University of Science and Technology
Zewail City

CIE 337 Communication Theory and Systems

Project 1 Report

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1 Part A

1. Let's Begin By Showing and plotting $m_1(t)$ and $m_2(t)$:

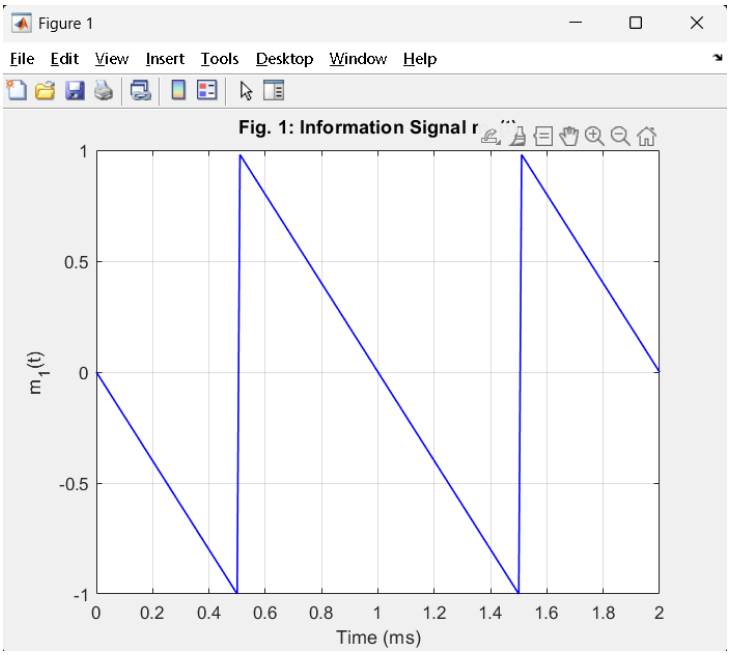

Figure 1: Information Signal 1 $m_1(t)$

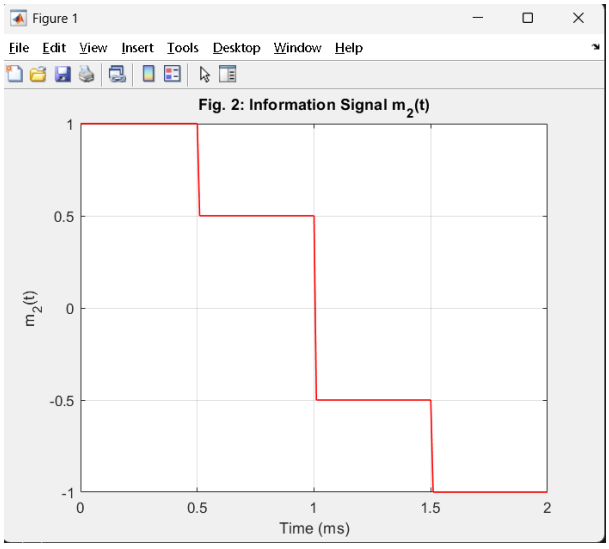

Figure 2: Information Signal 2 $m_2(t)$

2. $\mathbf{s(t)}$

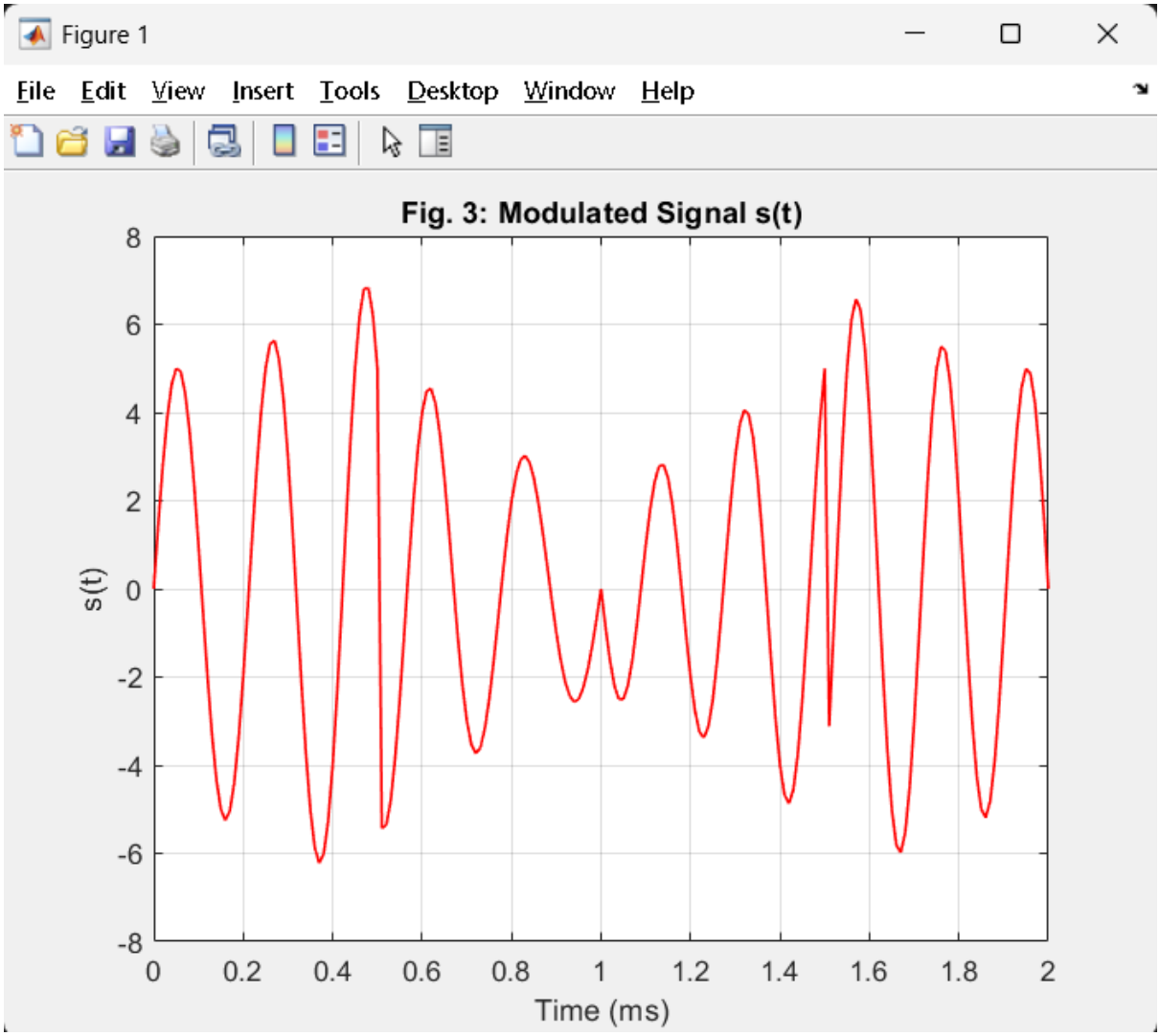

Figure 3: DSB-QAM Signal Carrying info in both the information and the phase. This Is Helpful By Transmitting 2 Signals with efficient Bandwidth

