Ahsanullah University of Science and Technology

Department Of EEE

Project Report

Course No : EEE 3218

Course Name : Digital Signal Processing Lab

Project Name : Voice Signal Processing

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Submitted by-

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Year : 3rd

Abstract:

In this assignment we will proceed to record 3 distinct voices.Two male and one female. Then we will pass them through a lowpass filter. After that these recordings will be modulated , it is to be noted that each of the recordings will be modulated using carrier signals of varying frequency. After that they will be sent through a common channel. The recordings will then be passed through a band pass filter and demodulated afterwards.Soon after the original messege signal which is the initial voice recording will be reconstructed.

Methodology:

1. Voice Massage Input:
   In our project, we have taken 3 different voice records. Those voice recordings are converted in to massage signals through MATLAB. Each voice has different frequency ranges. As we know male and female voices have different frequency ranges (female voice is sharper than male voice), the input massages that we took can't be of the same frequency. In our project, we took two male voice records and one female voice record.

2. Low Pass Filter:
   After taking the input massage signal, we put those signals through low pass filter to eliminate the unwanted over noise and have the signals in range. Here, the frequency range we took was from 3.3kHz to 3.7kHz.

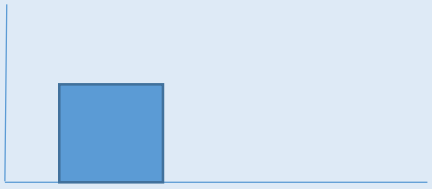
3. Carrier signals:
   To have this transmission, three different carrier signals have been taken. All of them have different frequency range. Those carrier signals are 1MHz ,4MHz and 8MHz.

4. Modulation:
   In the modulator the modulation has been done for each signal. Three signals have been modulated with three different carriers. After the modulation the

modulator generates a modulated signal and the output signal carries the carrier's frequency with the massage signal.

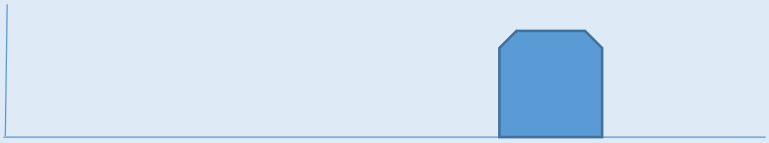
5. Multiplexing:
   All the signals are combined together for the transmission in this multiplexing stage. As the three different modulated signals will be transmitted at a time, they make a packet by multiplexing. Suppose the three modulated signals are,

Signal 01,

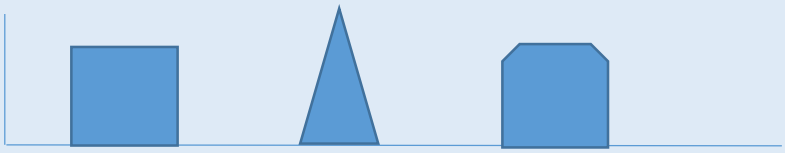


Signal 02,

Signal 03,



After multiplexing the output will be,



6. Band Pass Filter:
   After the transmission, the multiplexed signal will go through the band pass filter. This process will work like a demultiplexing process. In this stage, the signal having three massages gets separated from each other by the band pass filter. As we know the signals have different frequency ranges so that they

are not mixed together. And in between the massages of these signals, there is a guard band. This guard band stops the three massage signals from mixing up. Usually for the transmission, the guard band is of (300+600) kHz=900kHz range.

7. Demodulator:
   The separated signals that we got after the demultiplexing stage they are not quiet the massage signals. To get the actual massage signal, demodulation have been done. By demodulating the carriers have been removed and demodulator's output is more likely to the massage signals. The signals we get from here are the reconstructed signals of our massage signal. With MATLAB, we get to convert these massages into voice massage again to hear the massage signals in the receiver side.

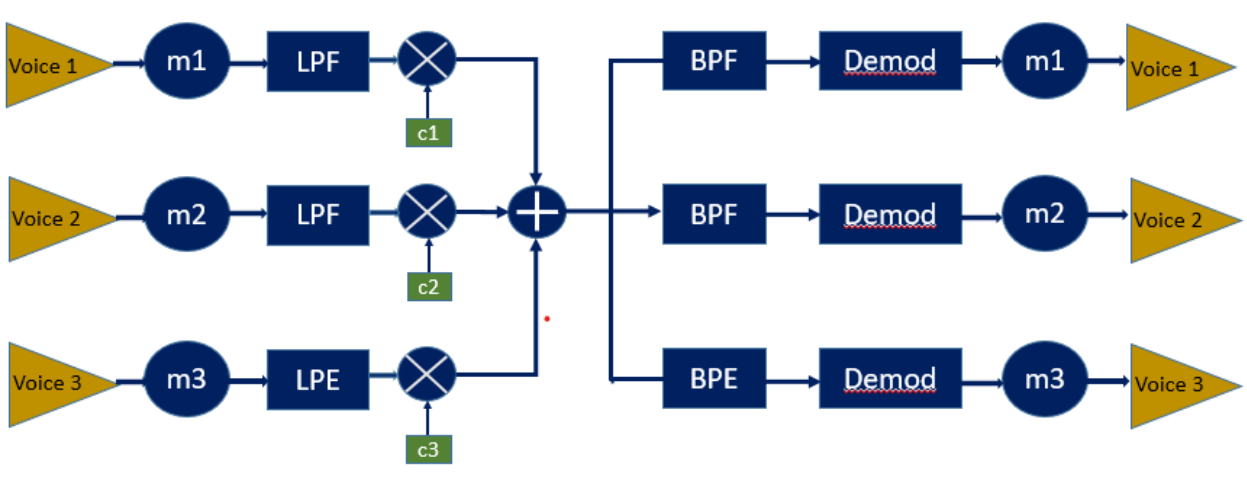


Figure: Layout of Voice Signal Processing

Result and Discussion:

