19AIE204
Introduction to Communication Systems

Assignment 1

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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

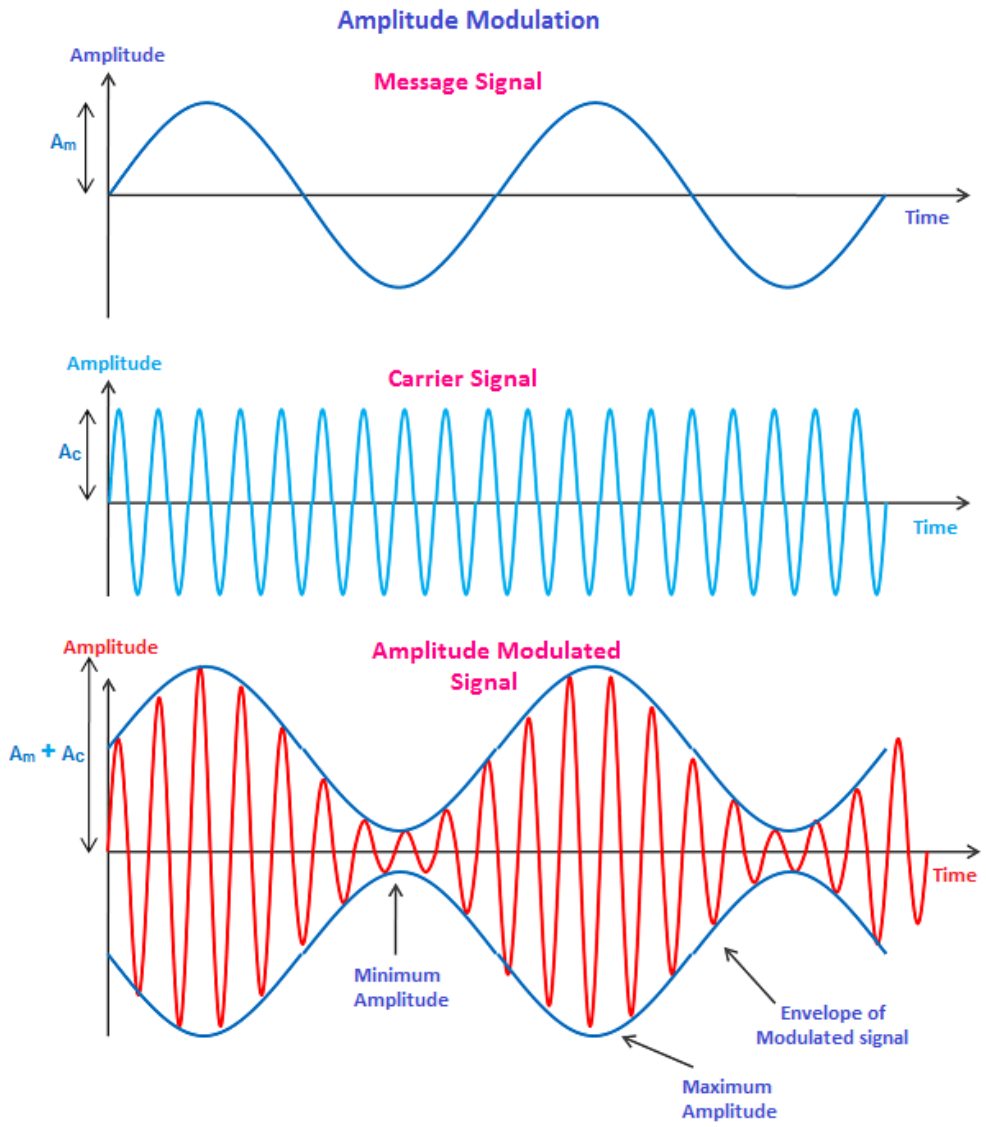
$y(t) = A(t) * \sin(2*pi*f(t) + phi(t))$,

