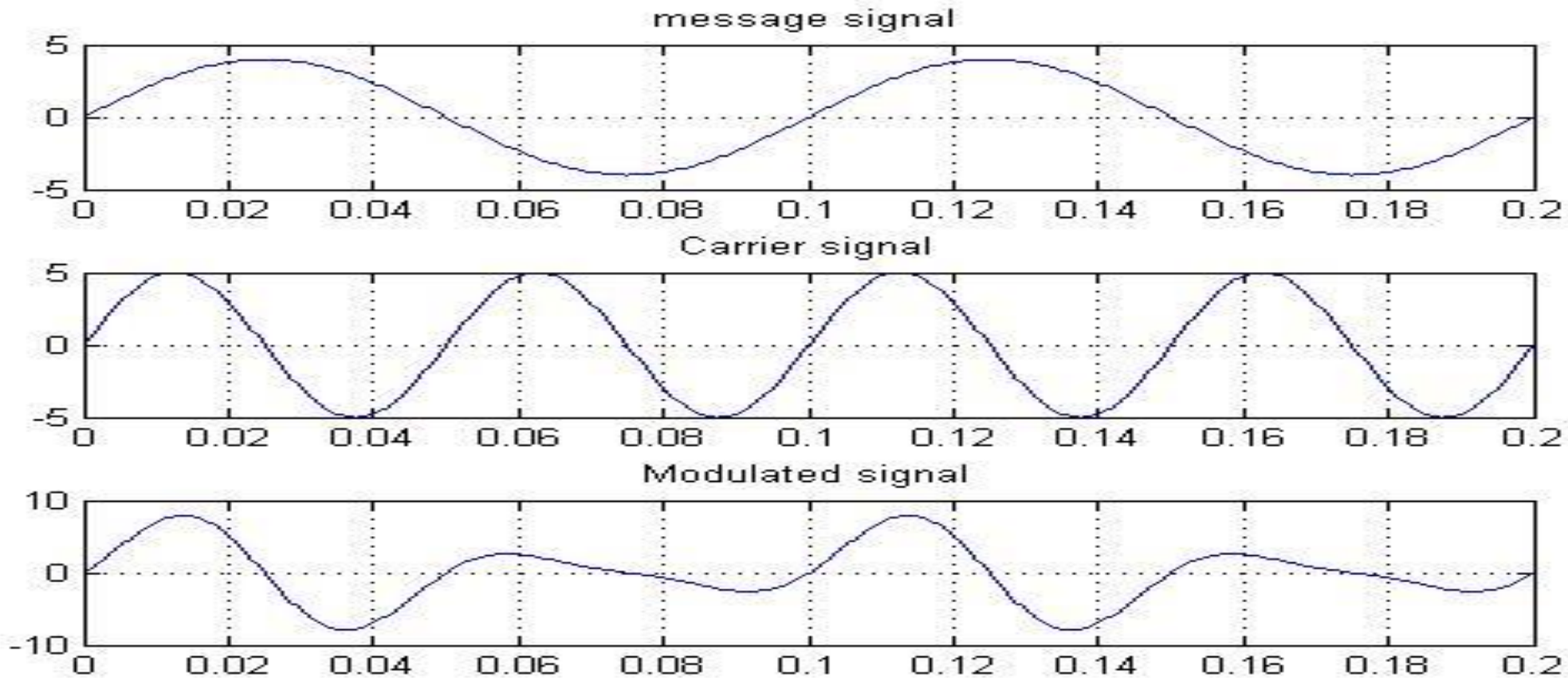
Modulated signal is distorted (Over modulation)



When Carrier frequency is not enough high than the Message.

```
fm=10;
fc=20;
am=4;
ac=5;
t=0:1/(100*fc):2/fm;
mt=am.*sin(2*pi*fm*t);
ct=ac.*sin(2*pi*fc*t);
c=(ac+mt);
ca=c.*sin(2*pi*fc*t);
subplot(3,1,1);
plot(t,mt);
title('message signal');
grid;
subplot(3,1,2);
plot(t,ct);
title('Carrier signal')
grid;
subplot(3,1,3);
plot(t,ca);
title('Modulated signal');
grid;
```

Waveform.....


message signal
5
0
-5
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Carrier signal
5
0
-5
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Modulated signal
10
0
-10
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2

To listen sounds of the waves……

```
sound(mt);%to hear the message signal
sound(ct);%to hear the carrier signal
sound(ca);%to hear amplitude modulated signal
```

- Upto `2/fm` seconds

Lab report 2

1. Observe a typical Amplitude Modulated waveform.
2. Observe perfectly modulated AM waveform at m=1.
3. Observe over modulated AM waveform.
4. Observe the waveform when carrier frequency is not high enough.

