Lab Report No 5

Digital Signal Processing

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Section: A

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work"

Student Signature: ___________

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Demonstration of Concepts	**Poor (Does not meet expectation (1))** The student failed to demonstrate a clear understanding of the assignment concepts	**Fair (Meet Expectation (2-3))** The student demonstrated a clear understanding of some of the assignment concepts	**Good (Exceeds Expectation (4-5)** The student demonstrated a clear understanding of the assignment concepts	**Score** **30%**
Accuracy	The student completed (<50%) tasks and provided MATLAB code and/or Simulink models with errors. Outputs shown are not correct in form of graphs (no labels) and/or tables along with incorrect analysis or remarks.	The student completed partial tasks (50% - <90%) with accurate MATLAB code and/or Simulink models. Correct outputs are shown in form of graphs (without labels) and/or tables along with correct analysis or remarks.	The student completed all required tasks (90%-100%) with accurate MATLAB code and/or Simulink models. Correct outputs are shown in form of labeled graphs and/or tables along with correct analysis or remarks.	**30%**
Following Directions	The student clearly failed to follow the verbal and written instructions to successfully complete the lab	The student failed to follow the some of the verbal and written instructions to successfully complete all requirements of the lab	The student followed the verbal and written instructions to successfully complete requirements of the lab	**20%**
Time Utilization	The student failed to complete even part of the lab in the allotted amount of time	The student failed to complete the entire lab in the allotted amount of time	The student completed the lab in its entirety in the allotted amount of time	**20%**

LAB NO: 5 . ANALYSIS OF AMPLITUDE MODULATED AND DEMODULATED SIGNAL USING MATLAB

Provide .m file with detailed comments

Tasks:

1. **Define Amplitude Modulation:**
   Amplitude Modulation is the process of varying the amplitude of a carrier signal proportional to the modulating signal while maintaining the carrier's frequency constant.

2. **Define Amplitude Demodulation:**
   Amplitude Demodulation is the process of extracting the original message signal from an amplitude-modulated (AM) carrier signal.

3. **List three reasons, why we implement Amplitude Modulation in Communication Systems:**
   - Efficient Transmission of Signals Over Long Distances
   - Smaller Antenna Size
   - Maximum Bandwidth utilization

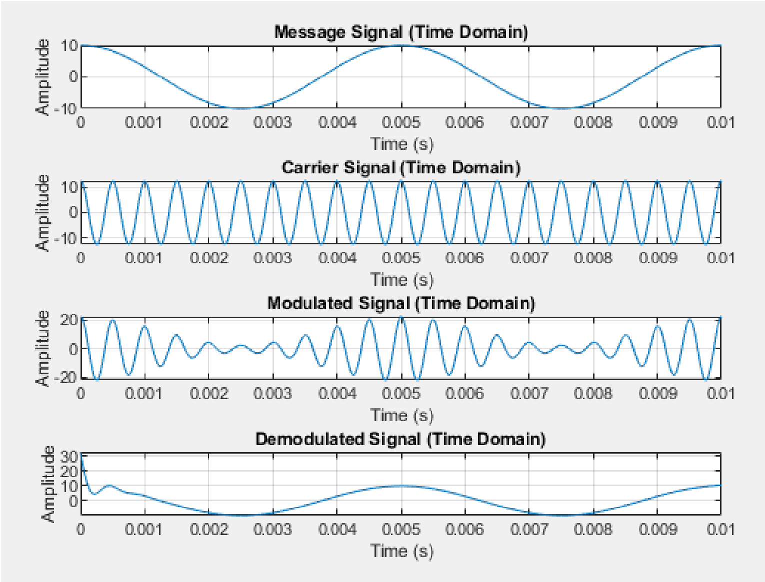
4. **Define Modulation Index:**
   Modulation index is defined as the ratio of the peak amplitude of the message signal to the peak amplitude of the carrier signal.

5. Input Modulation Index from 0 to 1.4, the increment step should be 0.2. Observe/analyze and comment about the output observed.
   Procedure:
   - Create and plot (both time and frequency domain) a message signal with amplitude 10 and frequency 200 Hz
   - Create and plot (both time and frequency domain) a Carrier signal with amplitude 10/Modulation Index and frequency 2000 Hz
   - Modulate the message signal with the carrier using the desired Modulation Index. Plot modulated signal in both time and frequency domain. Observe/Analyze the output.