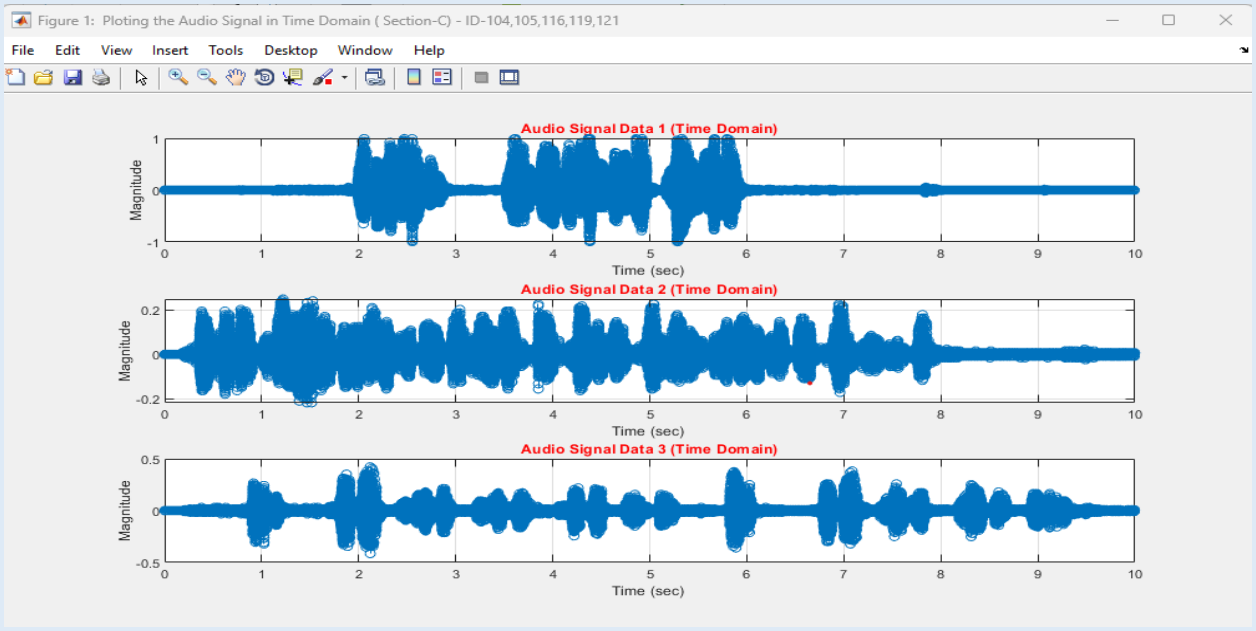


Figure: Plotting the audio Signal in Time Domain

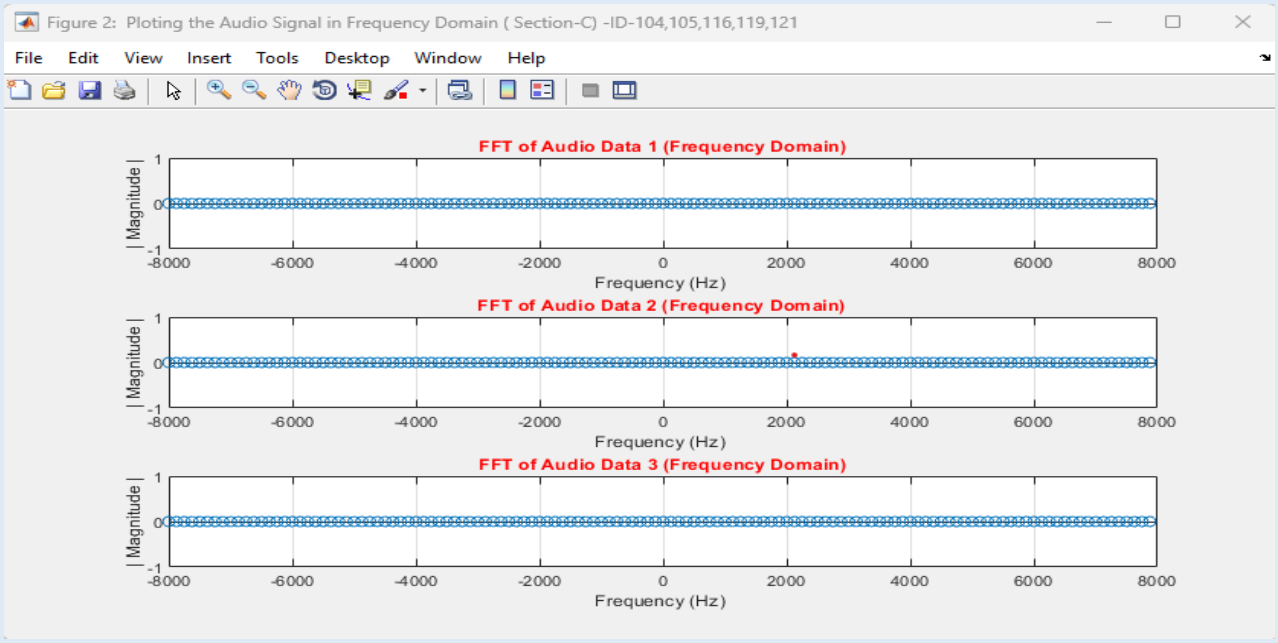


Figure: Plotting the Audio signal in Frequency Domain

