Assignment – 2

CONTENTS

By Subhajit Sahu

110EC0181

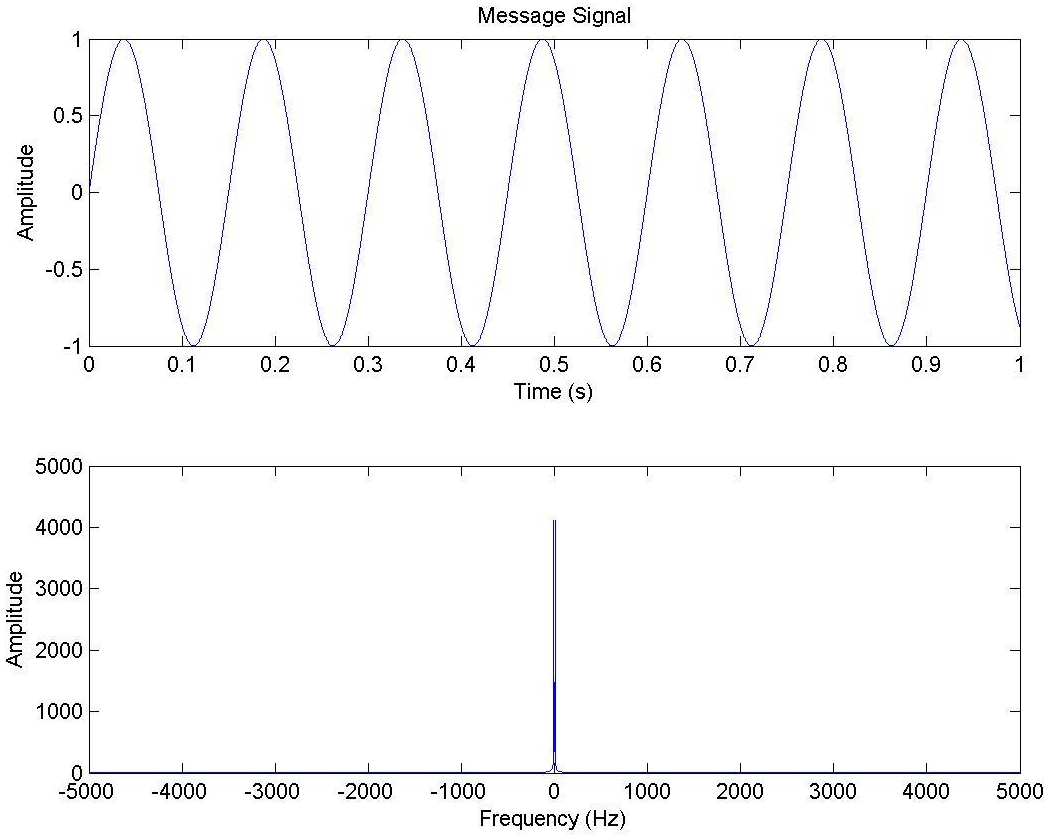
Under Prof. Shrishail Hiremath

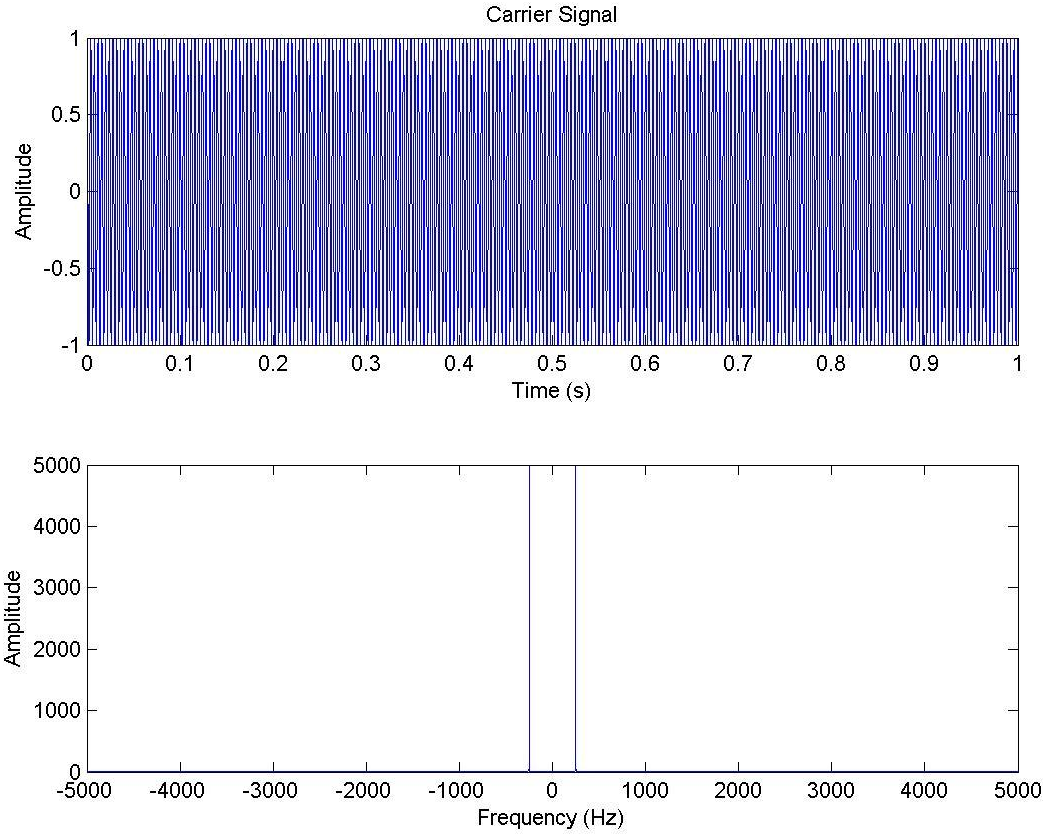
1. Main Program

```
% Assignment - 2
% --------------
%
% Determine the spectra of the message signal m(t) and amplitude-modulated
% signal s(t) (AM with carrier + both side bands) and plot them. Plot also
% the waveform of the message signal. Carrier  signal is cos (2*pi *250*t)
% and modulation index m = 0.33, .5, 0.85,1. The message signal is a
% sinusoidal signal of 6.67 Hz.
%

clc;
clear all;
close all;

% Generate the Message and Carrier Signals
[m_t, t] = sig_sin(1, 2*pi*6.67, 0, 0, 1, 10000);
c_t = sig_sin(1, 2*pi*250, pi/2, 0, 1, 10000);
tLen = length(t);
m_f = abs(fftshift(fft(m_t)));
c_f = abs(fftshift(fft(c_t)));
f = linspace(-10000/2, 10000/2, tLen);

% List of Modulation indexes for which to plot
m = [0.33, 0.5, 0.85, 1];
mLen = length(m);

% Get the DSB-FC Modulated signals
s_t = zeros(mLen, tLen);
s_f = zeros(mLen, tLen);
for i = 1 : mLen
    s_t(i, :) = Mod_dsb_fc(m_t, 1, c_t, m(1, i));
    s_f(i, :) = abs(fftshift(fft(s_t(i, :))));
end

% Plot all figures
h = figure;
name = 'Message Signal';
subplot(2,1,1); plot(t, m_t);
title(name);
xlabel('Time (s)');
ylabel('Amplitude');
subplot(2,1,2); plot(f, m_f);
xlabel('Frequency (Hz)');
ylabel('Amplitude');
saveas(h, [name '.jpg']);

h = figure;
name = 'Carrier Signal';
subplot(2,1,1); plot(t, c_t);
title(name);
xlabel('Time (s)');
ylabel('Amplitude');
subplot(2,1,2); plot(f, c_f);
xlabel('Frequency (Hz)');
ylabel('Amplitude');
```