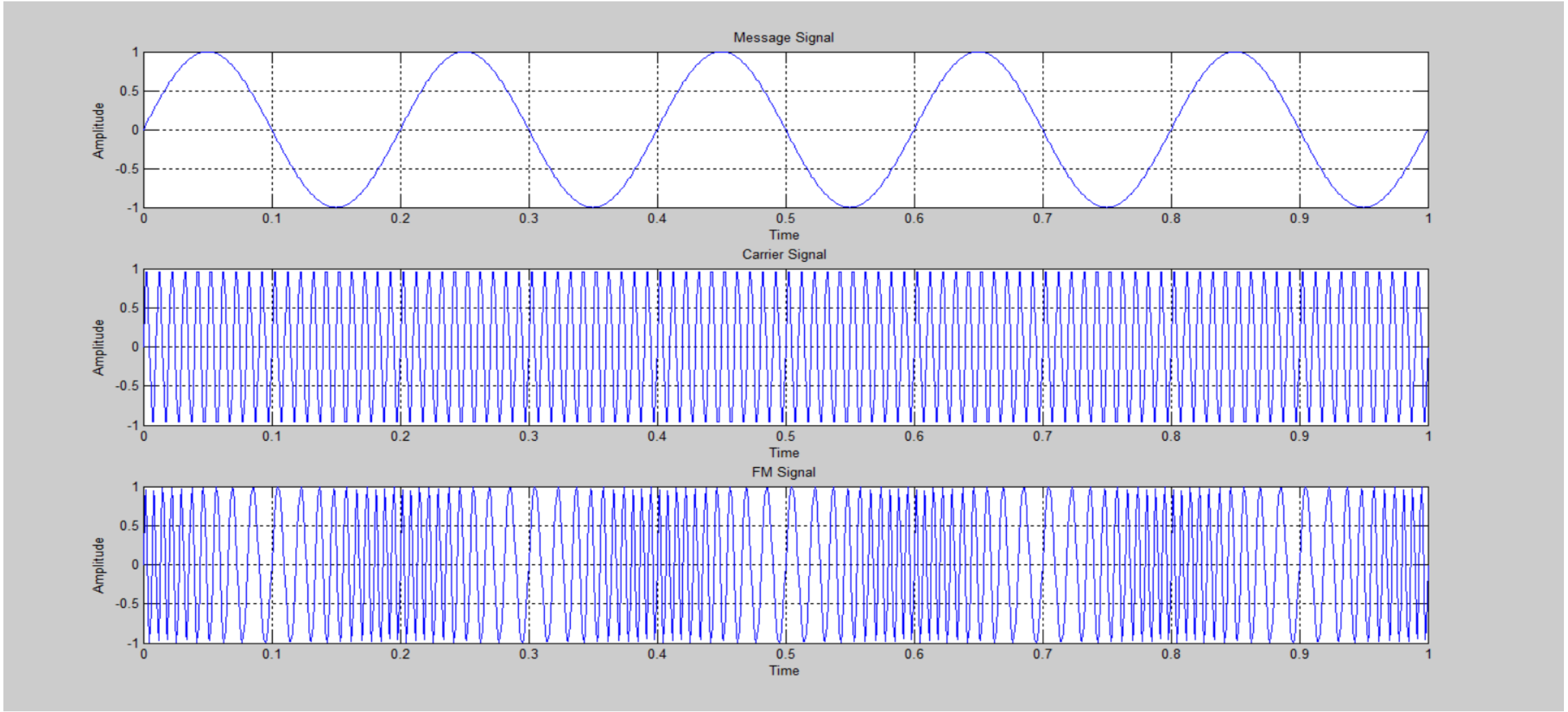
Frequency Modulation

```
clear all;
close all;
fm=input('Message Frequency=');
fc=input('Carrier Frequency=');
mi=input('Modulation Index=');
t=0:0.0001:0.1;
m=sin(2*pi*fm*t);
subplot(3,1,1);
plot(t,m);
xlabel('Time');
ylabel('Amplitude');
title('Message Signal');
grid on;

c=sin(2*pi*fc*t);
subplot(3,1,2);
plot(t,c);
xlabel('Time');
ylabel('Amplitude');
title('Carrier Signal');
grid on;

y=sin(2*pi*fc*t+(mi.*sin(2*pi*fm*t)));%Frequency changing w.r.t Message
subplot(3,1,3);
plot(t,y);
xlabel('Time');
ylabel('Amplitude');
title('FM Signal');
grid on;
```

Message Frequency=5
Carrier Frequency=100
Modulation Index=10



Lab report 3

- Observe a typical Frequency Modulated waveform using MATLAB