



Department of Electrical Engineering and
Computer Science

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Dated: 09/04/2023

Semester: 6th

Section: BEE 12C

EE-351 Communication Systems

Lab 9: Frequency Modulation with MATLAB

Group Members

Name	Reg. No	Viva / Quiz / Lab Performan ce	Teamwork	Ethics	Softwar e Tool Usage	Analysi s of data in Lab Report
		5 Marks	5 Marks	5 Marks	5 Marks	5 Marks
Muhammad Ali Farooq	331878					
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2 Frequency Modulation

2.1 Objectives

- To understand the concept of Frequency modulation with the help of MATLAB and observe its results.

2.2 Introduction

Frequency Modulation (FM) is a commonly used technique in communication systems for transmitting information over a carrier signal by varying its frequency. FM is widely used in applications such as radio broadcasting, wireless communication systems, and navigation systems, among others. In this lab experiment, the aim is to understand the concept of FM and observe its results through simulations performed using MATLAB software.

The objective of this lab report is to provide a detailed explanation of the FM technique and its practical applications. Additionally, we aim to demonstrate how the FM signal can be generated using MATLAB and explore the effects of varying the modulation index on the FM signal. The report will also discuss the advantages and disadvantages of FM compared to other modulation techniques and highlight some of the practical challenges associated with implementing FM systems.

2.3 Lab Report Instructions

All questions should be answered precisely to get maximum credit. Lab report must ensure following items:

- Lab objective
- Results (screen shots) duly commented and discussed.
- Conclusion