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

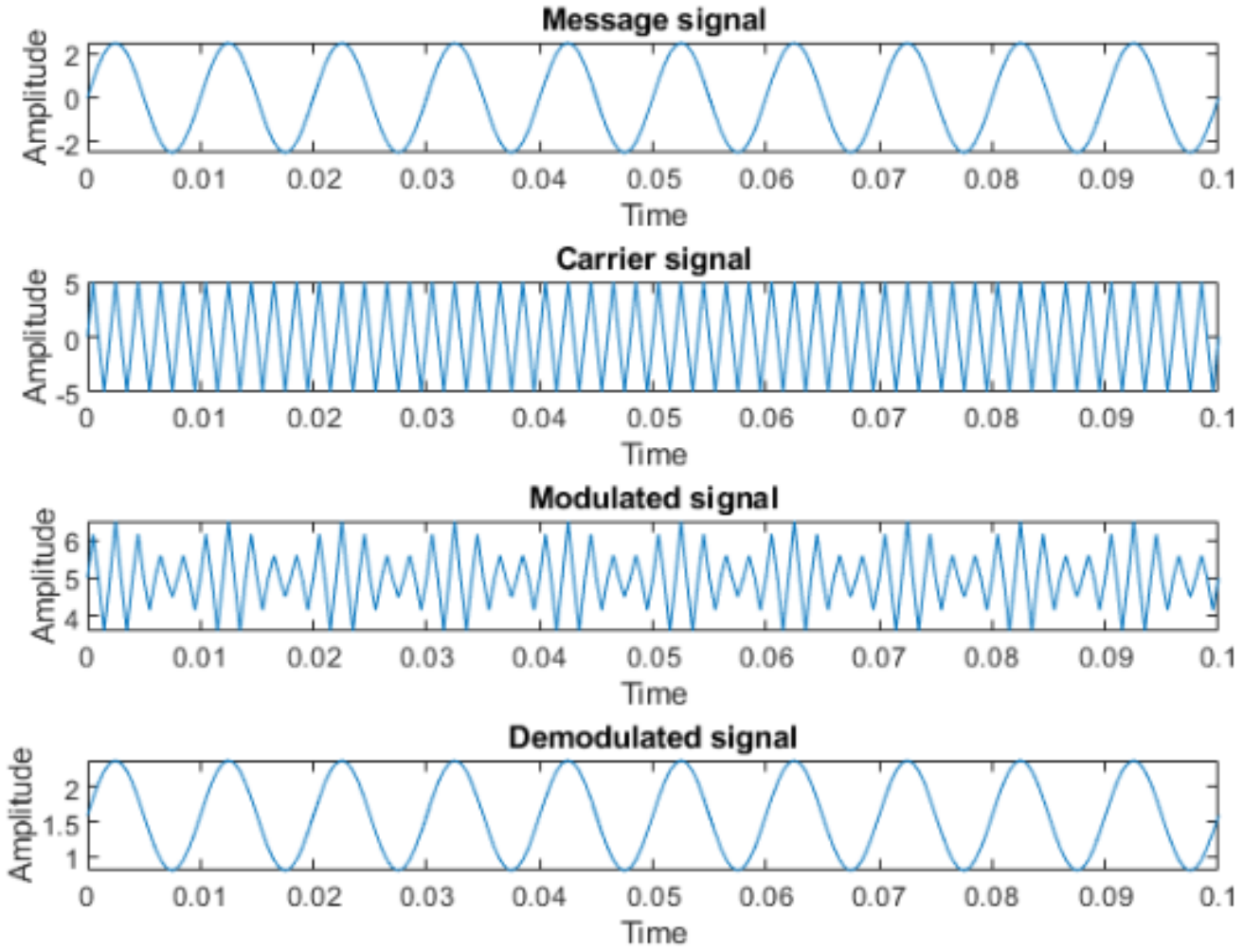
Modulation.mlx

```
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);
```

