COMMUNICATION SYSTEM AND NETWORKING LAB (EC16205)

SESSION 2021-2022

LAB REPORT

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EXPERIMENT 01

Objective: To study Amplitude Modulation and Demodulation through coding.

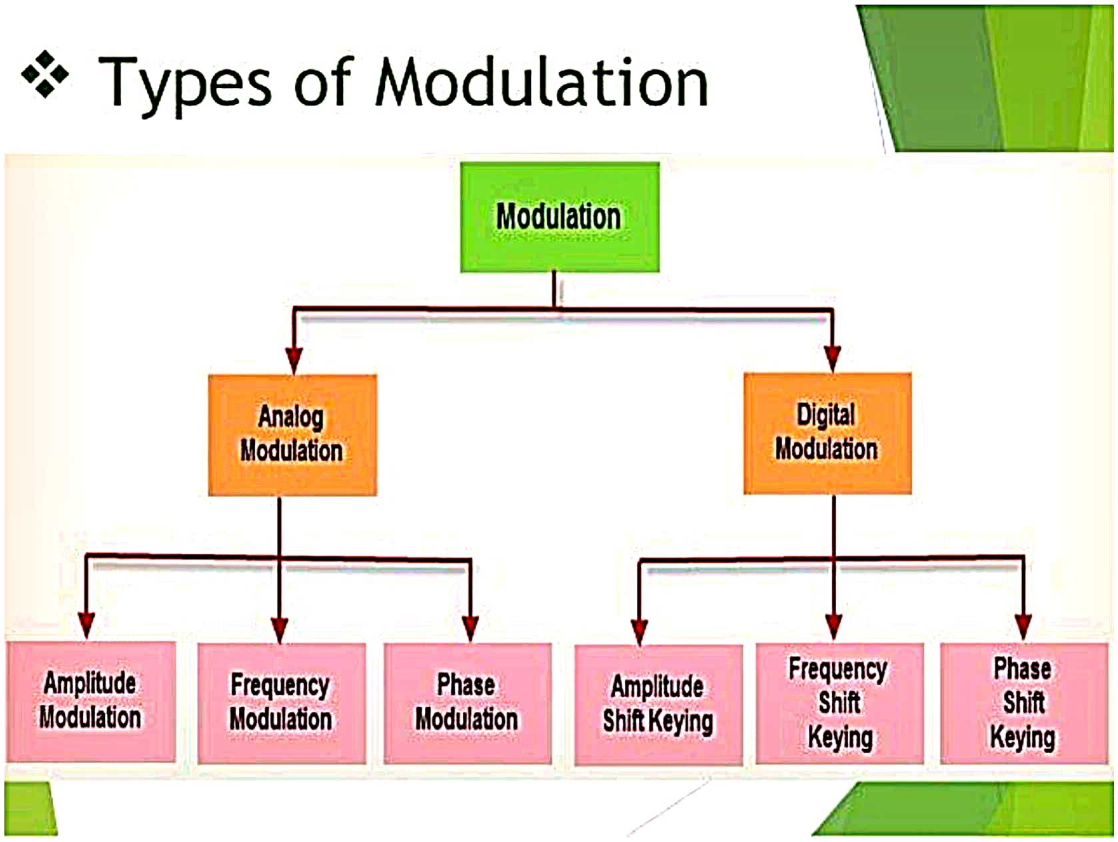
Tools Used: MATLAB R2021a (software)

Theory:

What is Modulation

Modulation is defined as the process of superimposing a low-frequency signal on a high-frequency carrier signal. The process of varying the RF carrier wave in accordance with the information in a low-frequency signal.