3. The Normal Carrier Demodulation(The Synchronous Case)

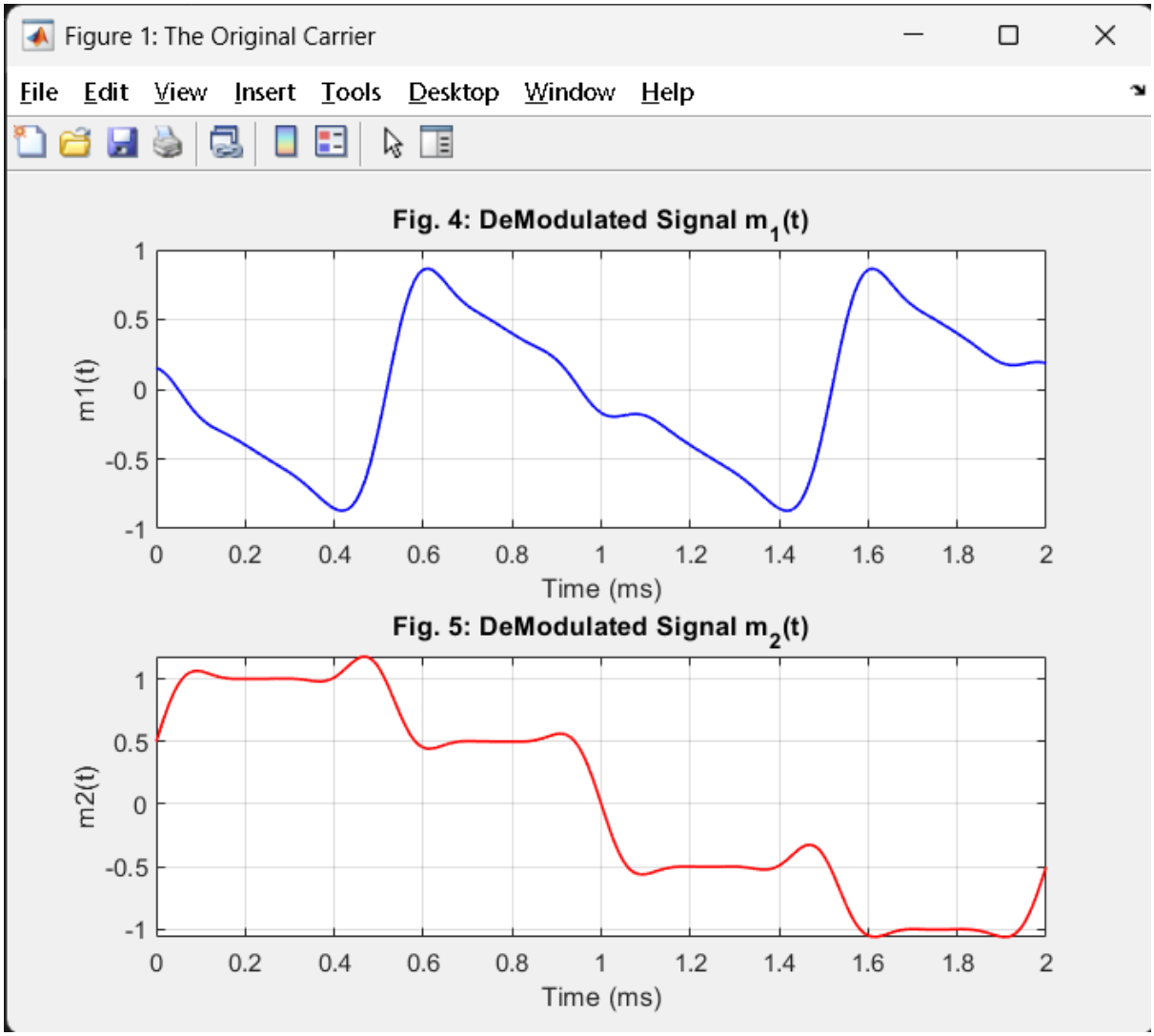

Figure 4: This Is the output after the LPF

4. The Normal Carrier Demodulation+ $\pi/3$(The Asynchronous Case)

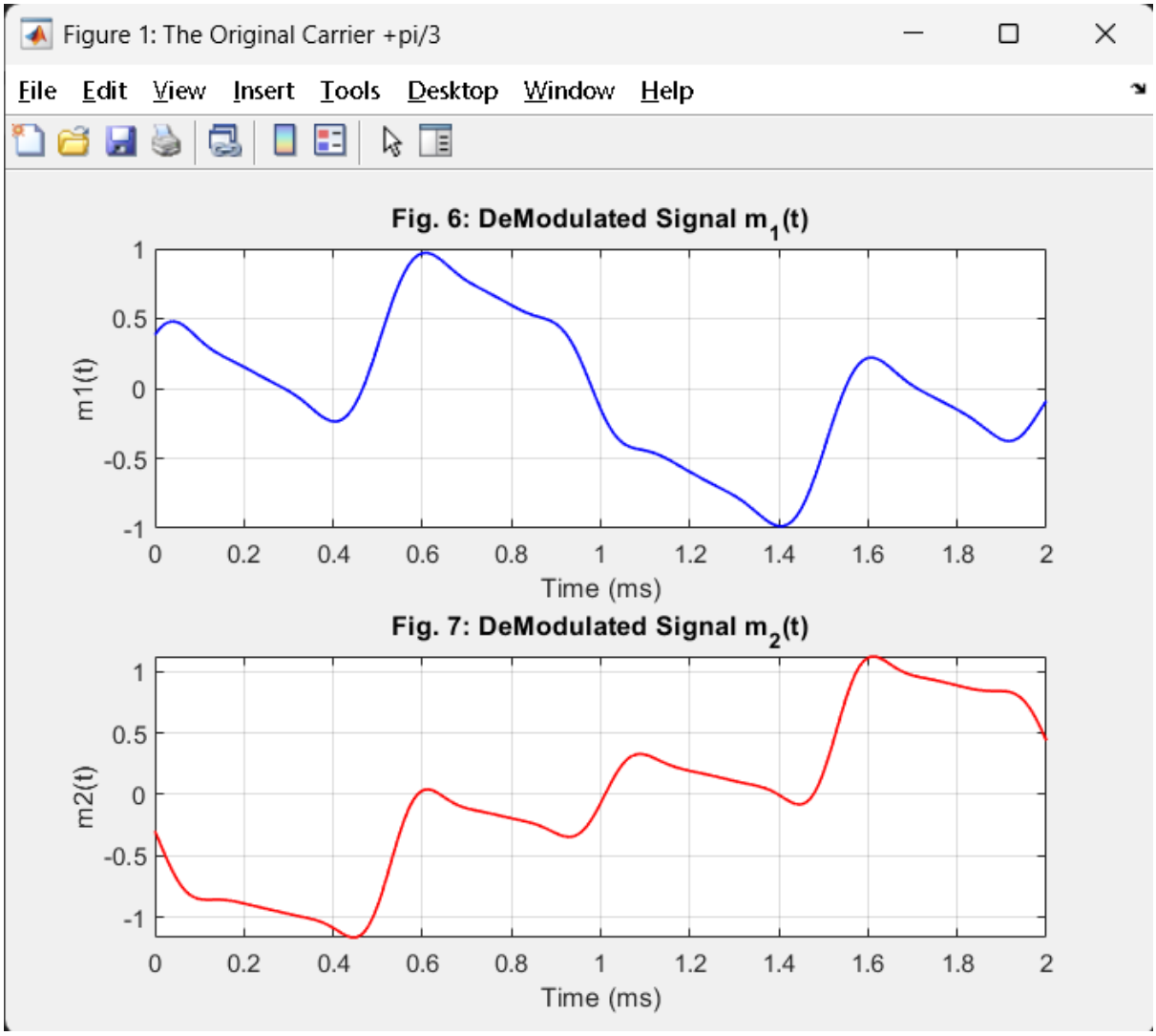

Figure 5: This Is the output after the LPF, We Can Clearly see the difference in the phase