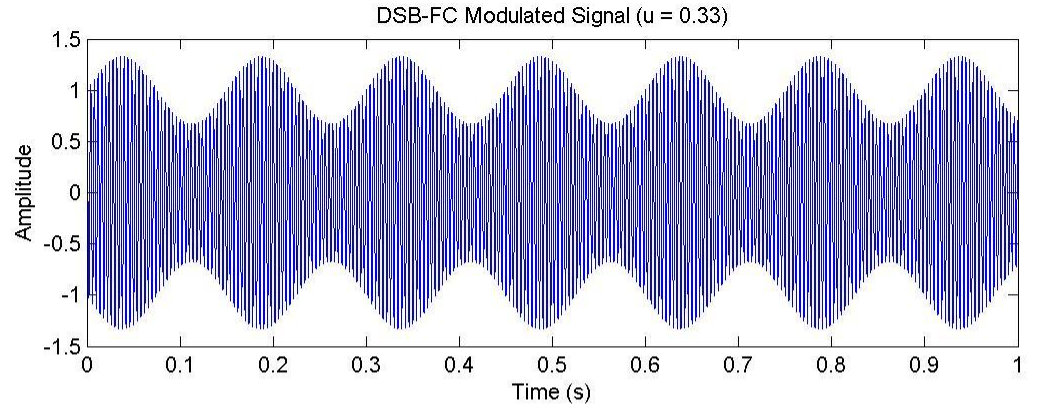
```
saveas(h, [name '.jpg']);

for i = 1 : mLen
    h = figure;
    name = sprintf('DSB-FC Modulated Signal (u = %1.2f)', m(1, i));
    subplot(2,1,1); plot(t, s_t(i, :));
    title(name);
    xlabel('Time (s)');
    ylabel('Amplitude');
    subplot(2,1,2); plot(f, s_f(i, :));
    xlabel('Frequency (Hz)');
    ylabel('Amplitude');
    saveas(h, [name '.jpg']);
end
```