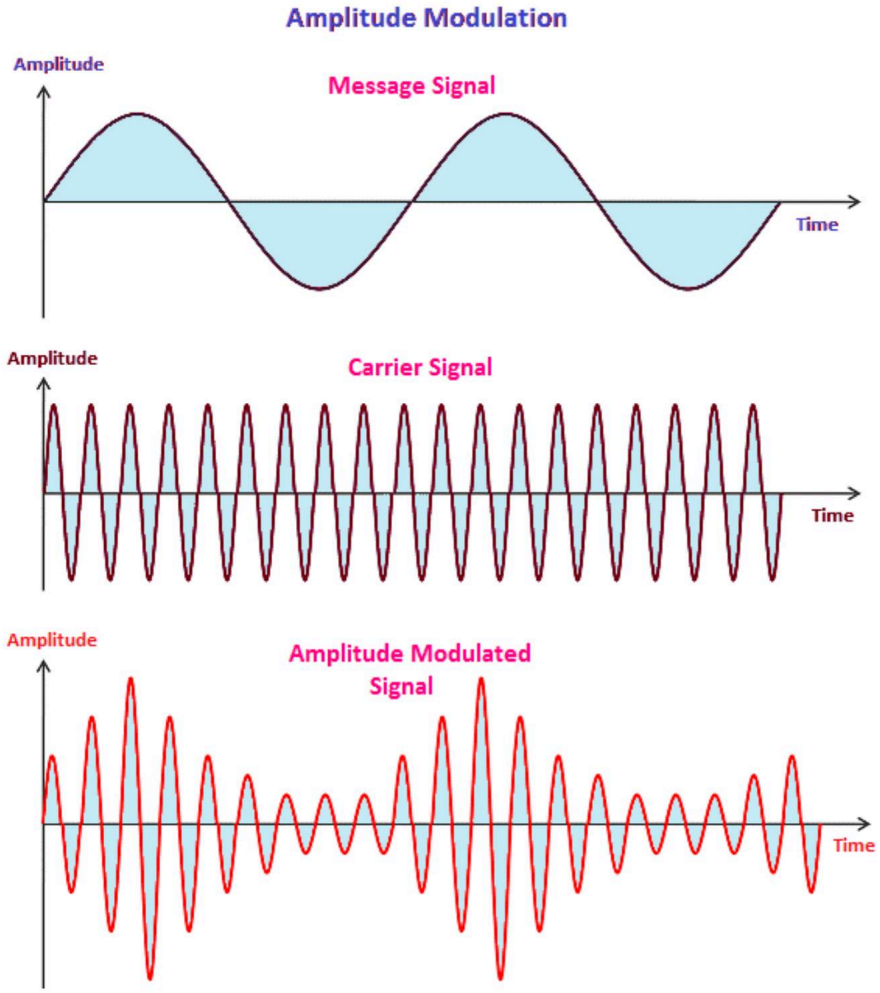
It is the process of transmission of **information signal** (low frequency signal) using a high frequency **Carrier signal**.



Amplitude Modulation

In order that a radio signal can carry audio or other information for broadcasting or for two way radio communication, it must be modulated or changed in some way. Although there are a number of ways in which a radio signal may be modulated, one of the easiest is to change its amplitude in line with variations of the sound.

In this way the amplitude of the radio frequency signal varies in line with the instantaneous value of the intensity of the modulation. This means that the radio frequency signal has a representation of the sound wave superimposed in it.