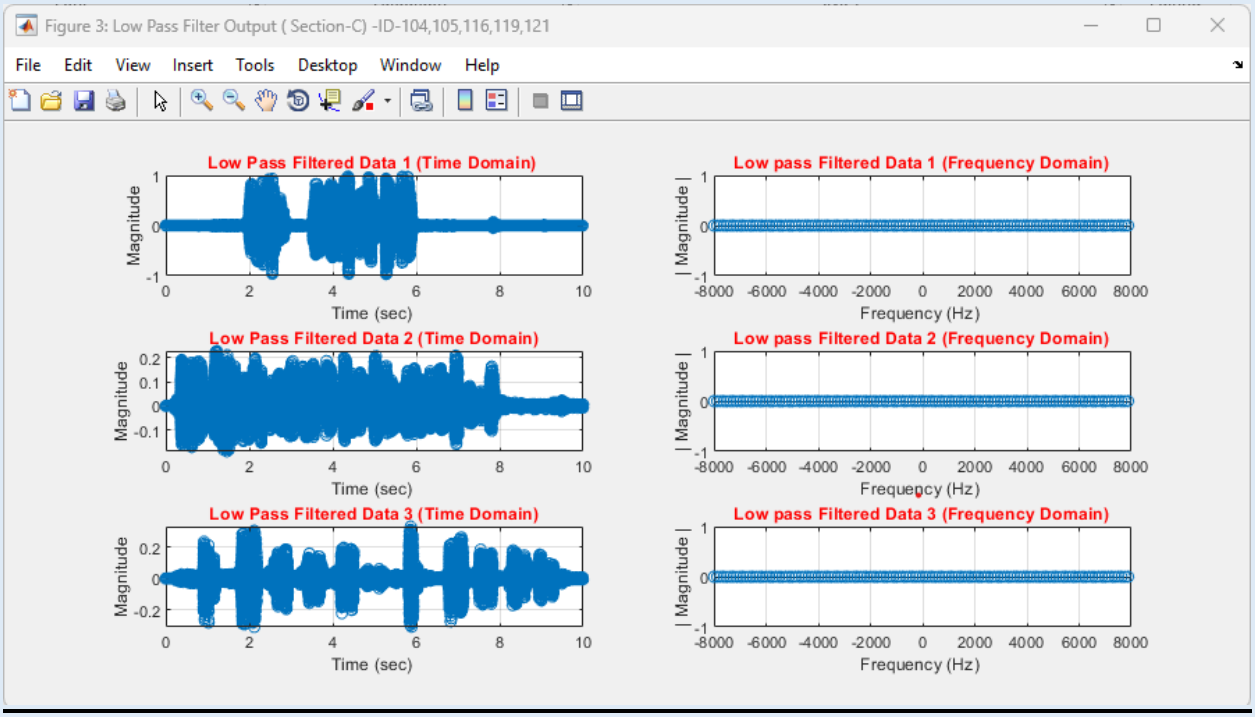


Figure: Plotting Low Pass Filter Output

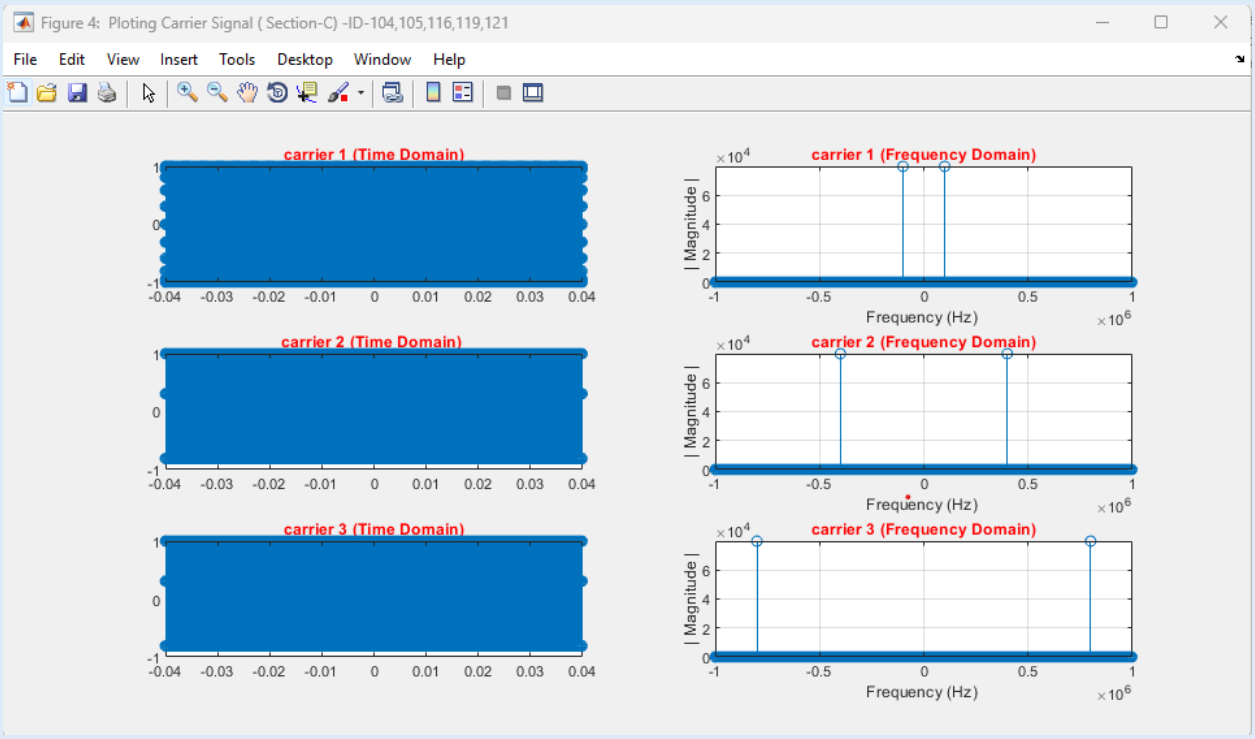


Figure: Plotting carrier frequency