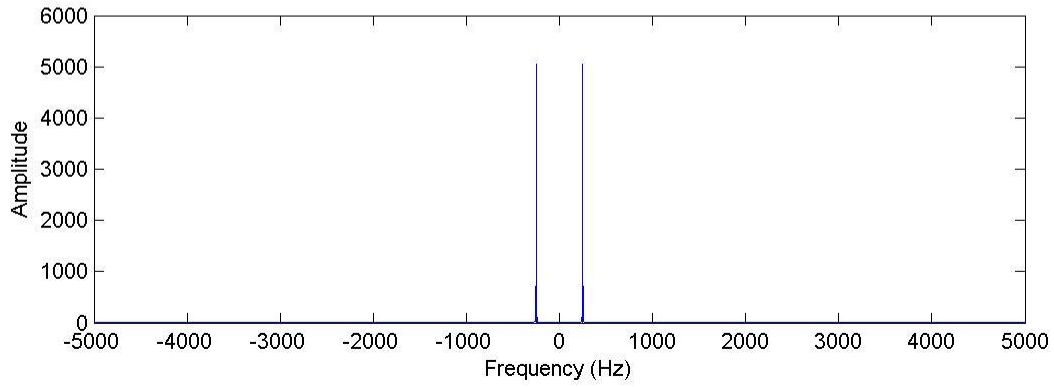
2. Outputs

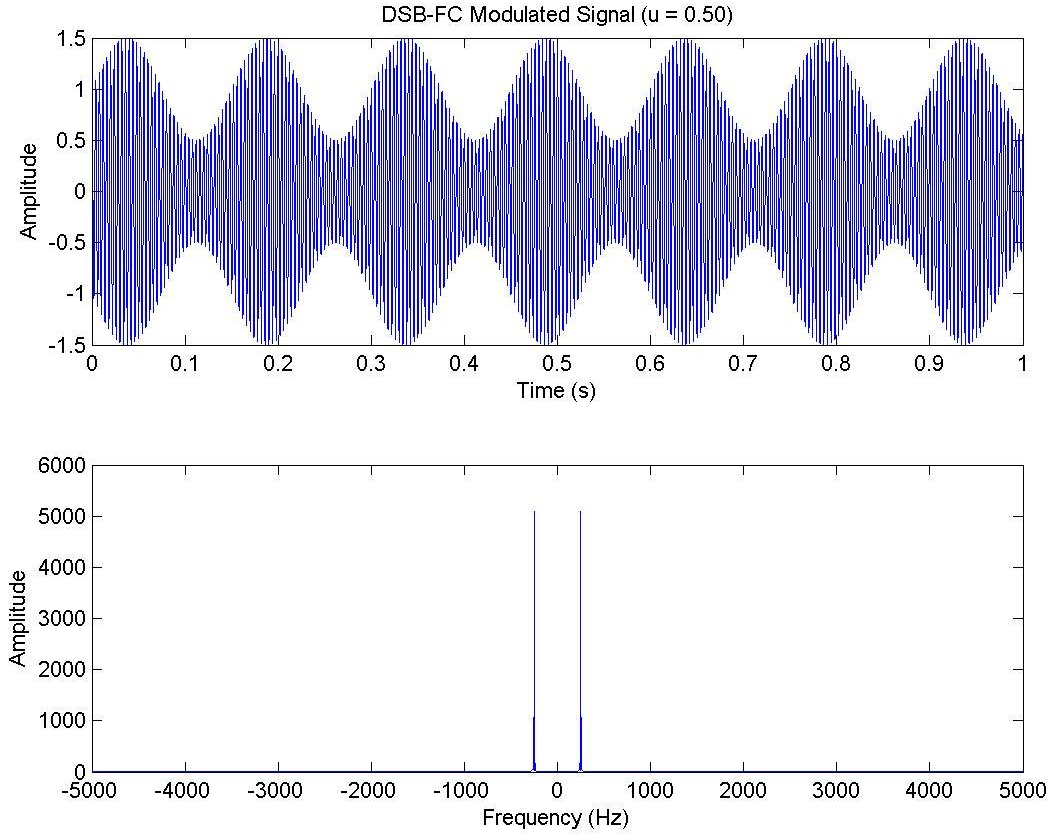


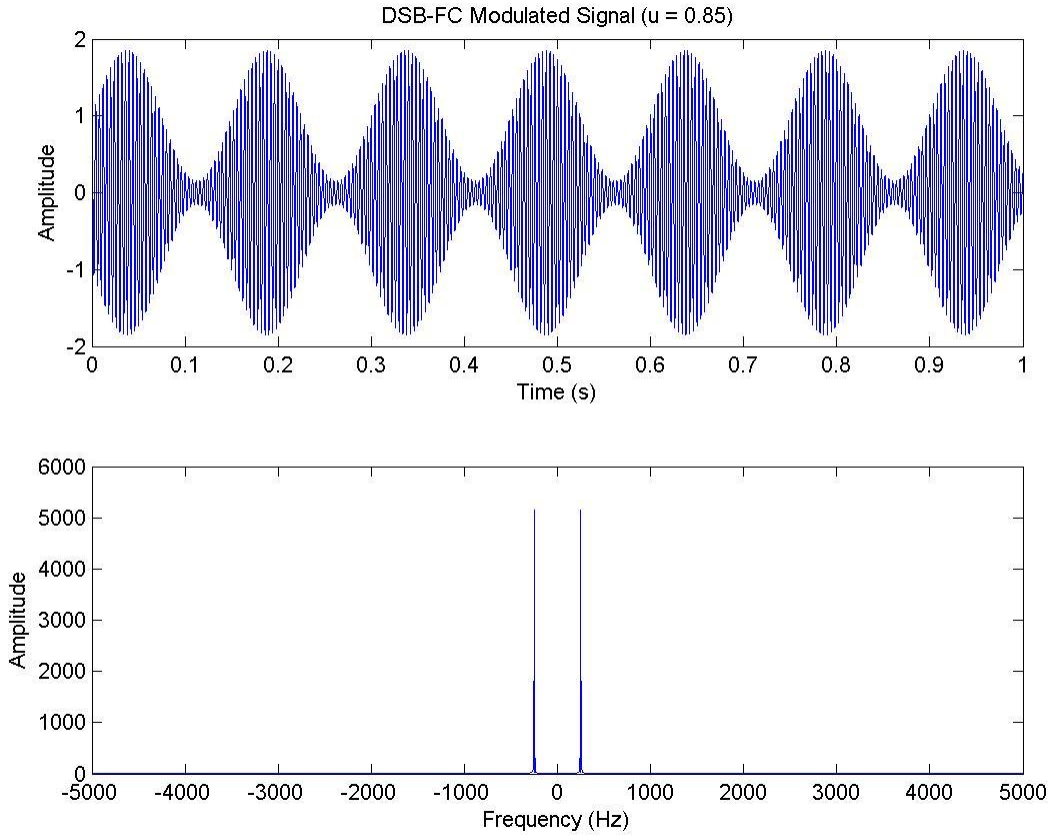

Carrier Signal
Amplitude
Time (s)
1
0.5
0
-0.5
-1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