5. In this case the carrier frequency is $2.02\pi f_c$ (Another Example of The Asynchronous Case)

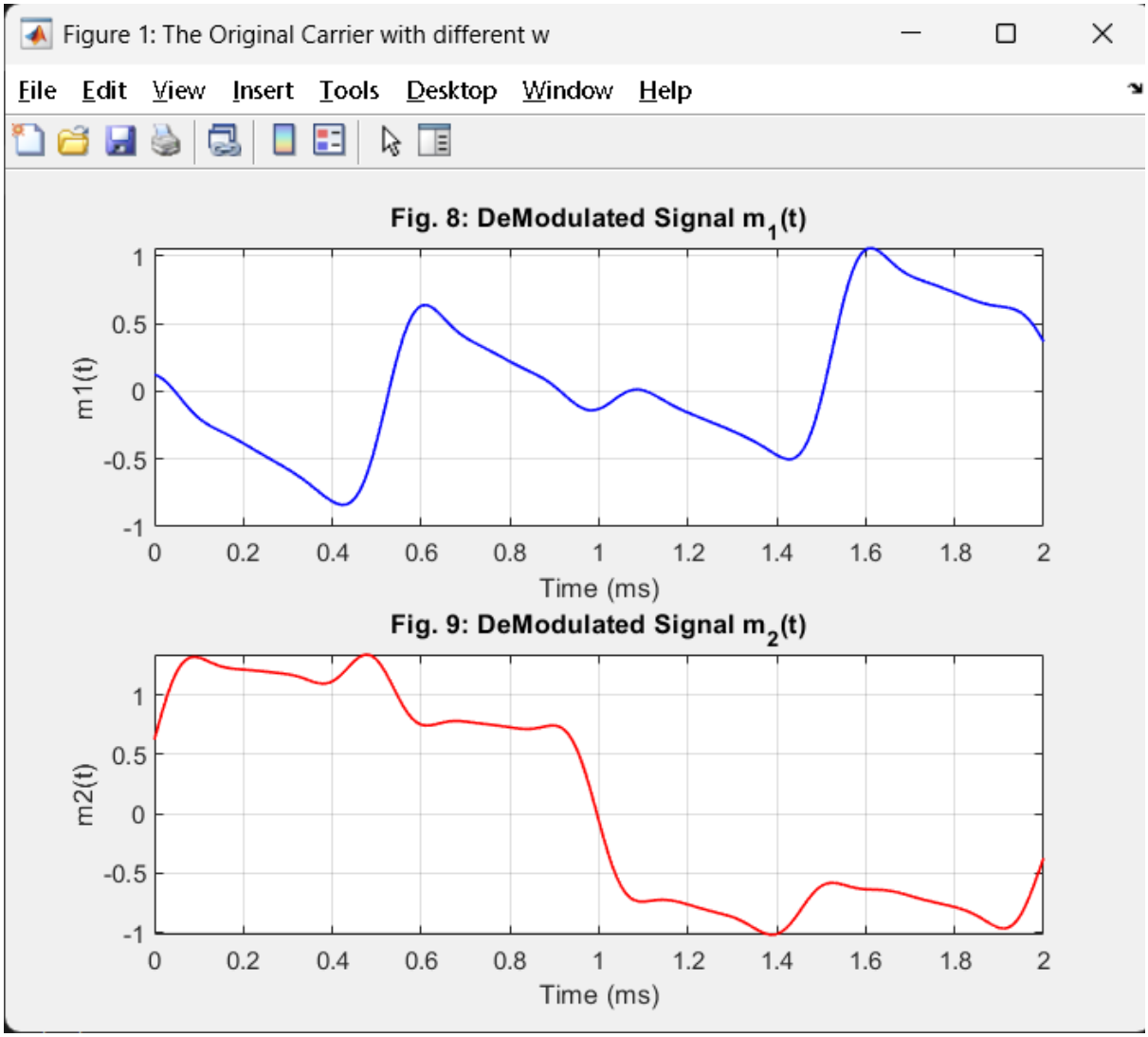

Figure 6: This Is the output after the LPF, The difference here may lie in the scaling in the code snippets

2 Part B

1. The First Deliverable is actually the same as the first in part A which is 1 and 2.
2. **S(t) with Amplitude =1V and 10 KHz Frequency**

