Problem Statement

Generate an AM output for the given modulating signal and carrier wave

Carrier frequency: Sine wave with A = 5; f = 4500Hz; Phi = 0

Modulating signal: Sine wave with A = 2.5; f = 100Hz; Phi = 0

Show all the signals in the time domain.

Build the Demodulation system and demonstrate demodulated output

Amplitude Modulation

Process by which the wave signal is transmitted by modulating the amplitude of the signal

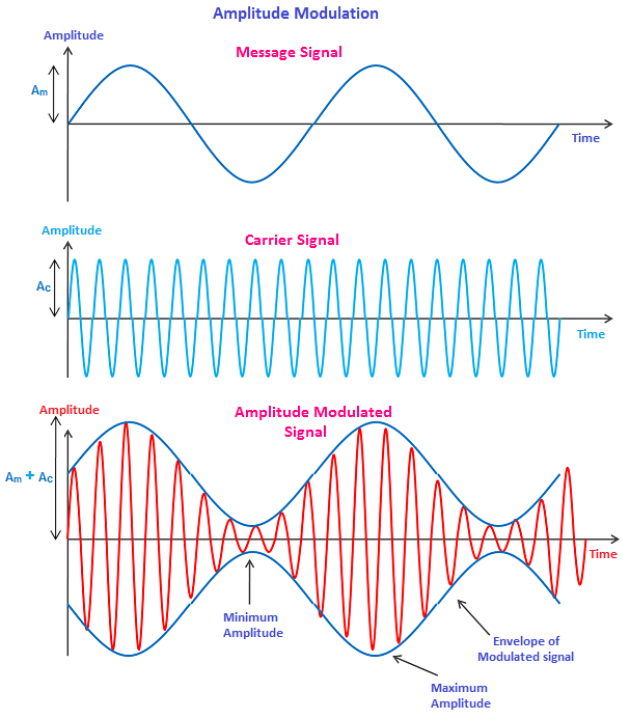
y(t) = A(t) * sin(2*pi*f(t) + phi(t)),

Where,

A(t) = Amplitude

f(t) = Frequency

Phi = Phase Difference



Modulation Index

It is the ratio of Amplitude of modulating signal to Amplitude of carrier signal.

$m = Am / Ac$

Where,

m = Modulating Index

Am = Amplitude of modulating signal

Ac = Amplitude of Carrier signal

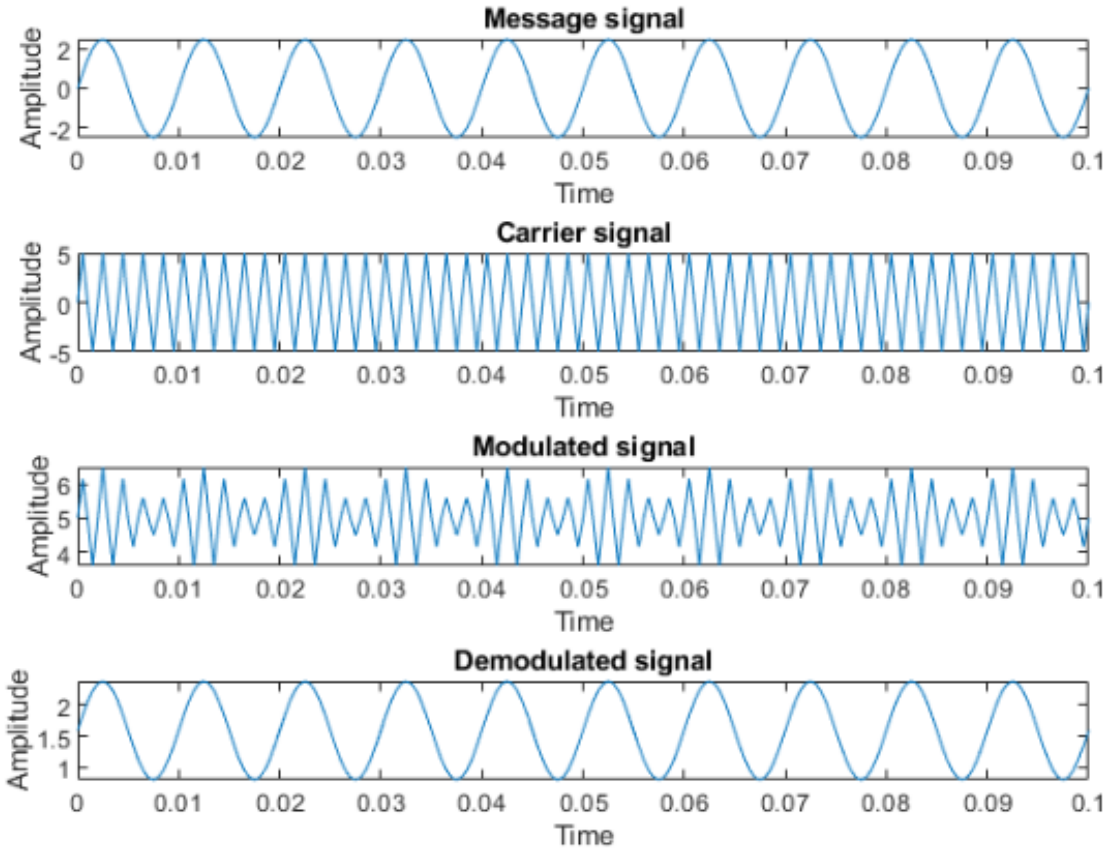
MATLAB Simulation

```
clc; clear all; clf;

Am = 2.5;
Ac = 5;
fm = 100;
fc = 4500;
phi = 0;
t = 0 : 0.0005 : 0.1;
m = Am / Ac;
wc1 = 2*pi*fm;
wc2 = 2*pi*fc;

Modulating = Am * sin(wc1*t + phi);
Carrier = Ac * sin(wc2*t + phi);
Modulated = Ac + (1 + m*sin(2*pi*fm*t + phi)) .*
sin(2*pi*fc*t + phi);
Demodulated = (1/pi)*(Ac+Modulating);

subplot(4, 1, 1);
```