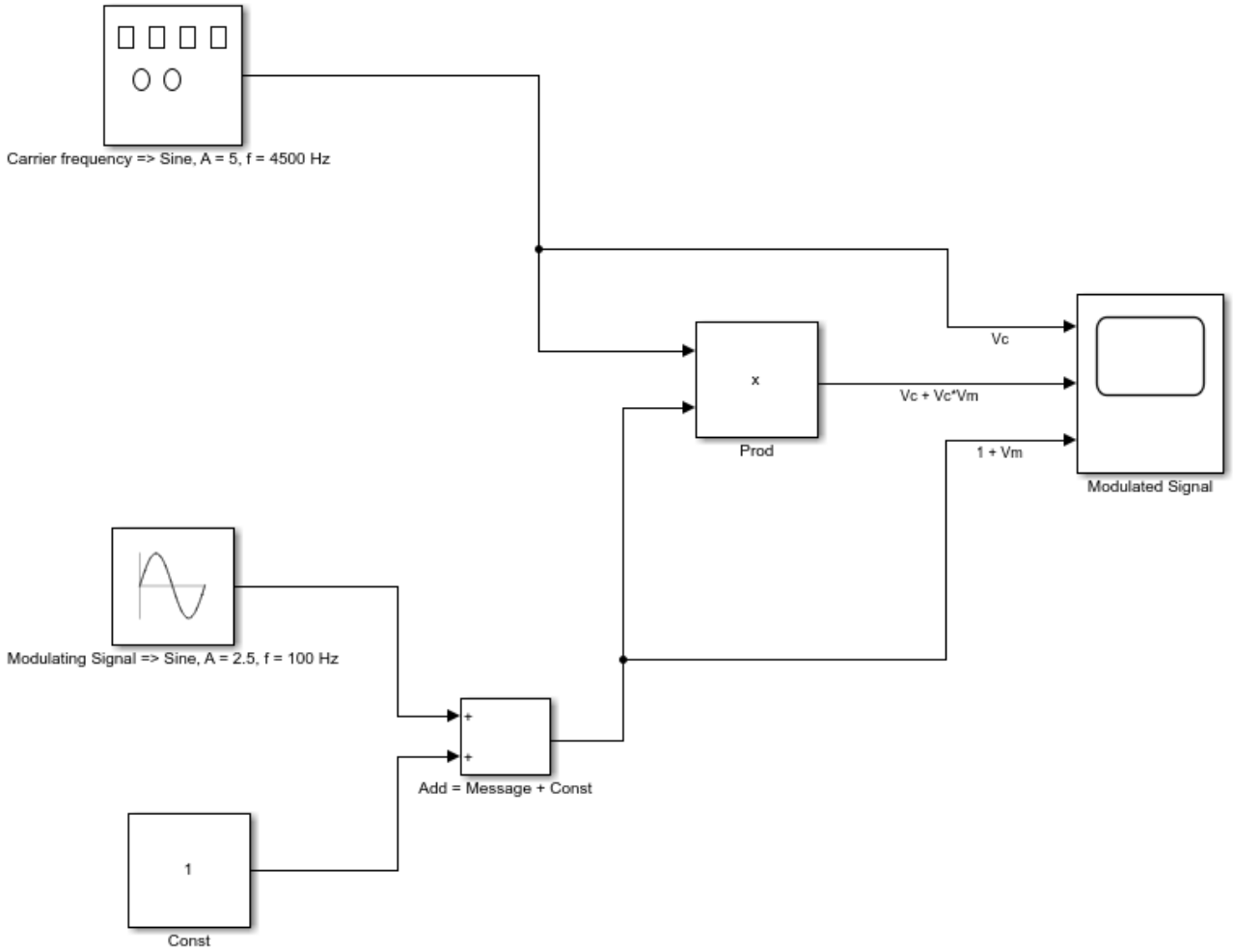
Modulation.mlx

```
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')
```