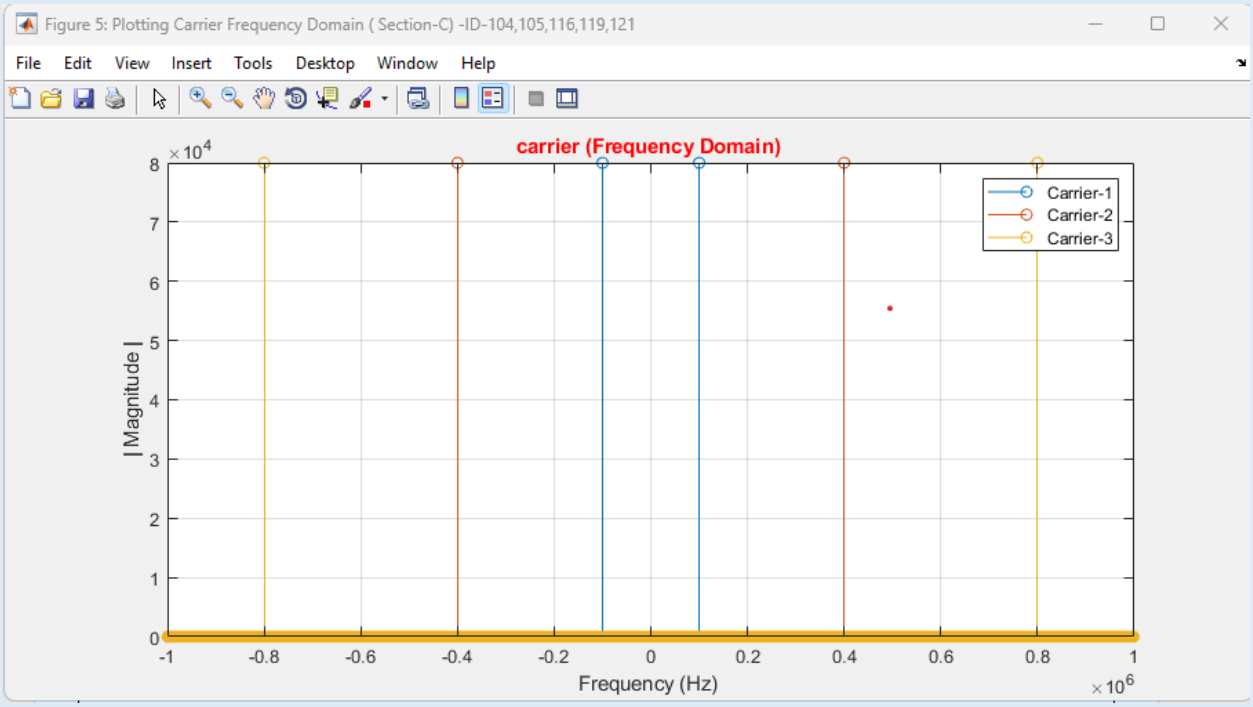


Figure: Plotting carrier in frequency domain

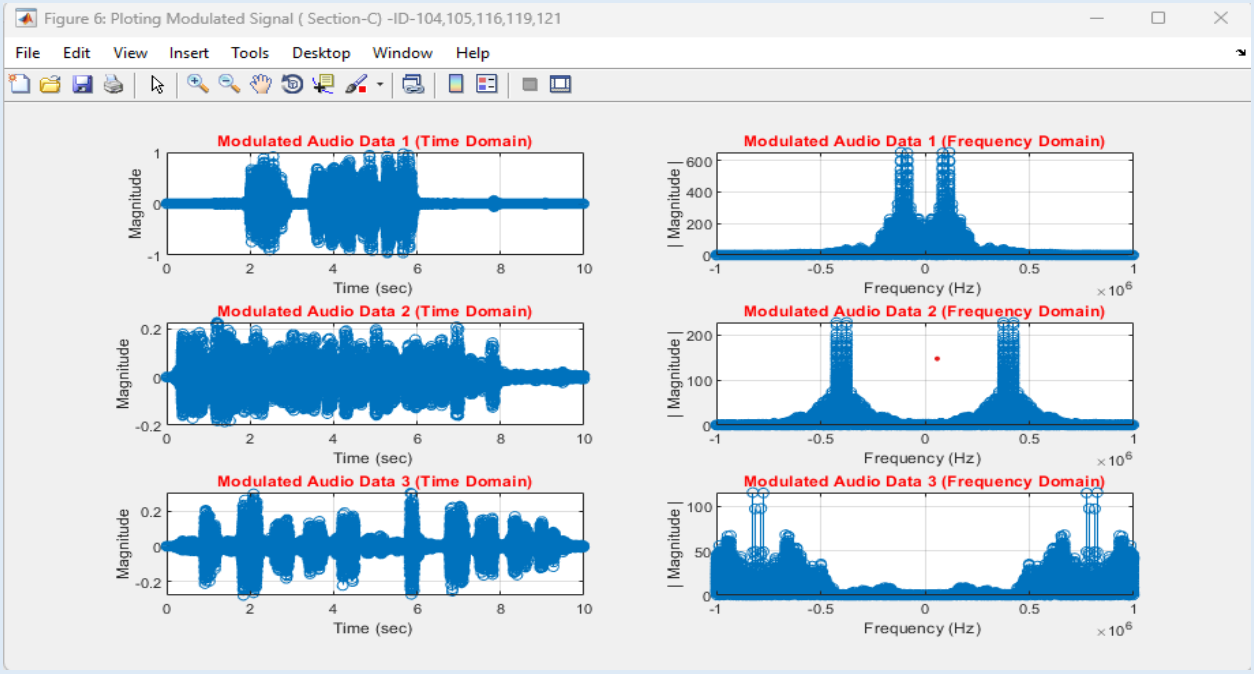


Figure: Plotting Modulated signal(Separate Signal)