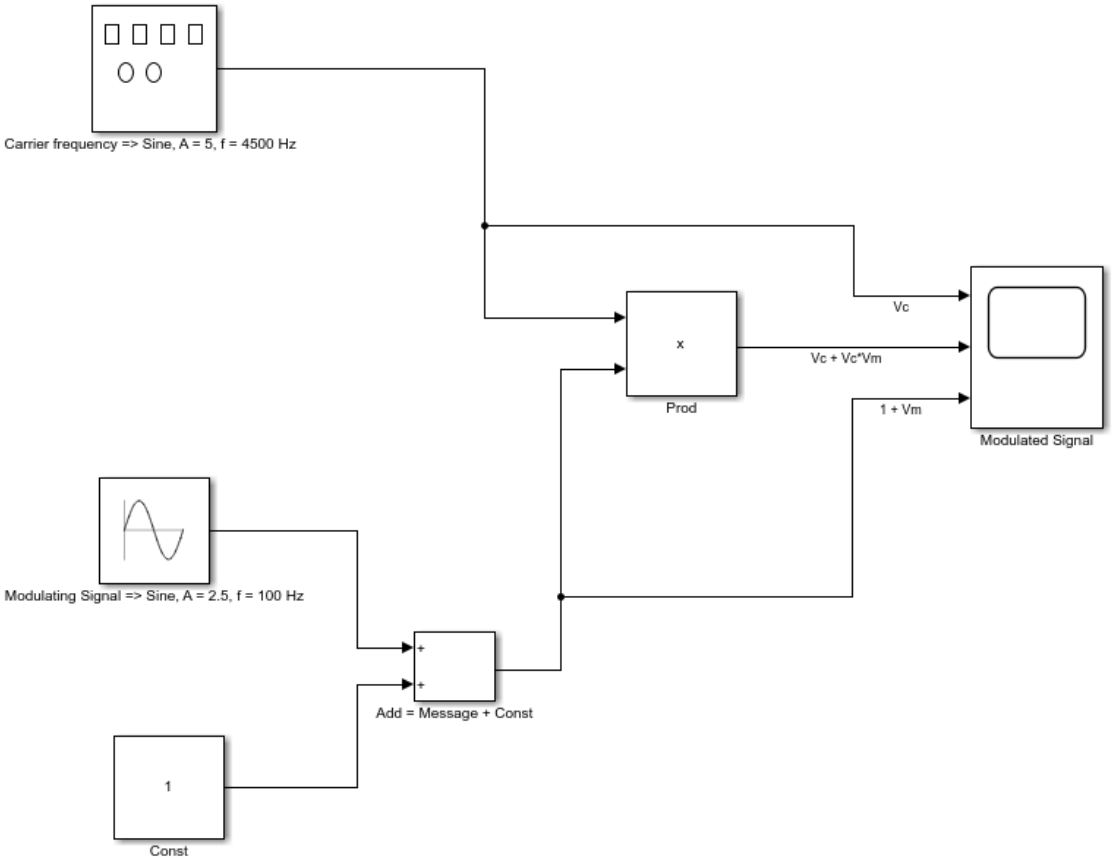
```
plot(t, Modulating);
title('Message signal');
xlabel('Time');
ylabel('Amplitude')

subplot(4, 1, 2);
plot(t, Carrier);
title('Carrier signal');
xlabel('Time');
ylabel('Amplitude')

subplot(4, 1, 3);
plot(t, Modulated);
title('Modulated signal');
xlabel('Time');
ylabel('Amplitude')

subplot(4, 1, 4);
plot(t, Demodulated);
title('Demodulated signal');
xlabel('Time');
```