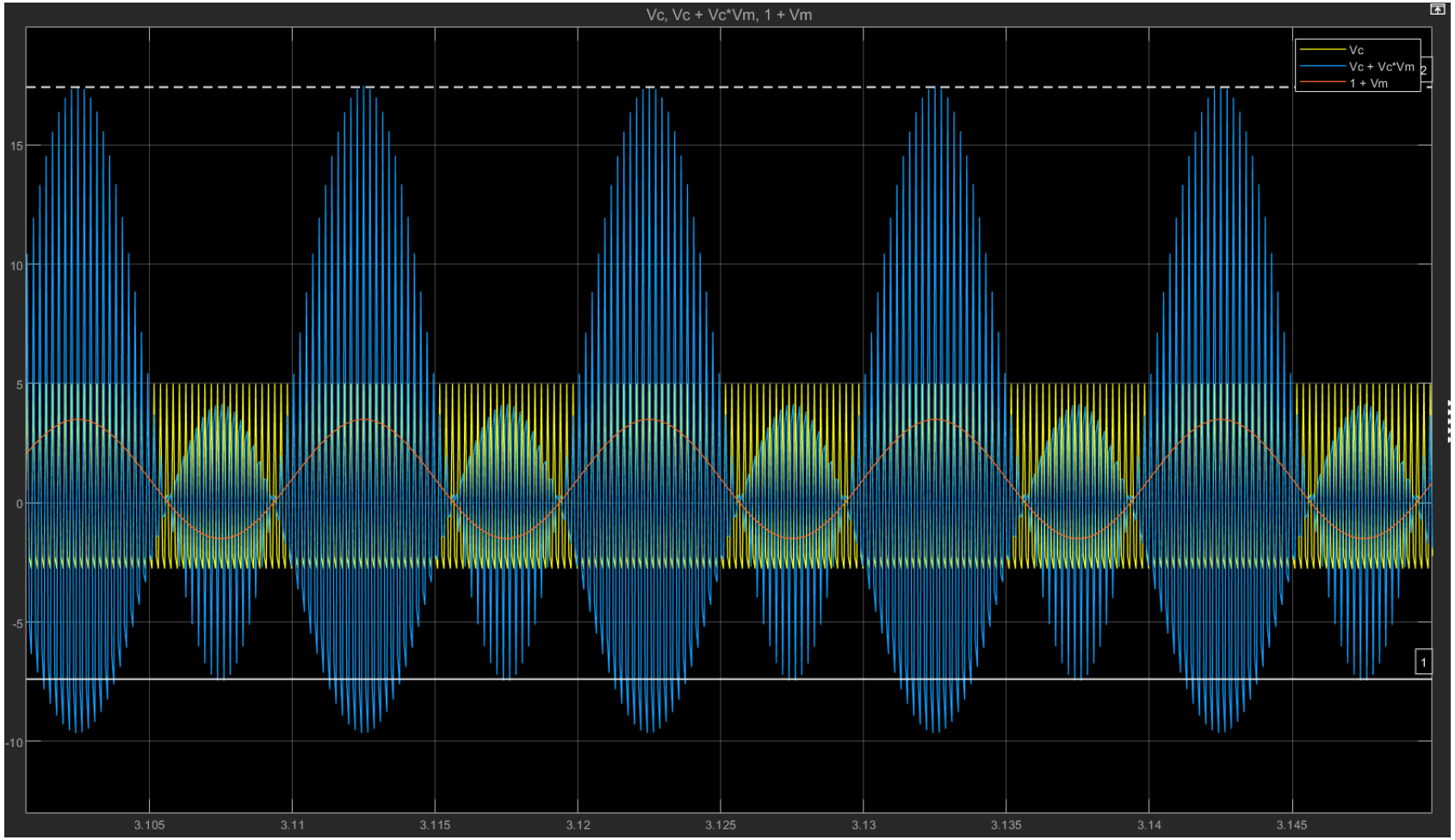
MATLAB Output