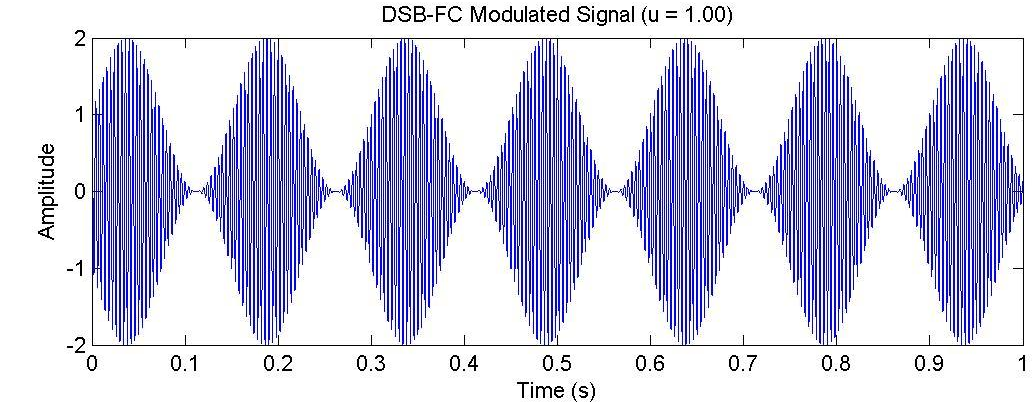
Amplitude
Frequency (Hz)
5000
4000
3000
2000
1000
0
-5000
-4000
-3000
-2000
-1000
0
1000
2000
3000
4000
5000

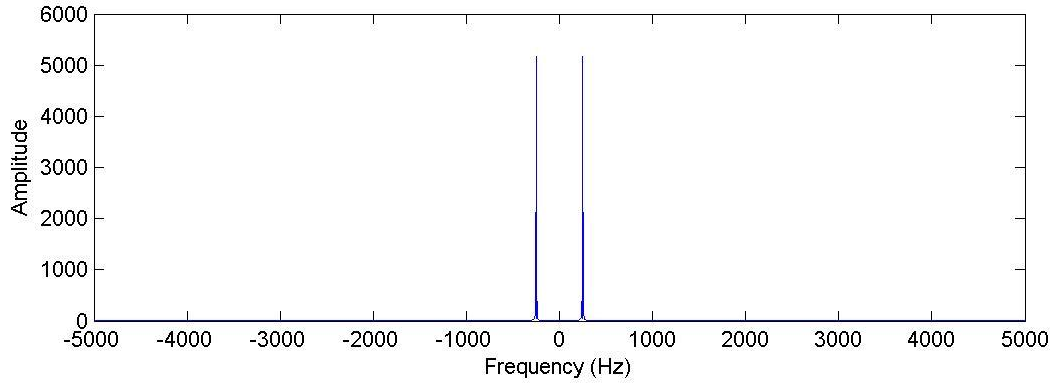

DSB-FC Modulated Signal (u = 0.33)
Amplitude
Time (s)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Amplitude
Frequency (Hz)
6000
5000
4000
3000
2000
1000
0
-5000
-4000
-3000
-2000
-1000
0
1000
2000
3000
4000
5000


DSB-FC Modulated Signal (u = 0.50)
Amplitude
Time (s)
Amplitude
Frequency (Hz)


DSB-FC Modulated Signal (u = 0.85)
Amplitude
Time (s)
Amplitude
Frequency (Hz)





3. Function: Mod_dsb_fc()

```
function y = Mod_dsb_fc(x_m, A_m, x_c, u)
% x_m  = Input Message signal
% A_m  = Amplitude of Message Signal
% x_c  = Carrier Signal
% u    = Modulation Index
% y = Acos(wct) + Aum'(t) cos(wct)

y = x_c + u * (x_c .* (x_m / A_m));
end
```

4. Function: sig_sin()

```
function [x, t] = sig_sin(A, b, c, tStart, tStop, Fs)
% x = Asin(bt+c)

Ts = sign(tStop - tStart) * (1/Fs);
t = tStart : Ts : tStop;
x = A * sin(b*t + c);
end
```