ylabel('Amplitude')

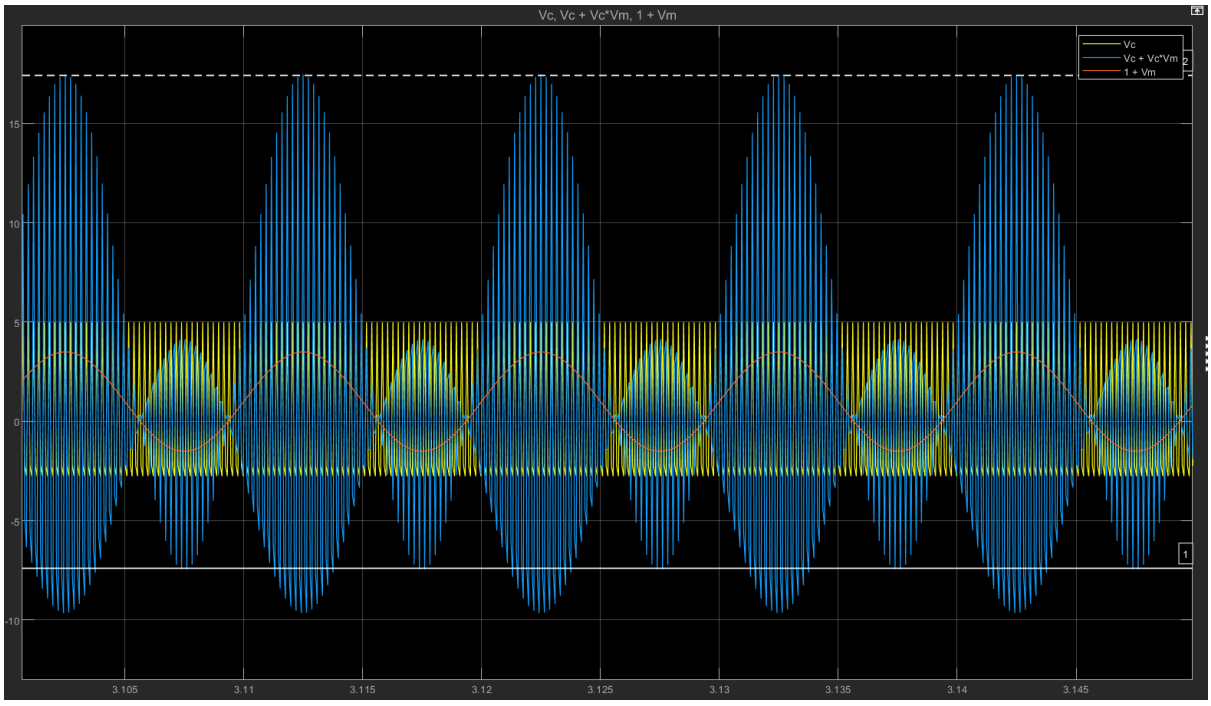
MATLAB Output



Simulink Simulation (Modulation)