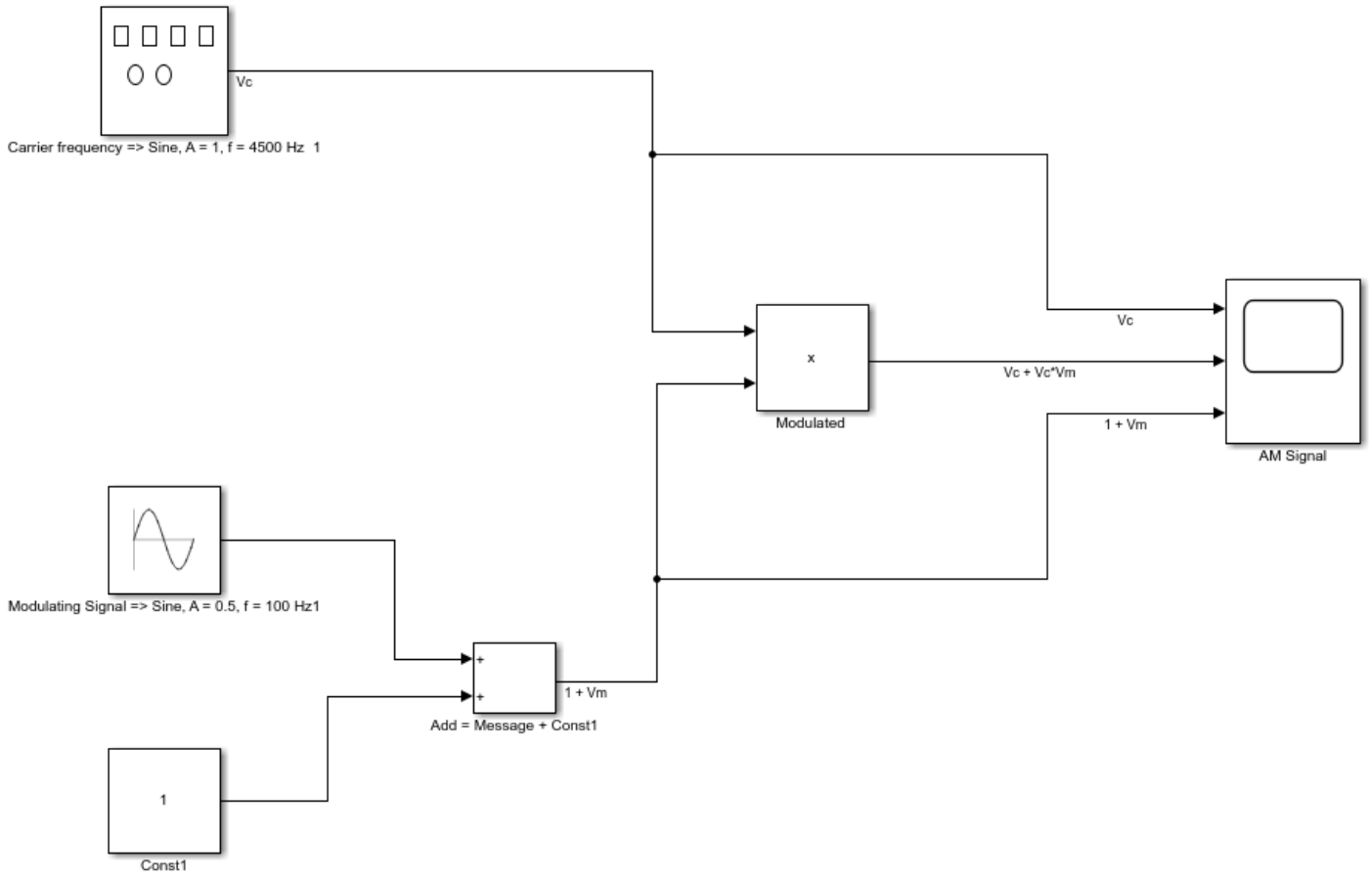
Simulink Simulation (Modulation)