Mathematical Equations of AM

- Carrier Signal C(t)=

$$A_c \sin(2\pi f_c t) \text{ or } A_c \sin(\omega_c t)$$

- Modulating Message Signal m(t)=

  $A_m \sin(2\pi f_m t)$ or $A_m \sin(\omega_m t)$

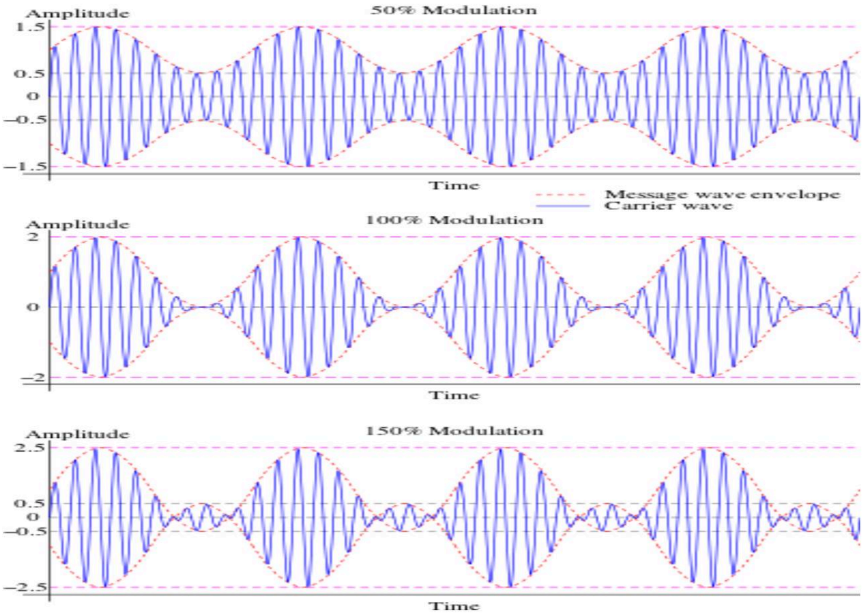
- The AM Signal $s_{AM}(t)$ =

  $(A_c + A_m \sin(\omega_m t)) \sin(\omega_c t) =$

  $A_c(1 + m \sin(\omega_m t)) \sin(\omega_c t)$

MODULATION INDEX

- The amount of modulation in AM signal is given by its modulationindex:
- $\mu = A_m / A_c$
- When Am =Ac ,μ =1 or 100% modulation.
  Over-modulation, i.e. Am>Ac , should be avoided because it will create distortions



What is Demodulation?

Demodulation is defined as extracting the original information-carrying signal from a modulated carrier wave. A demodulator is an electronic circuit that is mainly used to recover the information content from the modulated carrier wave. There are different types of modulation and so are demodulators. The output signal via a demodulator may describe the sound, images, or binary data.

Difference Between Modulation and Demodulation

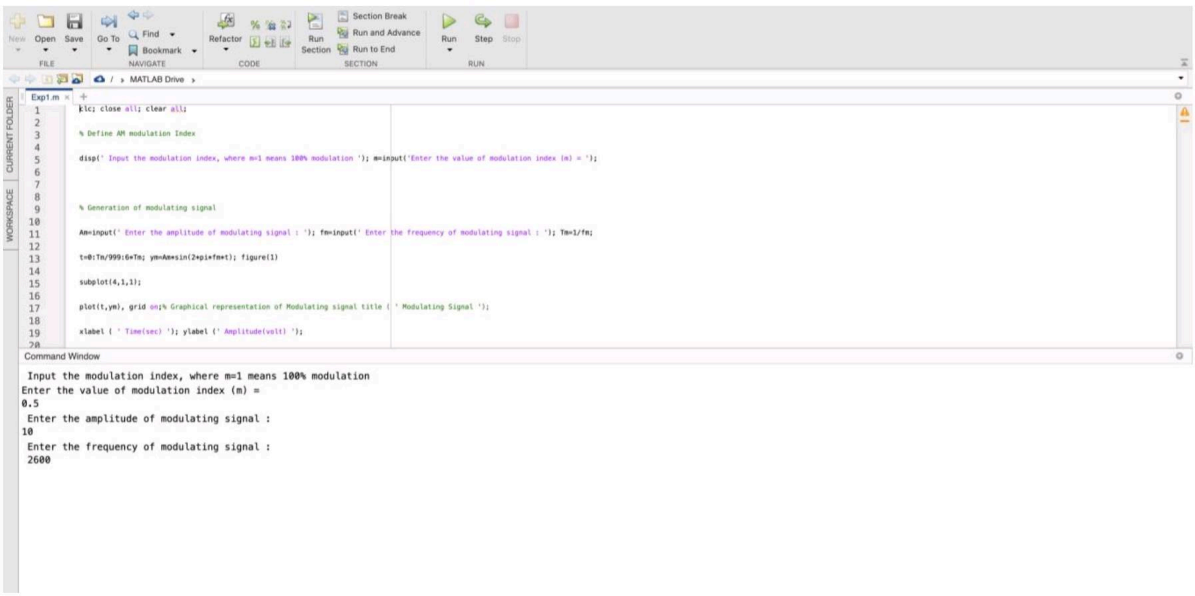
- Modulation is the process of influencing data information on the carrier, while demodulation is the recovery of original information at the distant end of the carrier.
- A modem is an equipment that performs both modulation and demodulation.
- Both processes aim to achieve transfer information with the minimum distortion, minimum loss, and efficient utilisation of spectrum.