3 Lab Procedure

3.1 Tasks

- Generate a message signal of amplitude 1V and frequency 2Hz.
- Generate a carrier signal of amplitude 1V and frequency 20Hz
- Assume the value of sensitivity constant k_f as 14. Generate an FM modulated signal using formulas.
- The time scale division should be as mentioned below:
$$T = \text{linspace}(0, 1, 500);$$
- Change the Sensitivity constant and see if there are any changes in FM modulation.

```
Am = 1;
Ac = 1;
fm = 2;
fc = 20;
t = linspace(0, 1, 500);

%% Task 1
kf = 14;
beta = kf*Am / fm;
s_t = Ac*cos(2*pi*fc*t + beta*sin(2*pi*fm*t));
m_t = Am*cos(2*pi*fm*t);

subplot(211)
plot(t, m_t)
xlabel('Time (s)');
ylabel('Amplitude (V)');
title ('Message signal');

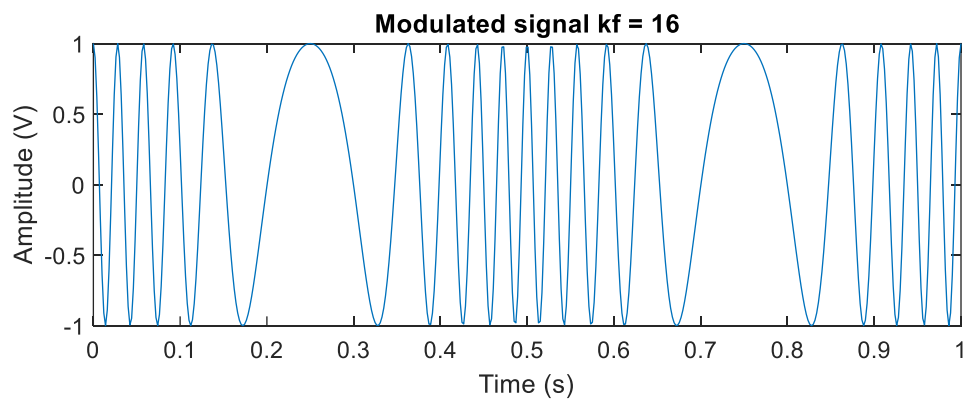
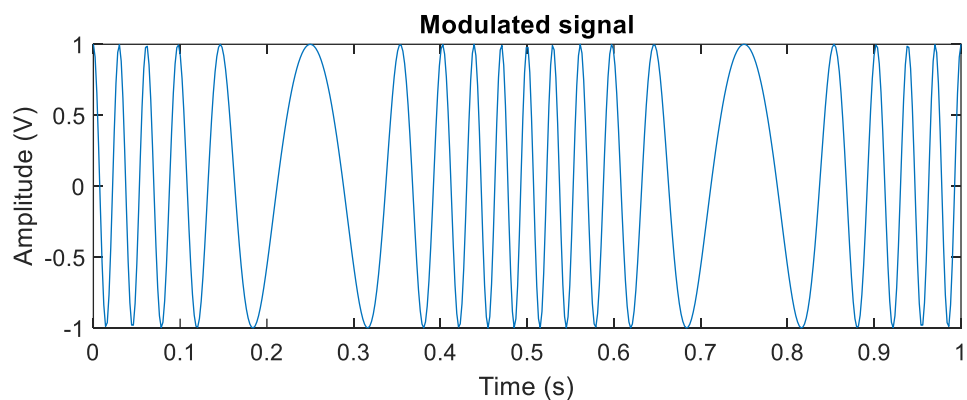
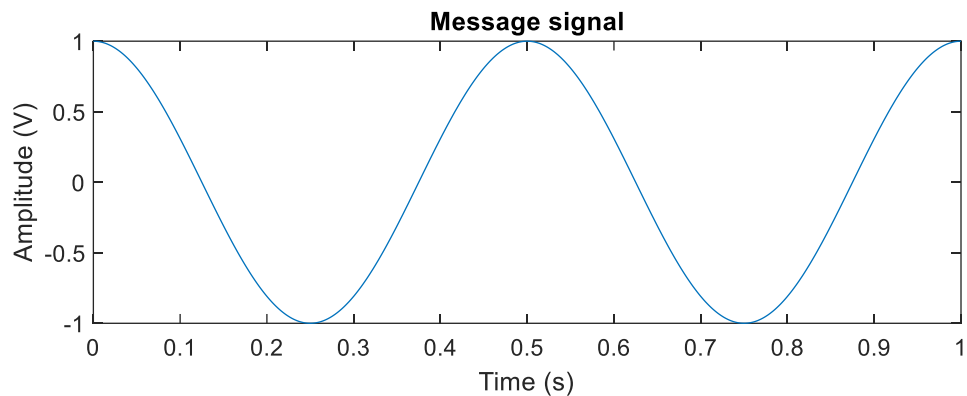
subplot(212)
plot(t, s_t)
xlabel('Time (s)');
ylabel('Amplitude (V)');
title ('Modulated signal');

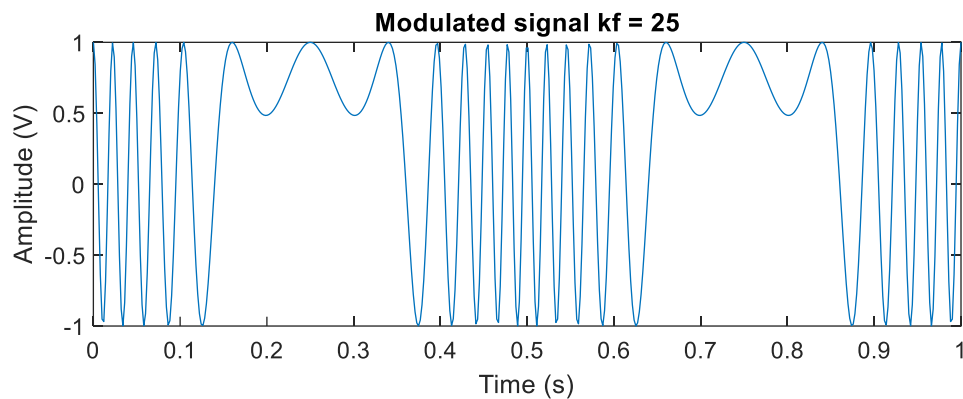
%%
figure
kf = 16;
beta = kf*Am / fm;
s_t = Ac*cos(2*pi*fc*t + beta*sin(2*pi*fm*t));

subplot(211)
plot(t, s_t)
xlabel('Time (s)');
ylabel('Amplitude (V)');
title ('Modulated signal kf = 16');
```



```
kf = 25;  
beta = kf*Am / fm;  
s_t = Ac*cos(2*pi*fc*t + beta*sin(2*pi*fm*t));  
  
subplot(212)  
plot(t, s_t)  
xlabel('Time (s)');  
ylabel('Amplitude (V)');  
title('Modulated signal kf = 25');
```





4 Conclusion

In conclusion, this lab experiment has provided a comprehensive understanding of Frequency Modulation (FM) and its practical applications in communication systems. Through simulations performed using MATLAB, we have observed the effects of varying the modulation index on the FM signal and explored its advantages and disadvantages compared to other modulation techniques. We have learned that FM is widely used in radio broadcasting, wireless communication systems, and navigation systems due to its resistance to noise and interference, and its ability to provide high fidelity audio transmission. However, FM systems can also be challenging to implement due to their relatively narrow bandwidth and the complexity of demodulating FM signals.