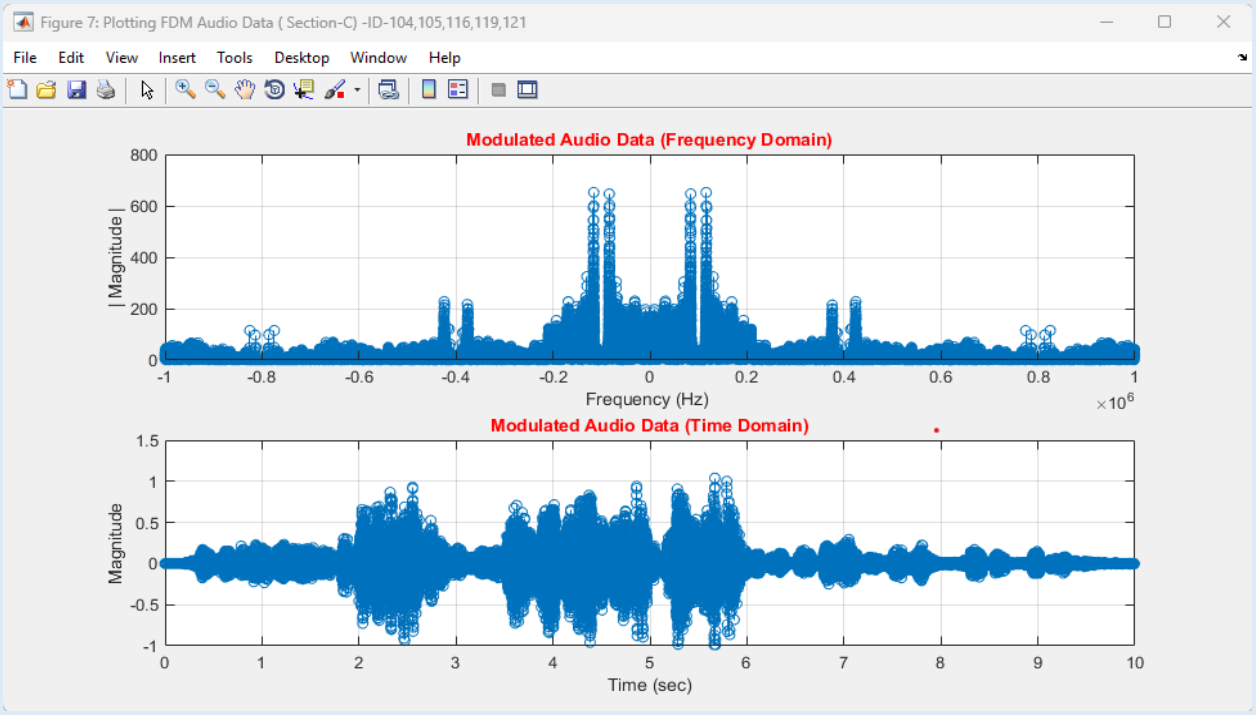


Figure: Plotting FDM Audio Signal

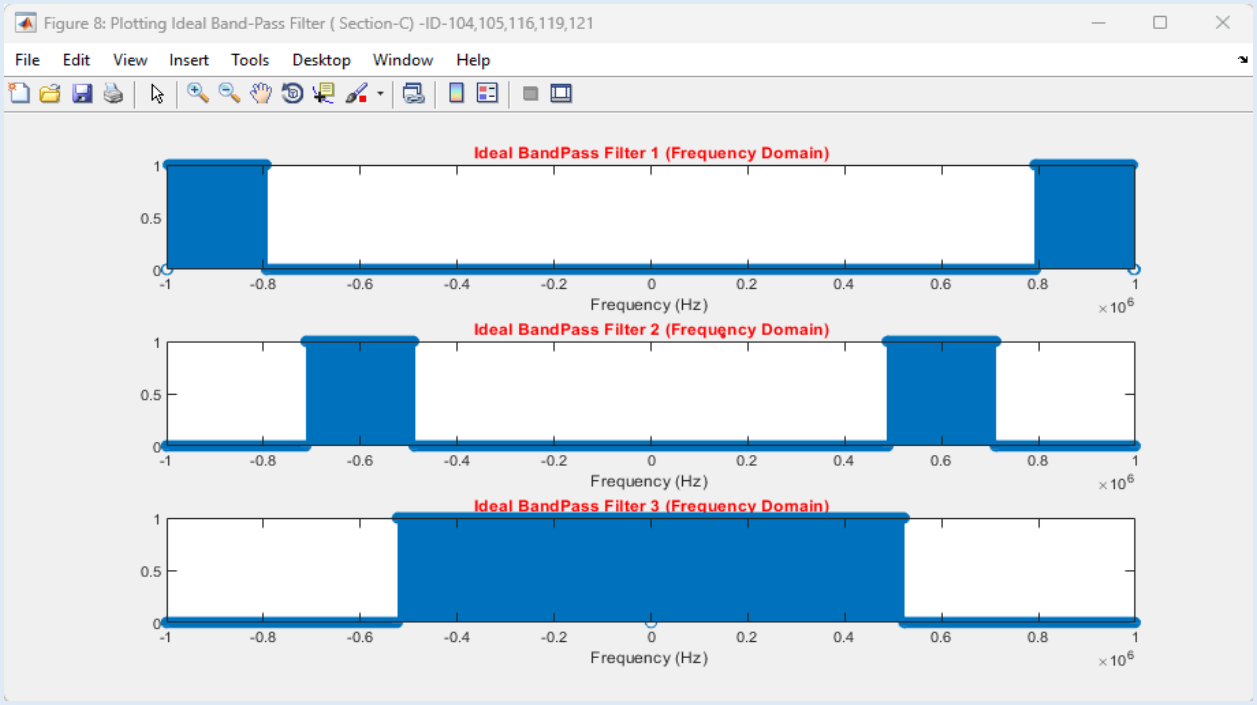


Figure: Plotting Ideal Band Pass Filter

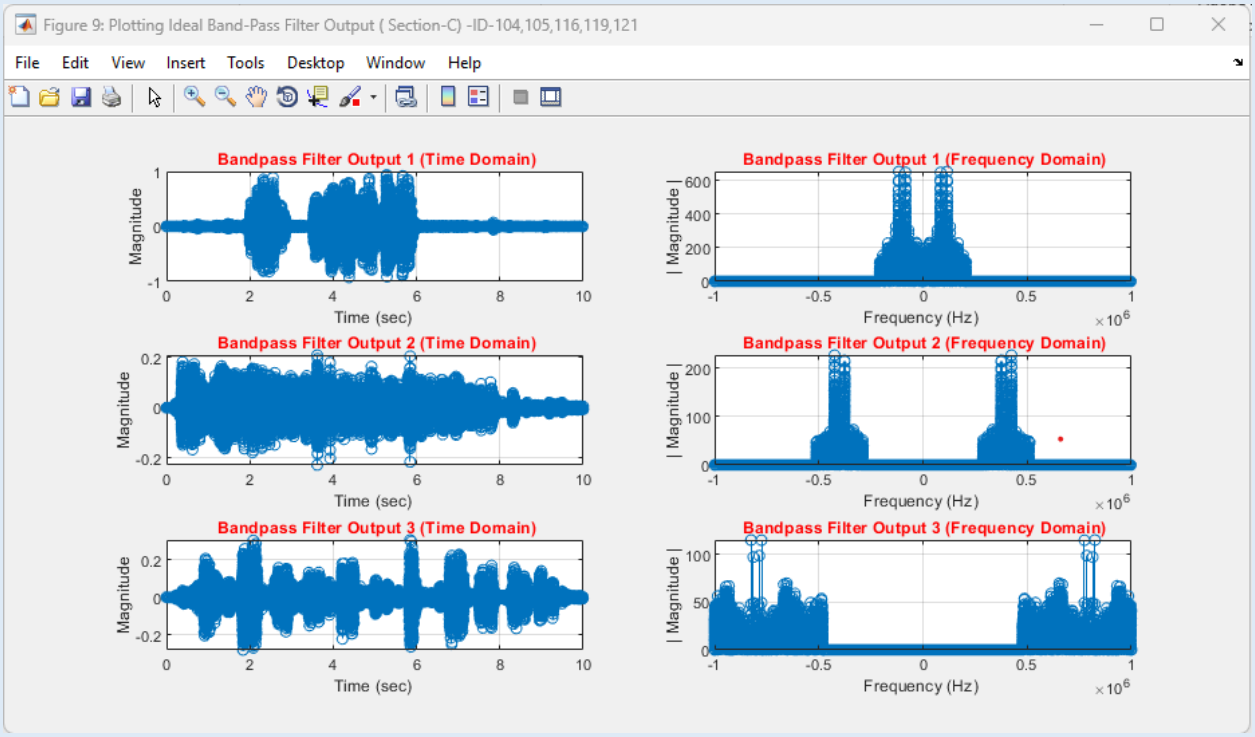


Figure: Plotting Ideal Band Pass filter output

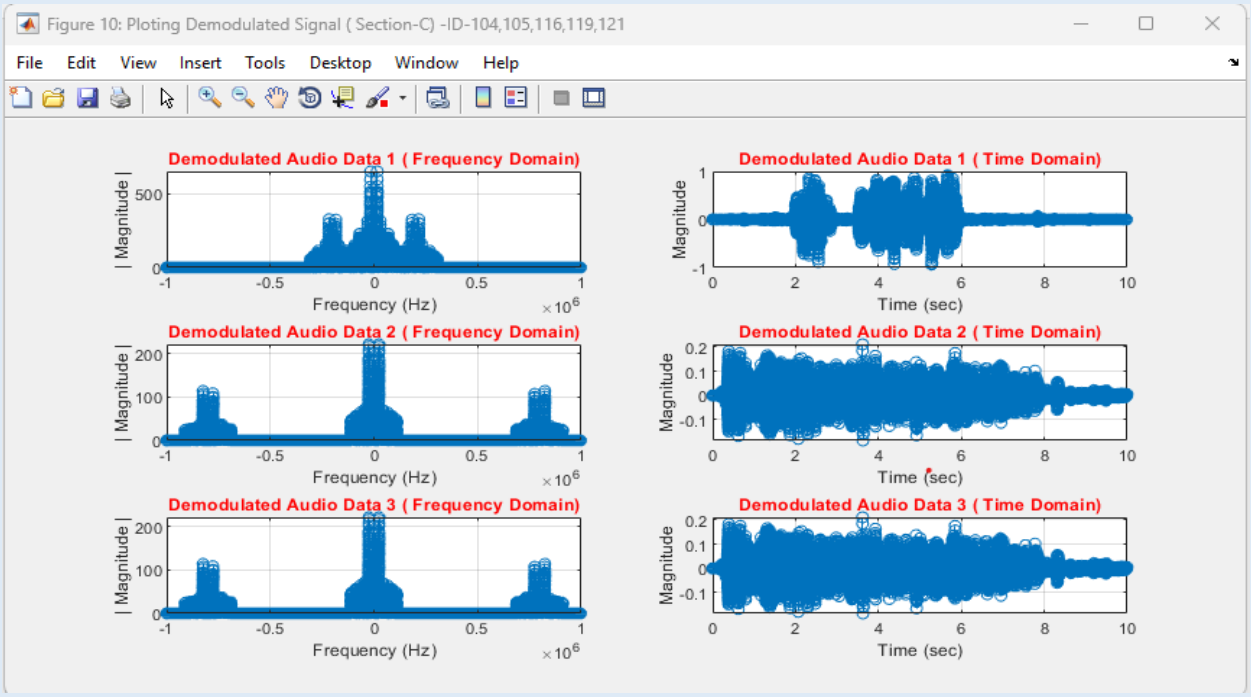


Figure: Plotting Demodulated Signal

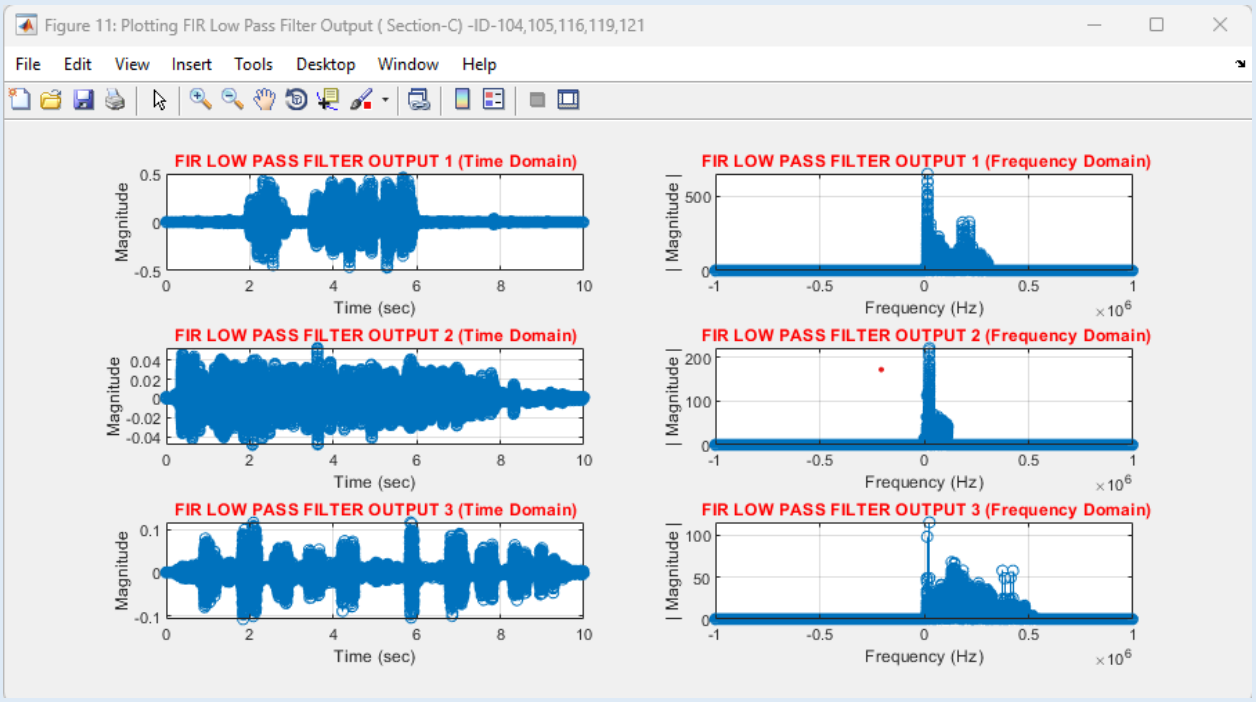