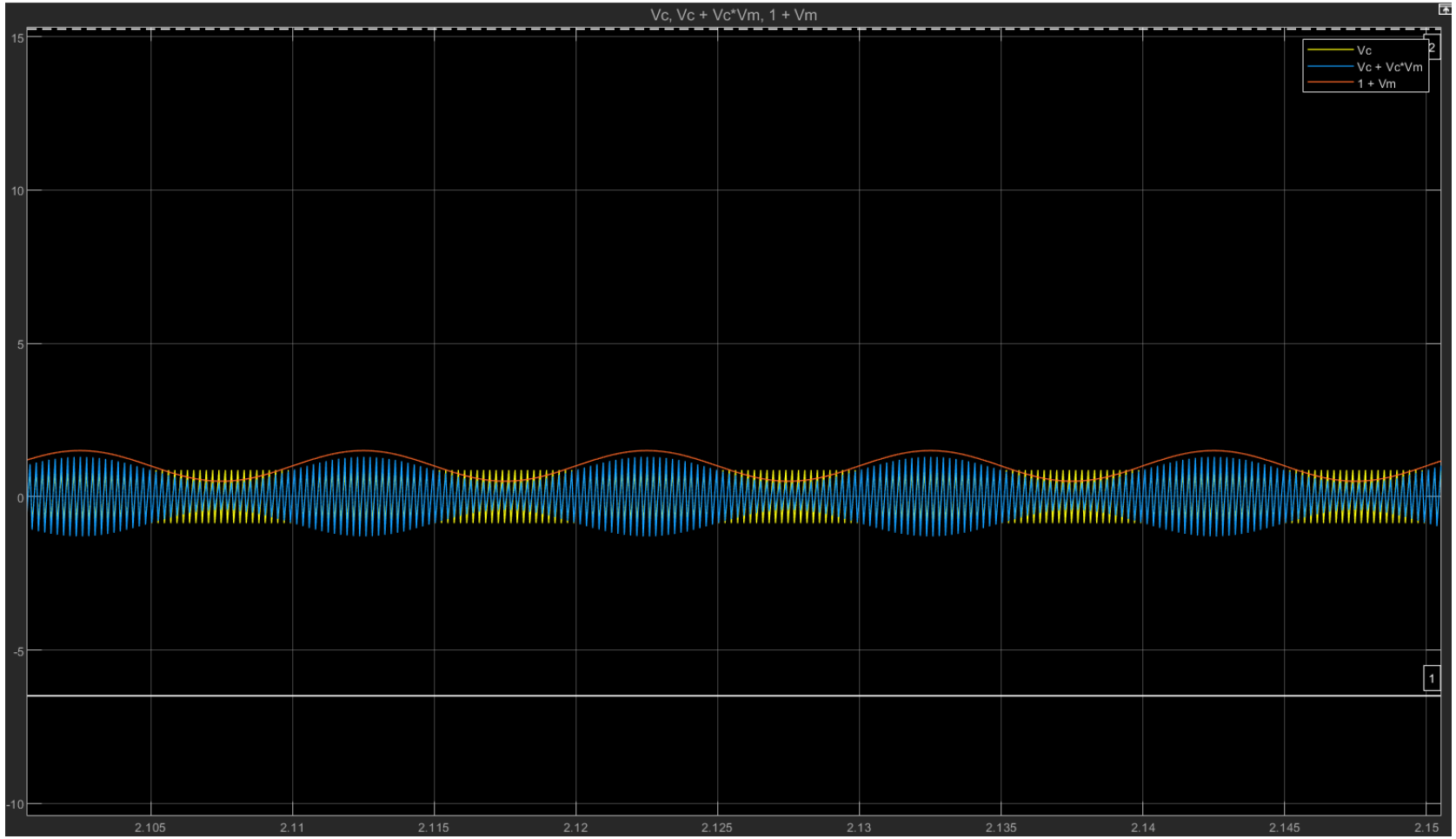
Output


Vc, Vc + Vc*Vm, 1 + Vm
Vc
Vc + Vc*Vm
1 + Vm
15
10
5
0
-5
-10
3.105
3.11
3.115
3.12
3.125
3.13
3.135
3.14
3.145
1
2

Simulink Simulation (Modulation)

