Date : 25-09-2022

Experiment no: 01

Experiment Name: Study of Amplitude Modulation.

Theory:

Amplitude Modulation is a process which is used in communication engineering where the amplitude of the signal is varied proportional to the message signal. There are 3 types of amplitude modulation.

1. Under Modulation
2. Ideal Modulation
3. Over modulation

- Under Modulation: In under Modulation the amplitude of the message is signal is less than the amplitude of the carrier signal. ($A_c > A_m$) . The modulation index is less than 1. The maximum Amplitude of modulated signal be 'A_c+A_m' . And minimum frequency will be A_c-A_m.
  'A_c-A_m' [here w=frequency]. B.W. is $2*w_{m..}$

- Ideal Modulation: In this case the amplitude of the message signal is equal to the amplitude of the carrier signal. ($A_c = A_m$) . The modulation index is
  equal to 1. The maximum Amplitude will be 'A_c+A_m' . But the minimum is 0. BW will be $2*W_{m.}$

- Over Modulation: In over modulation the amplitude of the message signal is greater than the amplitude of the carrier signal. Modulation index is greater than 1. (Ac<Am) The carrier experiences a 180 degree phase changes . So the modulated signal get distorted.

Code:

- Under Modulation :

labwork1.m

```
t=0:0.0001:10
Vm=10*sin(5*t);
Vc=25*sin(50*t);
Vf= Vc + 5*cos(5*t-50*t)-5*cos(5*t+50*t);

subplot(3,1,1);
plot(t,Vm);

subplot(3,1,2);
plot(t,Vc);

subplot(3,1,3);
plot(t,Vf);
```

- Ideal Modulation :

```
t=0:0.0001:10
Vm=10*sin(5*t);
Vc=10*sin(50*t);
Vf= Vc + 5*cos(5*t-50*t)-5*cos(5*t+50*t);

subplot(3,1,1);
plot(t,Vm);

subplot(3,1,2);
plot(t,Vc);

subplot(3,1,3);
plot(t,Vf);
```

Over Modulation :

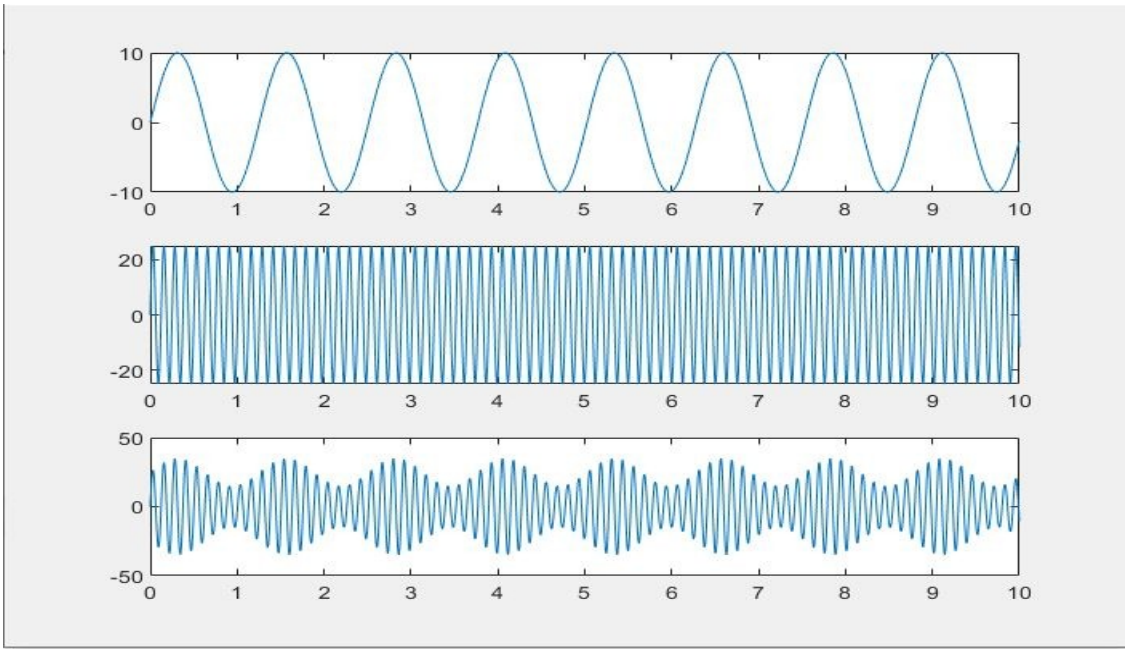
```
t=0:0.0001:10
Vm=10*sin(5*t);
Vc=5*sin(50*t);
Vf= Vc + 5*cos(5*t-50*t)-5*cos(5*t+50*t);

subplot(3,1,1);
plot(t,Vm);

subplot(3,1,2);
plot(t,Vc);

subplot(3,1,3);
plot(t,Vf);
```