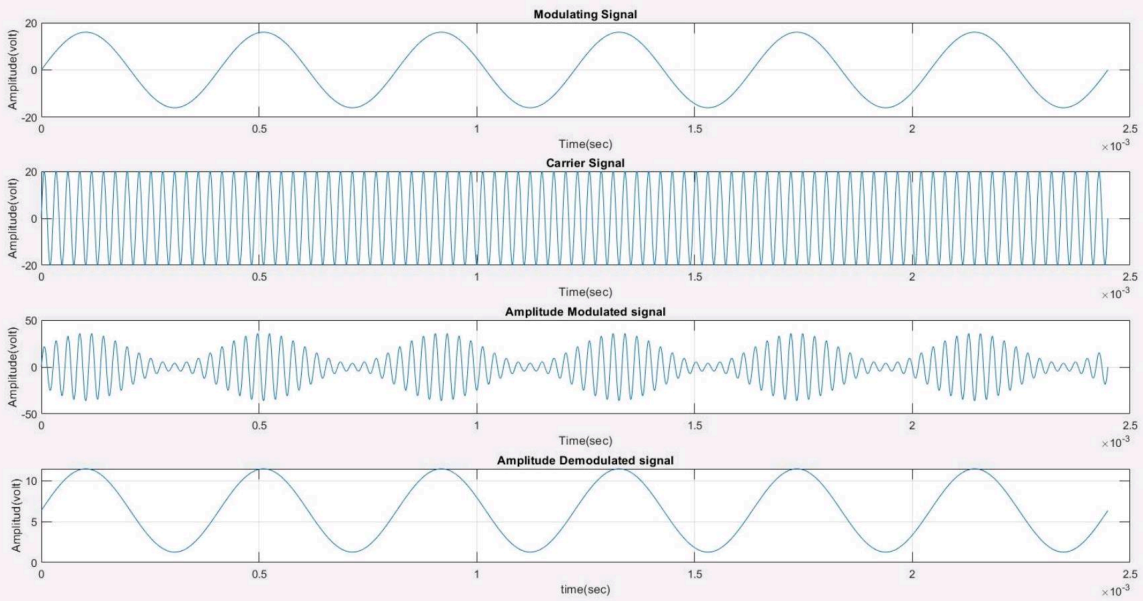
Coding:

```
clc;
close all;
clear all;
% Define AM modulation Index
disp(' Input the modulation index, where m=1 means 100% modulation ');
m=input('Enter the value of modulation index (m) =  ');

% Generation of modulating signal
Am=input(' Enter the amplitude of modulating signal : ');
fm=input(' Enter the frequency of modulating signal : ');
Tm=1/fm;
t=0:Tm/999:6*Tm;
ym=Am*sin(2*pi*fm*t);
figure(1)
subplot(4,1,1);
plot(t,ym), grid on;% Graphical representation of Modulating signal
title ( ' Modulating Signal ');
xlabel ( ' Time(sec) ');
ylabel (' Amplitude(volt) ');

%Generation of carrier signal
Ac=Am/m;
fc=fm*15;
Tc=1/fc;
yc=Ac*sin(2*pi*fc*t);
subplot(4,1,2);
plot(t,yc), grid on;
title ( ' Carrier Signal ');
xlabel ( ' Time(sec) ');
ylabel (' Amplitude(volt) ');

% AM Modulation
```

```
y=Ac*(1+m*sin(2*pi*fm*t)).*sin(2*pi*fc*t);
subplot(4,1,3);
plot(t,y);
title ( ' Amplitude Modulated signal ');
xlabel ( ' Time(sec) ');
ylabel (' Amplitude(volt) ');
grid on;

% AM Demodulation
d=(1/pi)*(Ac+ym);
subplot(4,1,4);
plot(t,d);
title ( ' Amplitude Demodulated signal ');
xlabel ( ' time(sec) ');
ylabel (' Amplitud(volt) ');
```

Observation:





Result: We have performed the above experiment using Matlab simulation and have obtained the above results for a given input parameters of a modulating signal

Conclusion: From this experiment we have examined the principle of amplitude modulation and their application to various system. The AM and it derivative scheme basically involve the controlled shifting of the signal spectrum to various point along the frequency scale. The modulation properties can be used to generate amplitude modulated waveform and to demodulated them again. It s because such waveform have no separate carrier frequency , they are called double side band.