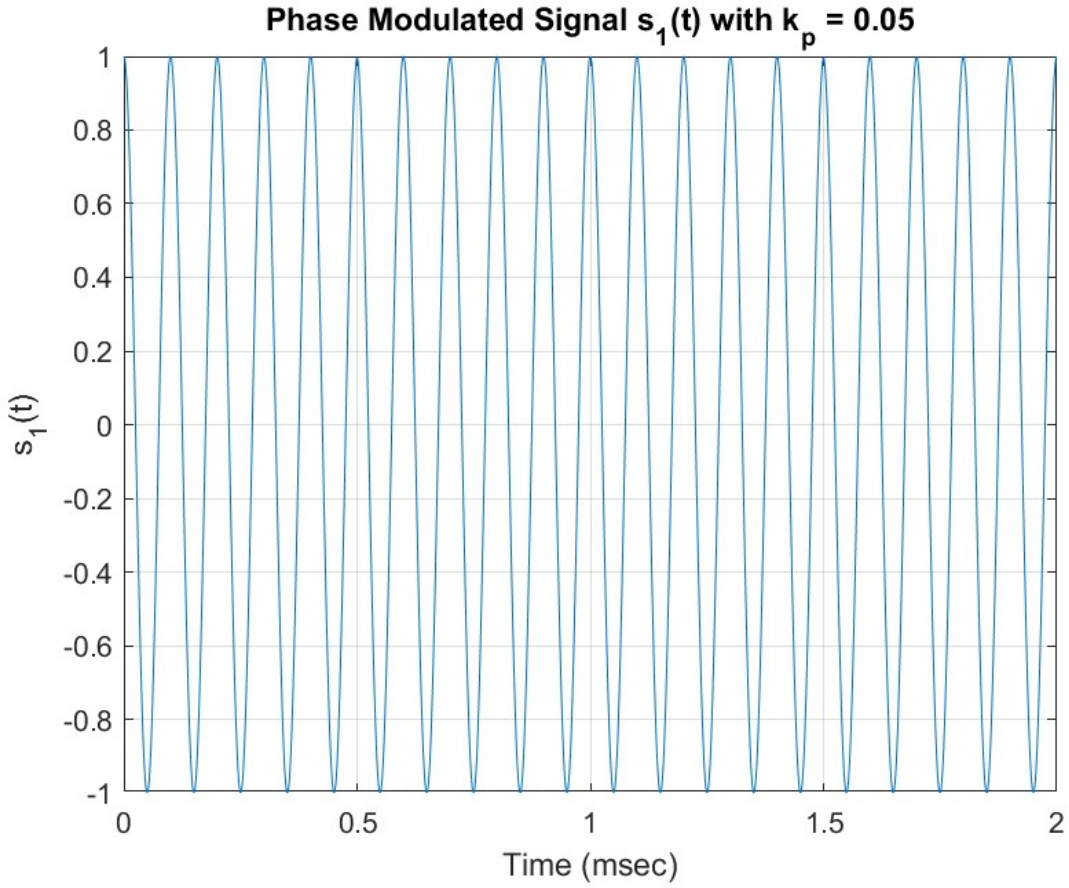

Figure 7: with $k_p = 0.05$ There is barely any shift

3. With Different k_p Values(1,5,10)
   By Increasing, k_p there occurs larger phase shifts, better modulation, increasing in bandwidth, stronger representation of m(t).