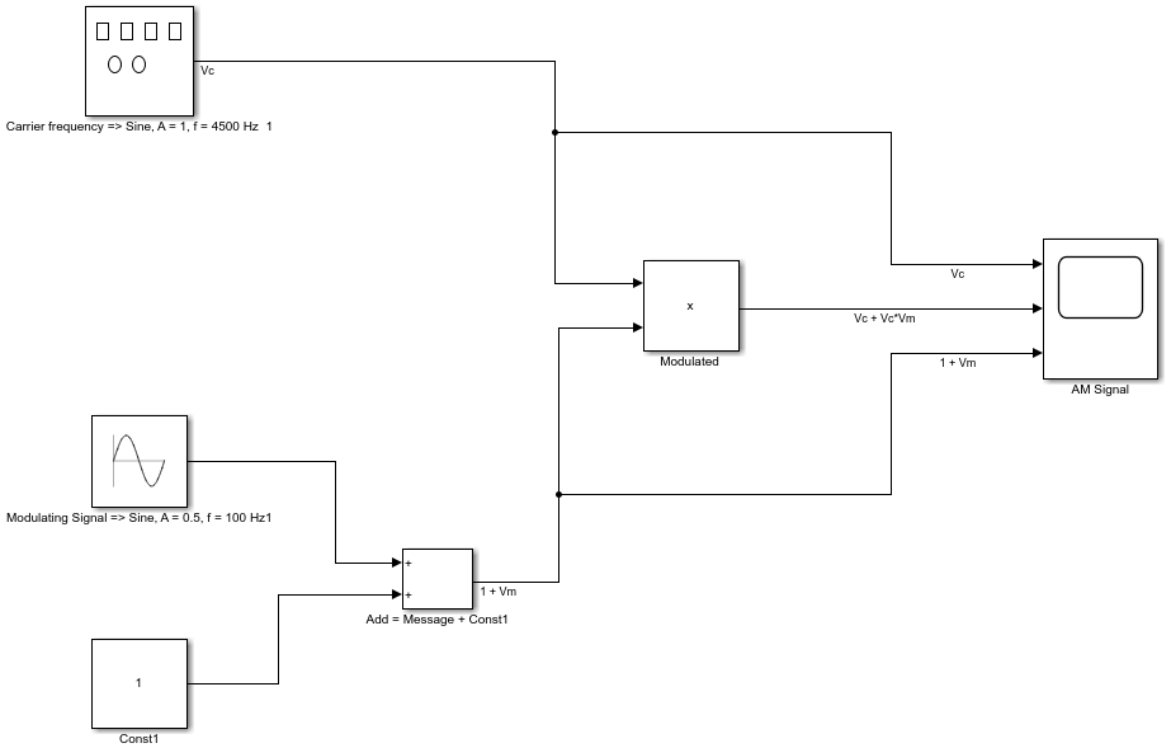
Output



Here we can see that the modulating signal does not really outline the modulated signal.

Initially, we have Ac as 5 and Am as 2.5. So Simulink automatically takes amplitude of Modulating signal as modulation index. So in order to overcome this problem, we reduce the carrier frequency to 1 and proportionally we reduce the modulating frequency to 0.5

Simulink Simulation (Modulation)

