Frequency Modulation (FM)

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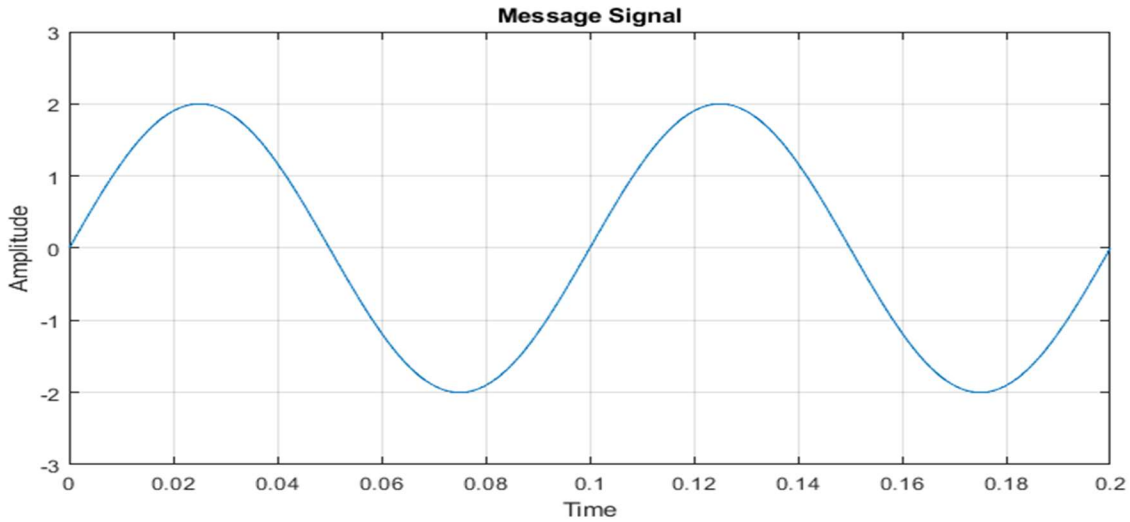
Variables

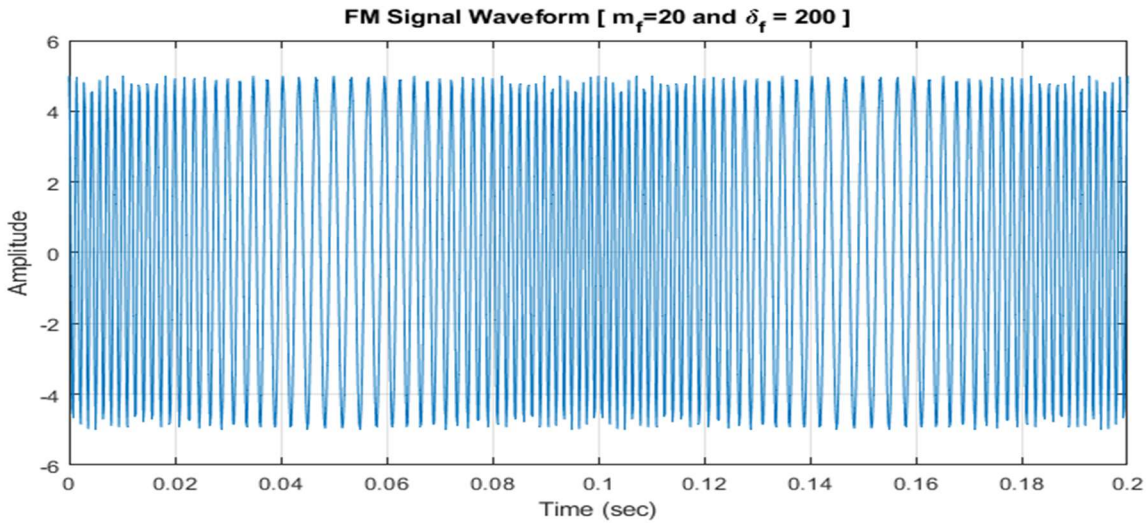
```
clc;
clear;
Vm=2;
Vc=5;
fm=10; % message frequency
fc=500; % carrier frequency
fs=10*fc; % sampling frequency
mf=20;
endpoint=5;
t=0:1/fs:endpoint; %% Time series index
l=length(t);
i=(-l/2:1:l/2-1).*2/10; %% frequency series index
% kf=10; % Sensitivity factor
% Frequency Deviation = mf*fm
fd=mf/fm;

%Message Signal
f0=figure;
v_m=Vm*sin(2*pi*fm*t);
plot(t,v_m);
title("Message Signal");
xlabel('Time');
ylabel('Amplitude');
```