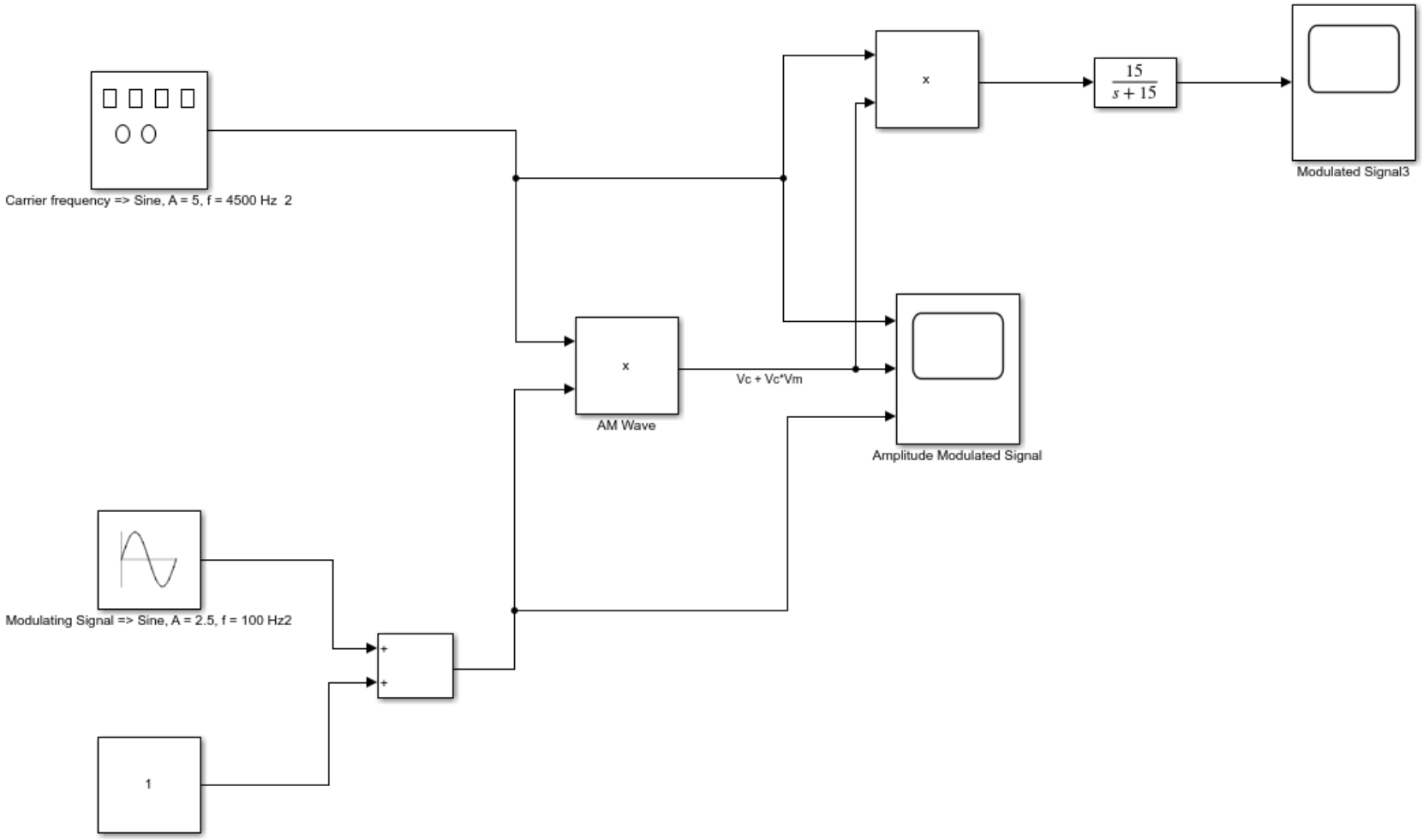


Output

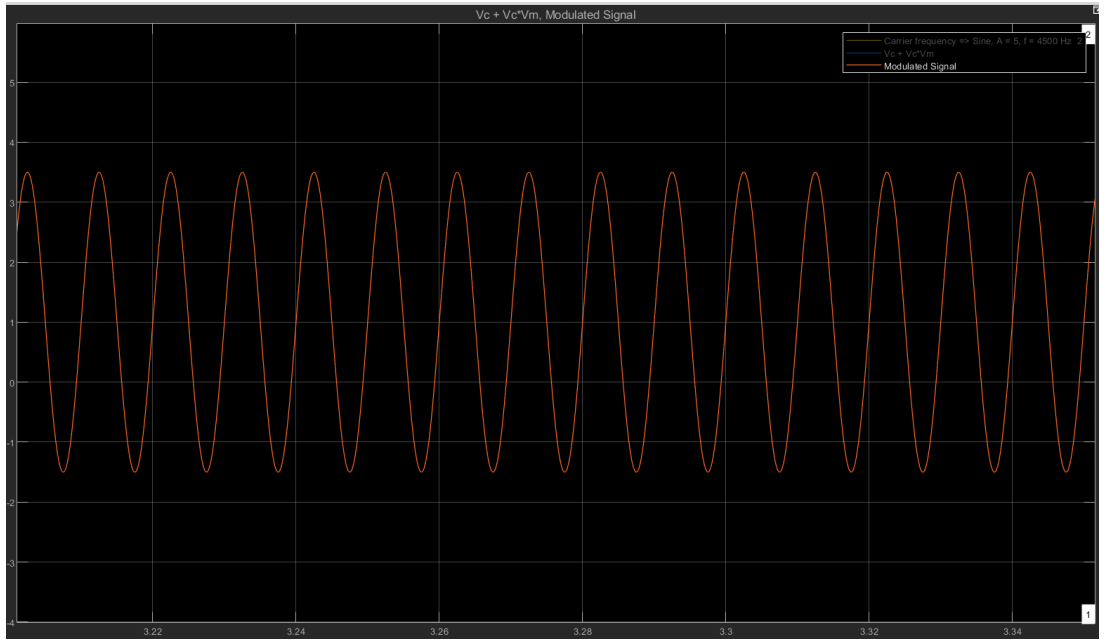


Amplitude Modulation