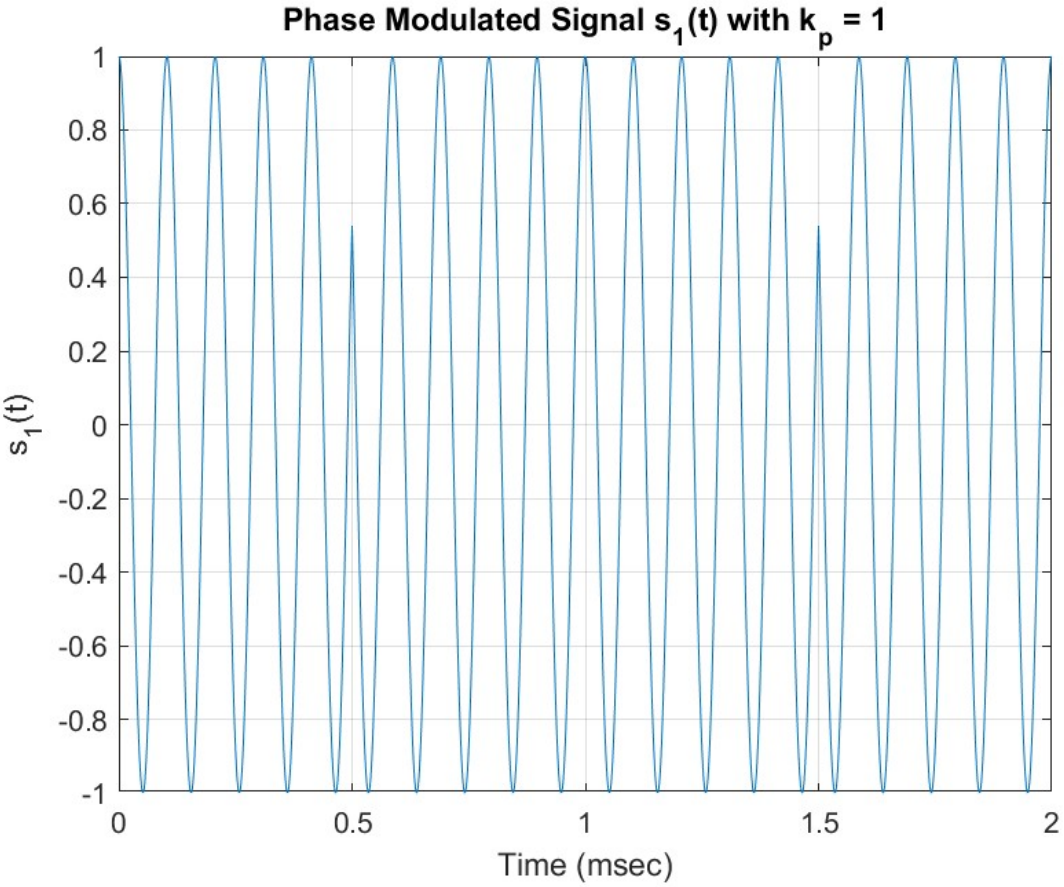

Figure 8: This Resembles Moderate Phase Modulation as the phase shifts starts appearing