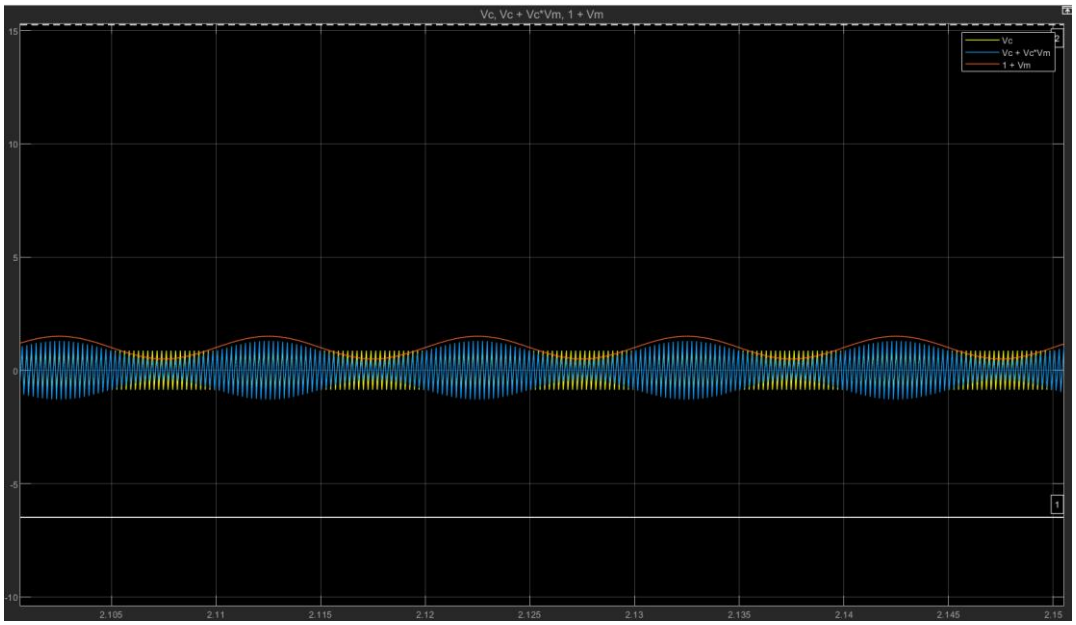


So, Am = 5/5 = 1

Ac = 2.5/ 5 = 0.5

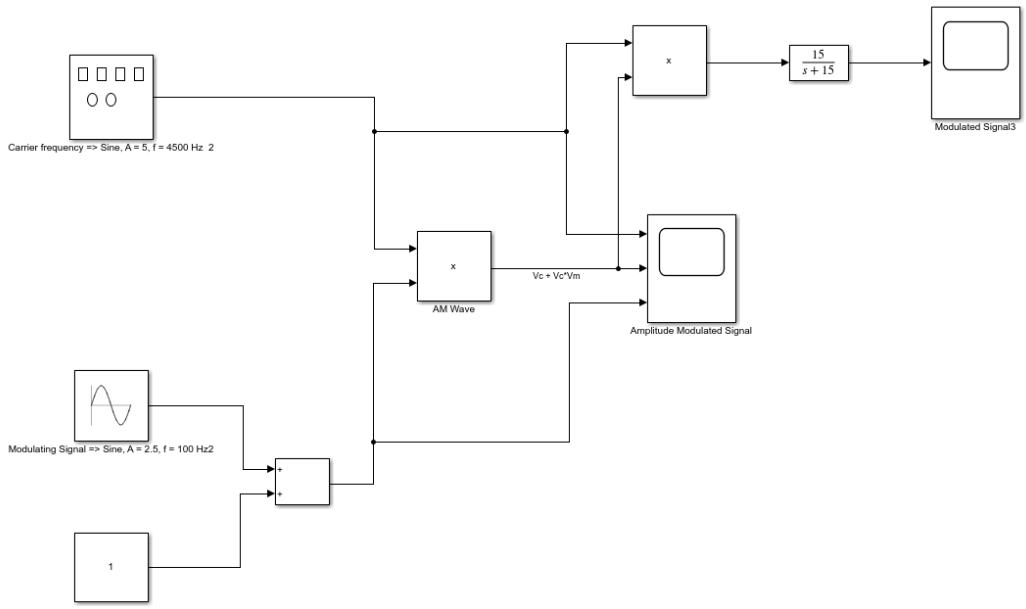
After doing so, we get the proper modulated signal

Output



Over here, we can see that we get a proper modulated signal.

Simulink Simulation (Demodulation)

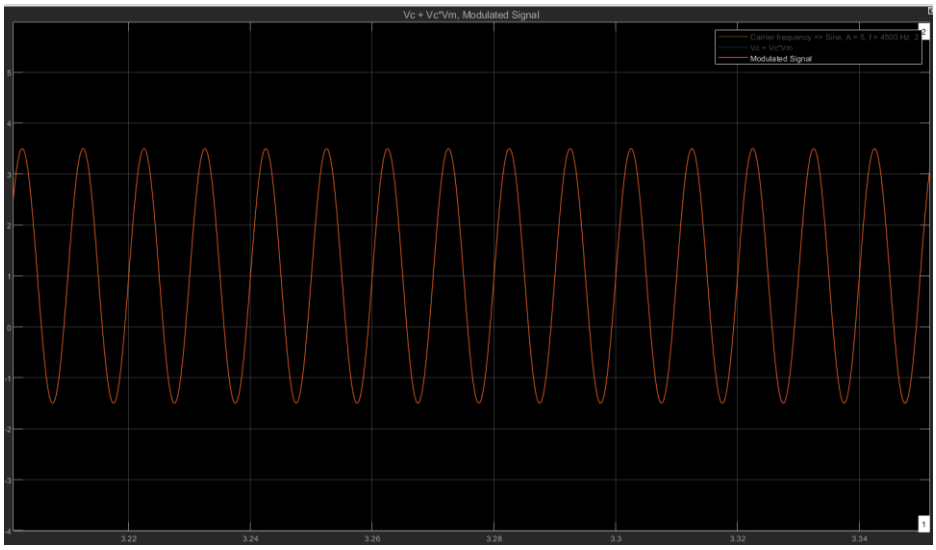


We need to remove carrier, so take product of carrier with modulated wave form.

We add a transfer function which acts as a low pass filter.

A low-pass filter is a filter that passes signals with a frequency lower than a selected cutoff frequency. So basically removes higher frequency signals.

Output



Modulating Signal