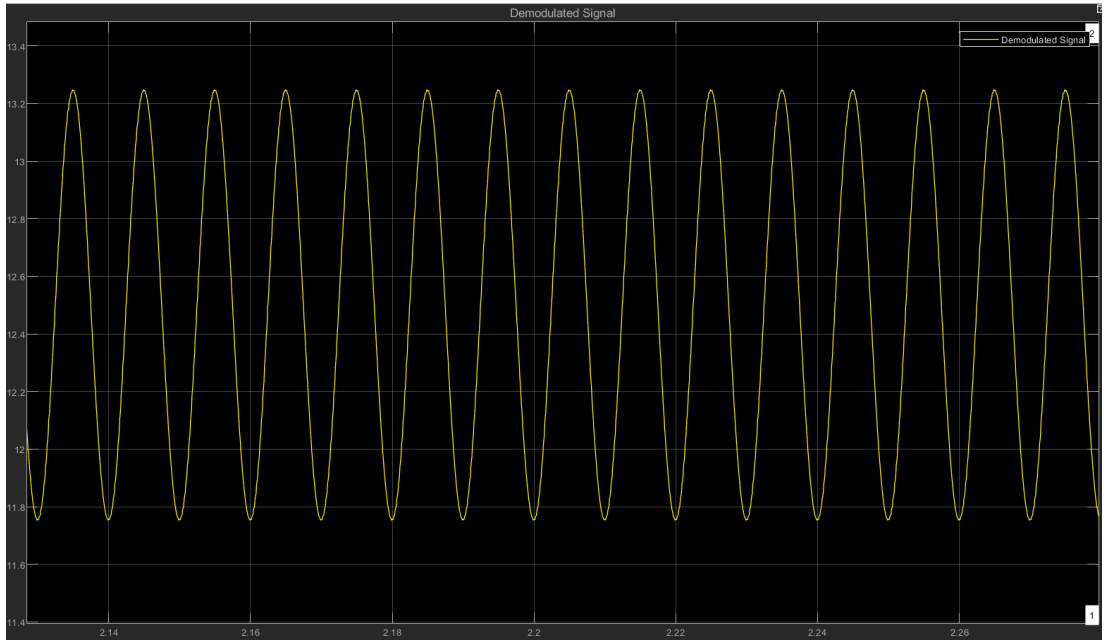
Simulink Simulation (Demodulation)



Output



Modulating Signal



Demodulated Signal