FM Signal

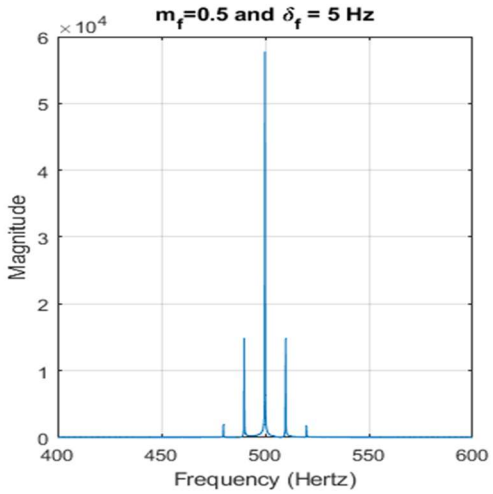
```
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
```

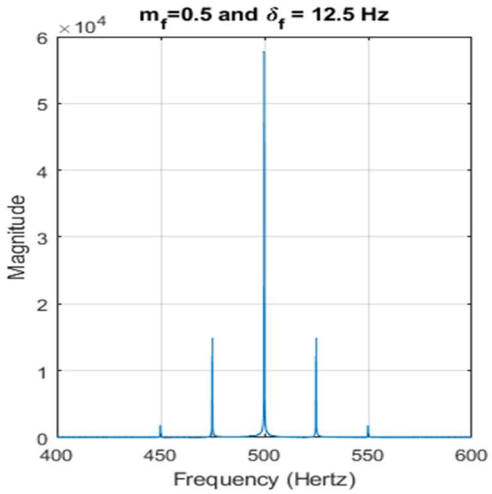
```
f1=figure;
plot(t,v_fm);
title(['FM Signal Waveform [ m_{f}=',num2str(mf),' and \delta_{f} =
',num2str(mf*fm),' ]']);
xlabel('Time (sec)');
ylabel('Amplitude');
```



Modulation Index = 0.5

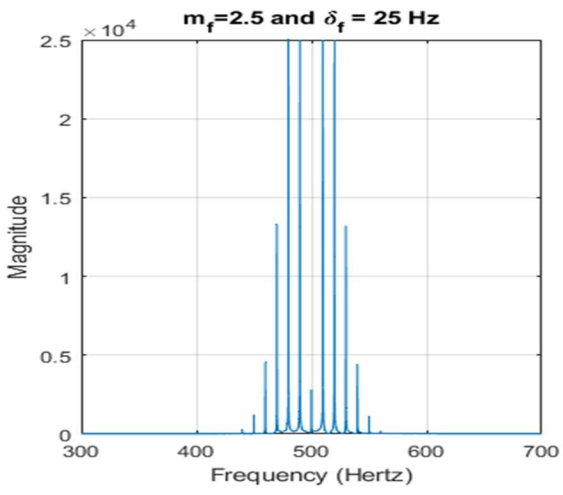
```
%                   Deflection Coefficient =5 Hz :
mf=0.5;
fm=10;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
figure(1);
subplot(1,2,1);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');

%                   Deflection Coefficient =12.5 Hz :
mf=0.5;
fm=25;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
figure(1);
subplot(1,2,2);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');
```

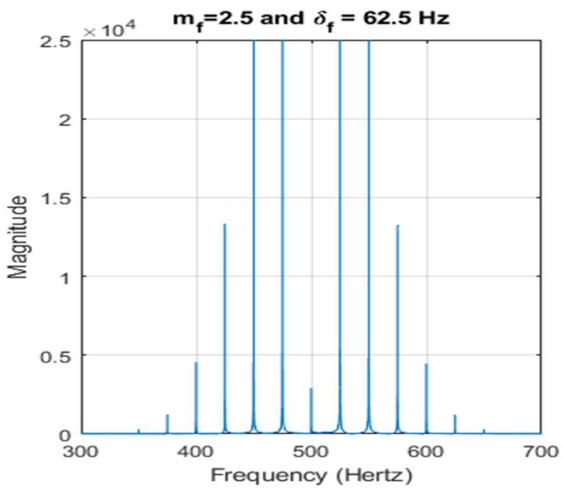




Modulation Index = 2.5

```
%                       Deflection Coefficient =25 Hz :
mf=2.5;
fm=10;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
figure(2);
subplot(1,2,1);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');
grid on;

%                       Deflection Coefficient =62.5 Hz :
fm=25;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
figure(2);
subplot(1,2,2);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');
```





Modulation Index = 5

```
%                       Deflection Coefficient =50 Hz :
mf=5;
fm=10;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
f3=figure;
subplot(1,2,1);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');

%                       Deflection Coefficient =125 Hz :
mf=5;
fm=25;
v_fm=Vc*cos(2*pi*fc*t+mf*sin(2*pi*fm*t));
spec_fm=abs(fftshift(fft(v_fm)));
subplot(1,2,2);
plot(i,spec_fm);
title(['m_{f}=',num2str(mf),' and \delta_{f} = ',num2str(mf*fm),' Hz']);
xlabel('Frequency (Hertz)');
ylabel('Magnitude');
```