LAB SESSION 3

AMPLITUDE MODULATION

OBJECTIVE

To perform the amplitude modulation using MATLAB and visualize the characteristics of signals by changing parameters

REQUIREMENTS

- Intel based computer
- MATLAB

THEORY

Amplitude modulation (AM) is a modulation technique used in electronic communication, most commonly for transmitting messages with a radio carrier wave. In amplitude modulation, the amplitude (signal strength) of the carrier wave is varied in proportion to that of the message signal, such as an audio signal. This technique contrasts with angle modulation, in which either the frequency of the carrier wave is varied as in frequency modulation, or its phase, as in phase modulation.

AM was the earliest modulation method used for transmitting audio in radio broadcasting. It was developed during the first quarter of the 20th century beginning with Roberto Landell de Moura and Reginald Fessenden's radiotelephone experiments in 1900. This original form of AM is sometimes called double-sideband amplitude modulation (DSBAM), because the standard method produces sidebands on either side of the carrier frequency. Single-sideband modulation uses bandpass filters to eliminate one of the sidebands and possibly the carrier signal, which improves the ratio of message power to total transmission power, reduces power handling requirements of line repeaters, and permits better bandwidth utilization of the transmission medium.

The carrier wave (sine wave) of frequency f_c and amplitude A is expressed by

$$c(t) = Asin\,(2\pi f_c t)$$

The message signal, such as an audio signal that is used for modulating the carrier, is $m(t)$, and has a frequency f_m, much lower than f_c:

,

$$m(t) = A_m sin\,(2\pi f_m t)$$

where m is the amplitude sensitivity, M is the amplitude of modulation. If $m < 1$, $(1 + m(t)/A)$ is always positive for under modulation. If $m > 1$ then overmodulation occurs and reconstruction of message signal from the transmitted signal would lead in loss of original signal. Amplitude modulation results when the carrier $c(t)$ is multiplied by the positive quantity $(1 + m(t)/A)$:

$$y(t) = \left[1 + \frac{m(t)}{A}\right] * c(t)$$

In this simple case m is identical to the modulation index, discussed below. With $m = 0.5$ the amplitude modulated signal $y(t)$ thus corresponds to the top graph (labelled "50% Modulation") in figure 4.

PROCEDURE

Generating message and carrier signals

Matlab Code :

```
m=1;

Am=10;

fa=1000;

Ta=1/fa;

t=0:Ta/99:6*Ta;

y1=Am*sin(2*pi*fa*t);

subplot(3,1,1)

plot(t,y1)

fc=fa*10;

Ac=Am/m;

Tc=1/fc;

y2=Ac*sin(2*pi*fc*t);

subplot(3,1,2)

plot(t,y2)

y=y1.*y2;

subplot(3,1,3)

plot(t,y)

y=Ac+(1+m*sin(2*pi*fa*t)).*(sin(2*pi*fc*t));

plot(t,y)

plot(t,y)
```

LAB WORK

Task 1

Generate the message signal with 100 Hz frequency and modulate it to the carrier with 1000 Hz frequency. Plot the message signal, carrier and modulated signal in single figure and place the plot in Figure 3.1. The plot should contain student ID and Name as title of the figure.

Figure 3.1

COMMENTS & DISCUSSION