- Modulate a modulated signal by another signal

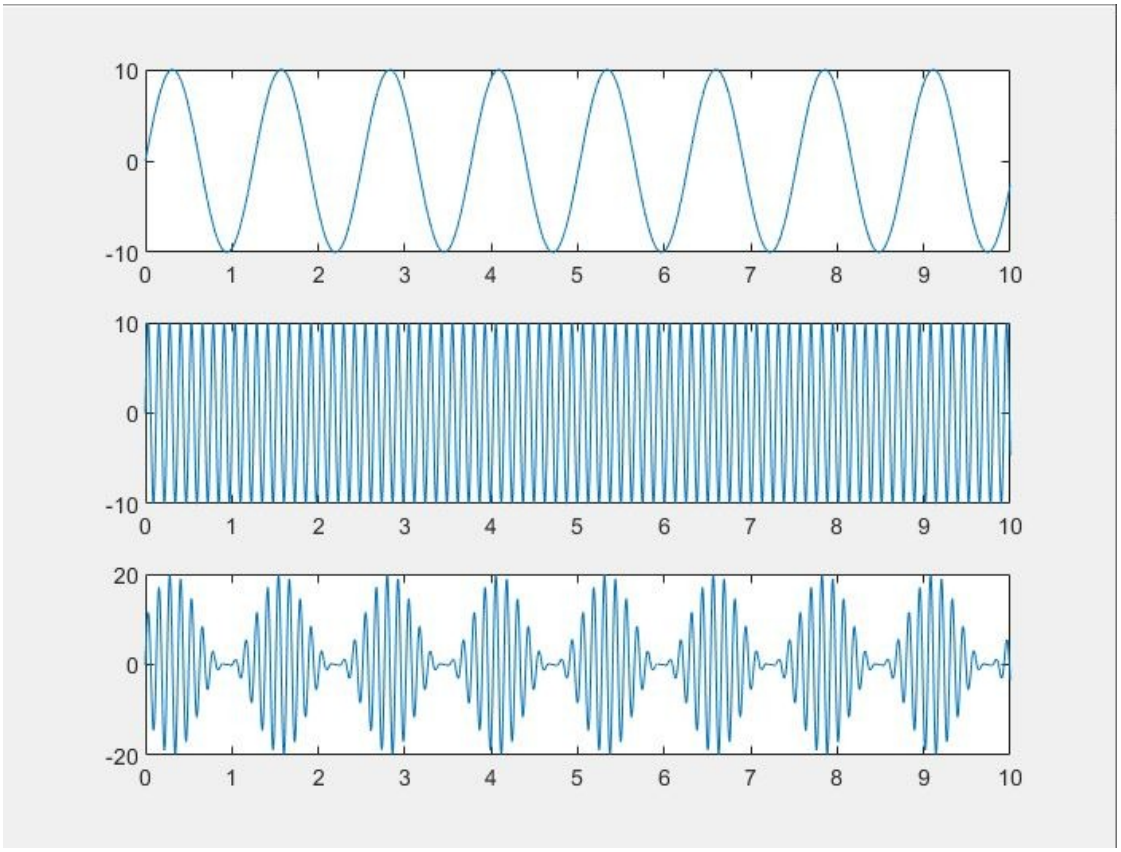
```
t=0:0.001:4
Vm=10*sin(3*t);
Vc=25*sin(50*t);
Vf= Vc + 2*cos(3*t-50*t)-2*cos(3*t+50*t);
Vc1=35*sin(100*t);
M1=(35+Vf).*sin(100*t);

subplot(3,1,1);
plot(t,Vf);

subplot(3,1,2);
plot(t,Vc1);

subplot(3,1,3);
plot(t,M1);
```