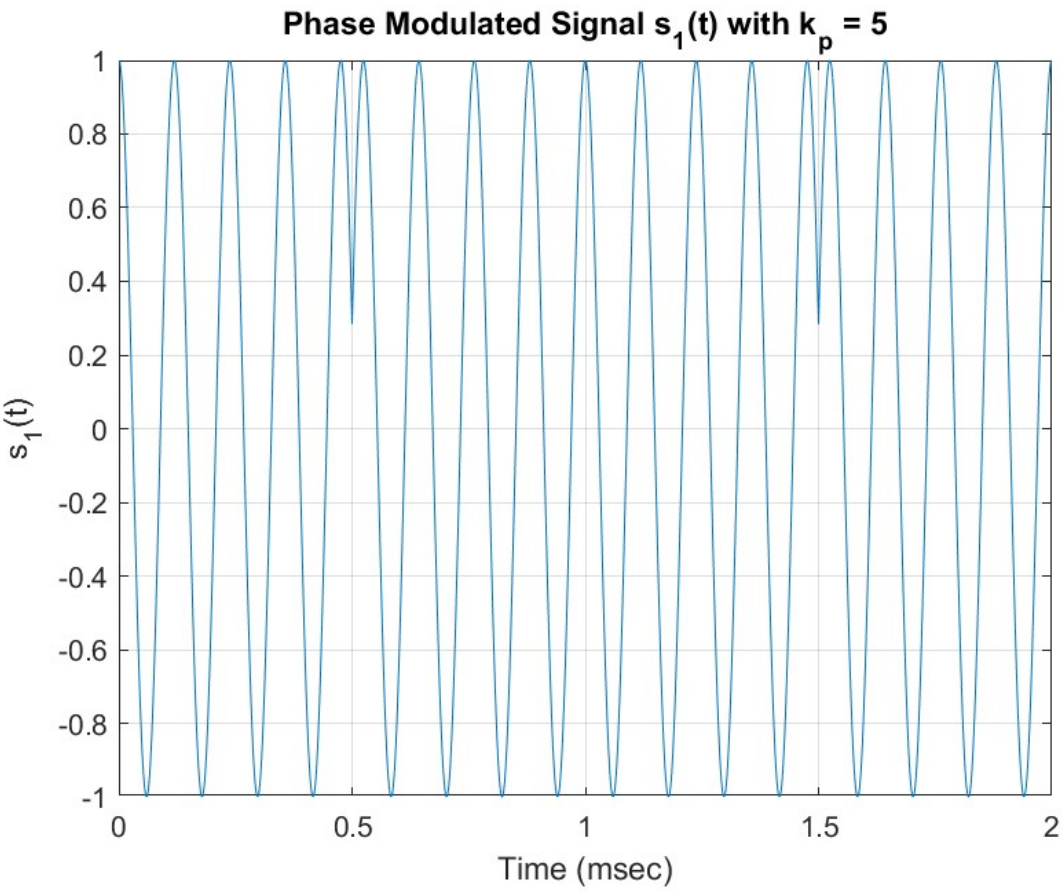

Figure 9: This Resembles stronger Modulation leading to larger phase shifts

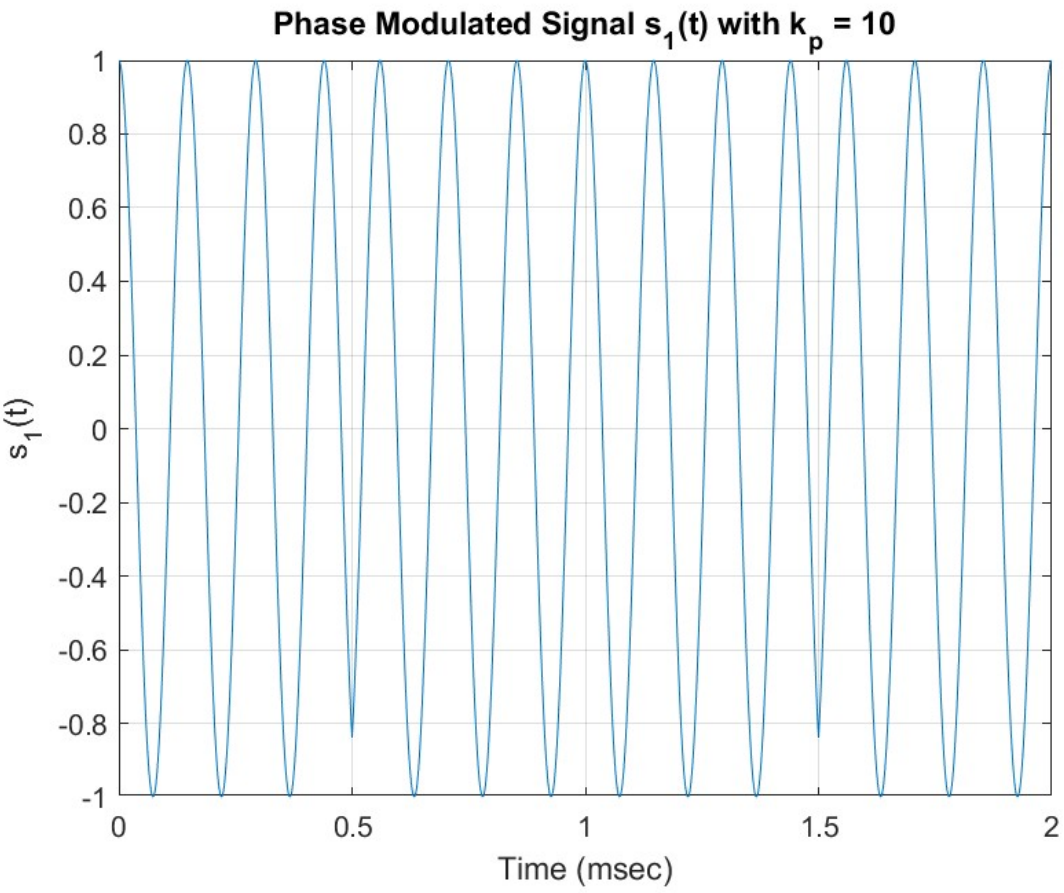

Figure 10: Very Strong Modulation Carrier is heavily Warped

4. For The FM with kf =1000 the s(t) is as below:

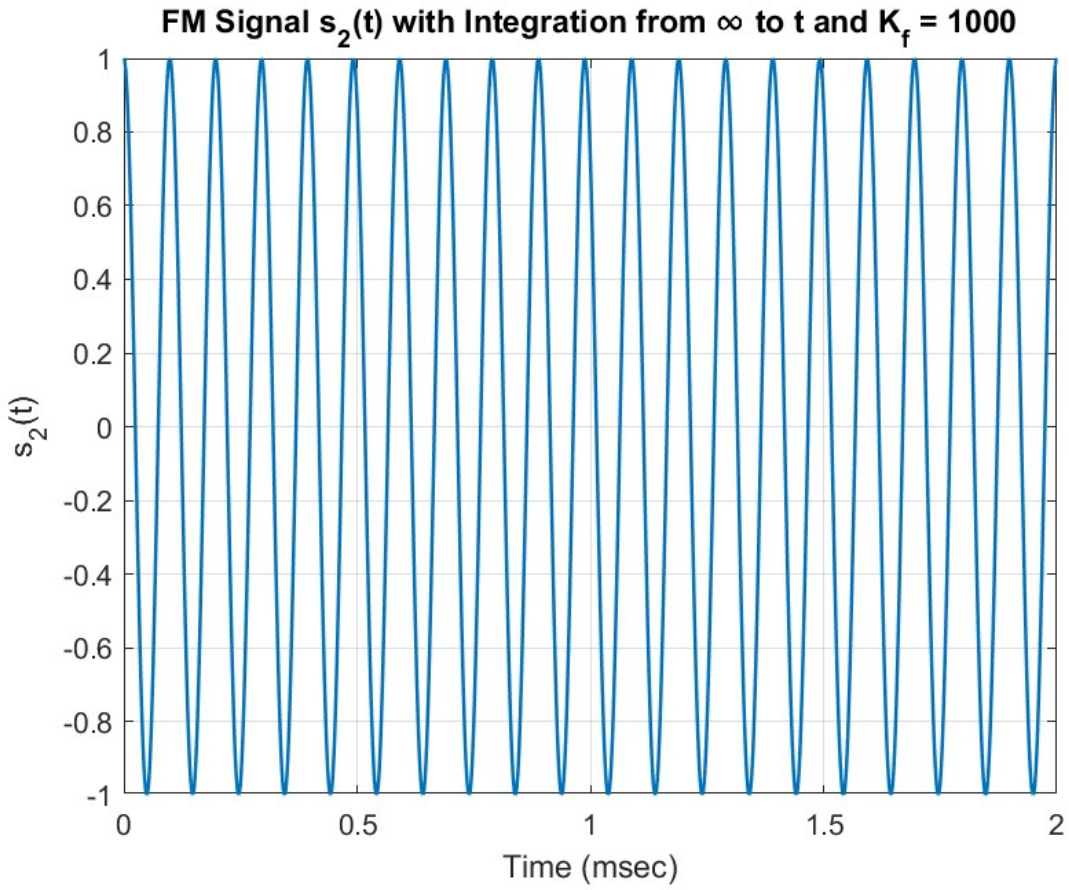

Figure 11: For $K_f = 1000$, the FM signal closely resembles a pure cosine wave, indicating minimal frequency deviation. This suggests that the message signal $m_2(t)$ has little influence on the carrier at this modulation index.

5. For The FM with kf =2000 the s(t) is as below:

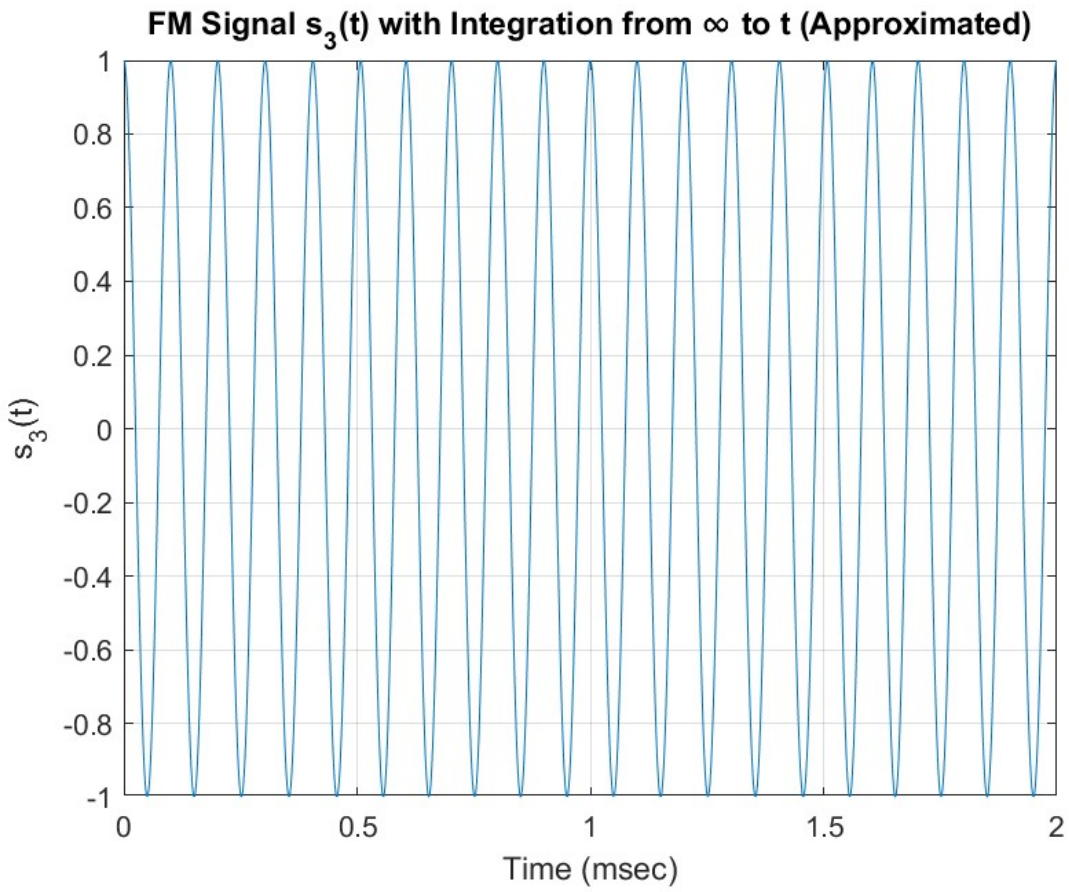

Figure 12: The FM signal $s_3(t)$ exhibits clear frequency variation over time, indicating effective modulation by the input message signal. The waveform maintains a constant amplitude, as expected in frequency modulation.