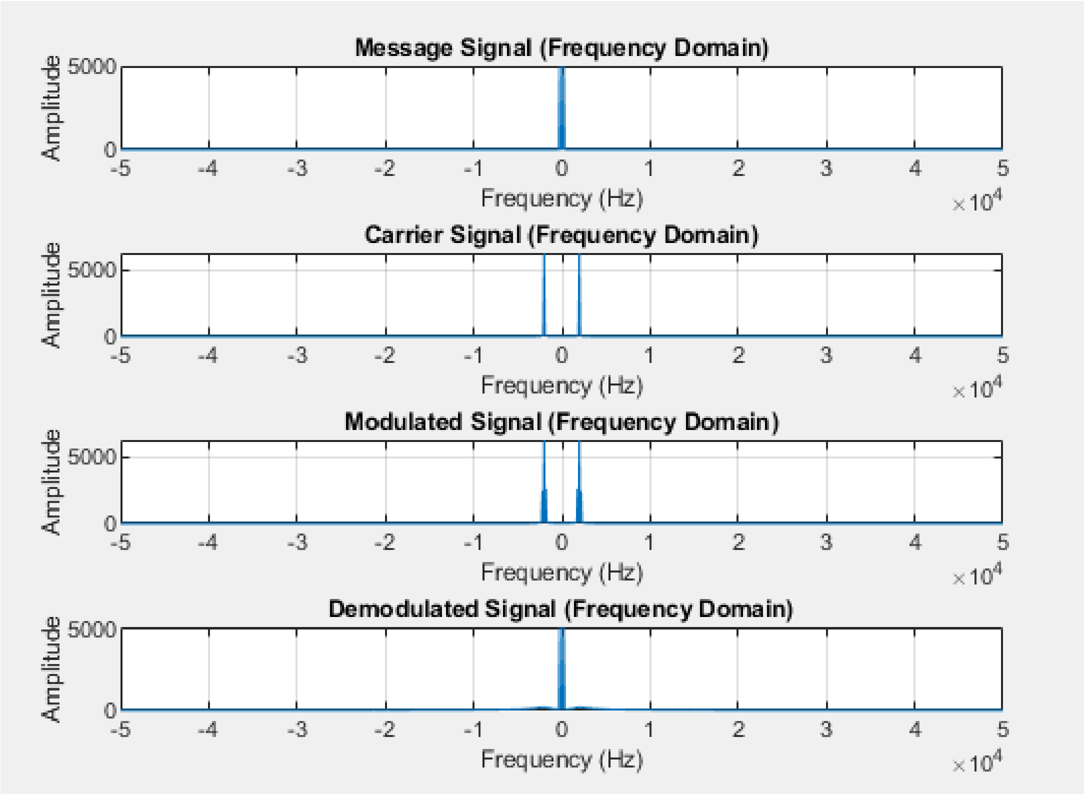
     Hint: y = ammod(ym, fc, 100000, 0, Ac);
   - Demodulate the Modulated signal . Observe/Analyze the output.

     Hint: z = amdemod(y, fc, 100000, 0, Ac);

```
Fs = 100000;
t = 0:1/Fs:0.01;
Am = 10;
fm = 200;
fc = 2000;
m = 0.8;
Ac = Am / m;

message_signal = Am * cos(2 * pi * fm * t);
carrier_signal = Ac * cos(2 * pi * fc * t);
modulated_signal = ammod(message_signal, fc, Fs, 0, Ac);
demodulated_signal = amdemod(modulated_signal, fc, Fs, 0, Ac);

freq_axis = linspace(-Fs/2, Fs/2, length(t));

fft_message = abs(fftshift(fft(message_signal)));
fft_carrier = abs(fftshift(fft(carrier_signal)));
fft_modulated = abs(fftshift(fft(modulated_signal)));
fft_demodulated = abs(fftshift(fft(demodulated_signal)));

figure;
subplot(4, 1, 1);
plot(t, message_signal);
title('Message Signal (Time Domain)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 2);
plot(t, carrier_signal);
title('Carrier Signal (Time Domain)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 3);
plot(t, modulated_signal);
title('Modulated Signal (Time Domain)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 4);
plot(t, demodulated_signal);
title('Demodulated Signal (Time Domain)');
xlabel('Time (s)');
ylabel('Amplitude');
grid on;
```




```
figure;
subplot(4, 1, 1);
plot(freq_axis, fft_message);
title('Message Signal (Frequency Domain)');
xlabel('Frequency (Hz)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 2);
plot(freq_axis, fft_carrier);
title('Carrier Signal (Frequency Domain)');
xlabel('Frequency (Hz)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 3);
plot(freq_axis, fft_modulated);
title('Modulated Signal (Frequency Domain)');
xlabel('Frequency (Hz)');
ylabel('Amplitude');
grid on;

subplot(4, 1, 4);
plot(freq_axis, fft_demodulated);
title('Demodulated Signal (Frequency Domain)');
xlabel('Frequency (Hz)');
ylabel('Amplitude');
grid on;
```



Message Signal (Frequency Domain)
Amplitude
5000
0
-5
-4
-3
-2
-1
0
1
2
3
4
5
Frequency (Hz)
×10^4
Carrier Signal (Frequency Domain)
Amplitude
5000
0
Frequency (Hz)
×10^4
Modulated Signal (Frequency Domain)
Amplitude
5000
0
Frequency (Hz)
×10^4
Demodulated Signal (Frequency Domain)
Amplitude
5000
0
Frequency (Hz)
×10^4