Output :

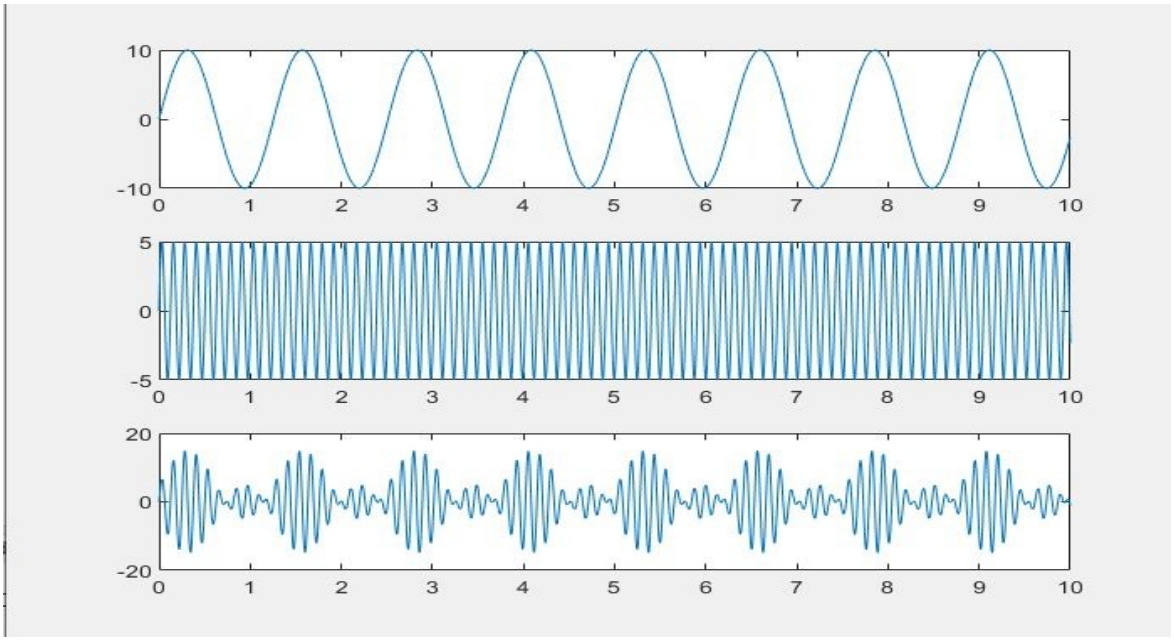
- Under Modulation



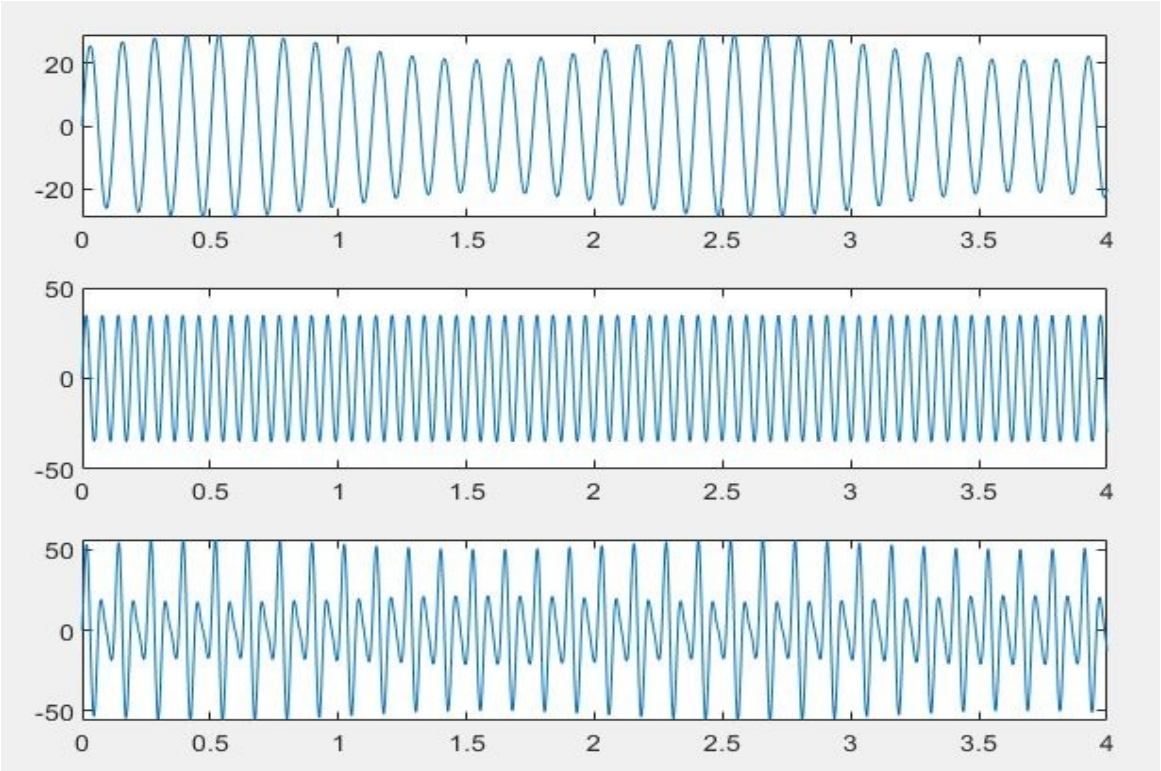
Ideal Mmodulation:



Over Modulation :



- **Modulating the modulated signal by another signal :**

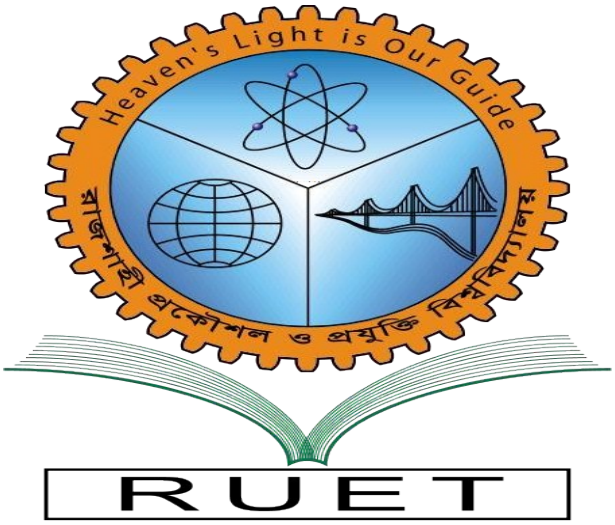


Discussion:

In the wave shape we can see that in case of 'Under modulation' the wave shape is according the theory. The maximum Amplitude of modulated signal be 'A_c+A_m'. and we can see the output is not zero. Because And minimum frequency will be A_c-A_m.
In case of ideal modulation we can see that though the highest amplitude is 'A_c+A_m'. But the signals minimum amplitude is zero. Because here the minus between 2 equal amplitude is zero for sure.
In case of over modulation we can see that the signal is distorted. It is because The carrier experiences a 180 degree phase changes . So the modulated signal get distorted. Here we know that the amplitude of the carrier signal is larger than the message signal. So that extra signal behaves like a noise.

Conclusion :

All the wave form has shown result exactly according to the theory. And the amplitude and frequency of the carrier signal we can see that is greater than the message signal. And modulated signal has components like the carrier signal which is unchanged in frequency and two sidebands with frequencies slightly above and below the carrier frequency.



Department of Electrical & Computer Engineering

Course No: ECE 3208

Course Title: Communication Engineering Sessional

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