Figure: Plotting FIR Low pass filter output

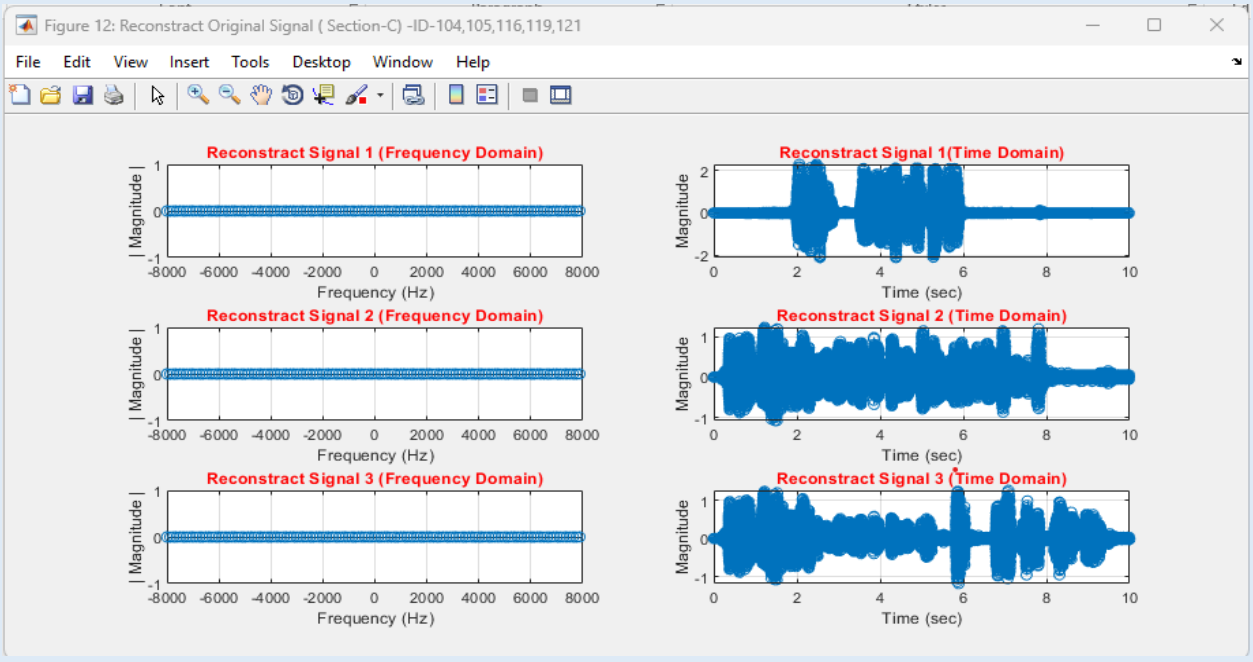


Figure: Reconstruct Original Signal

Conclusion:

I n conclusion the assignment was completed successfully. This particular problem had several key steps modulating, demodulating and reconstructing. Also we had to work with audio files. Completing all these steps required hundreds of lines of MATLAB code. After completing it, the first few times the code didn't run the way it was supposed to. So we had check for errors. After going through the code a few times we ran it again this time we changed a few things. At first we tried using 6 second recordings and we were unsuccessful. Then we extended the size of the recordings to 10 seconds and that seemed to be the answer. After sorting that out that we observed that there was still some noise in the output. We fixed that using another Low pass filter. And finally in order to get a clear output we had to adjust the gain properly. All in all the problem was somewhat challenging but we got the job done in the end.