Dept. of Electronics and Electrical Communication Engineering
Indian Institute of Technology Kharagpur

ANALOG COMMUNICATION THEORY (EC31001)

ASSIGNMENT-1 AMPLITUDE MODULATION

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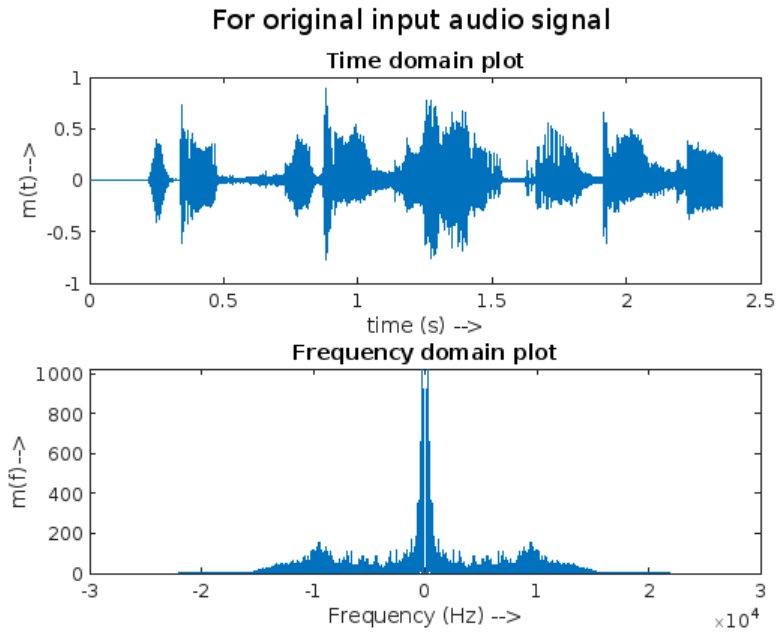
20EC30020
30/10/2022

The input audio signal in time and frequency domain can be represented as:



For frequency spectra we use the inbuilt function ***fft*** and shift it to center by ***fftshift*** and plot the absolute value using ***abs***.

Amplitude modulation:

We represent DSB-SC signal as:

$$s(t) = m(t).c(t)$$

Where m(t) is the input audio signal (with sampling frequency 44100Hz) and c(t) is the carrier signal (with frequency 50kHz).

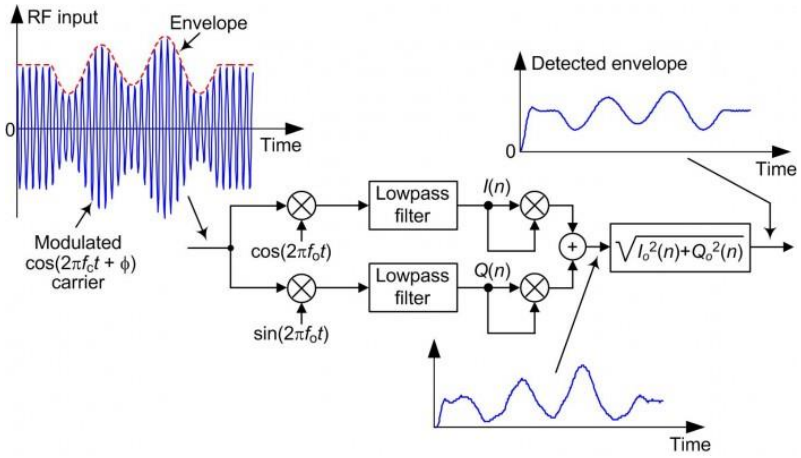
Amplitude demodulation:

For coherent demodulation we multiply the modulated signal with the carrier signal and then pass it through low pass filter.

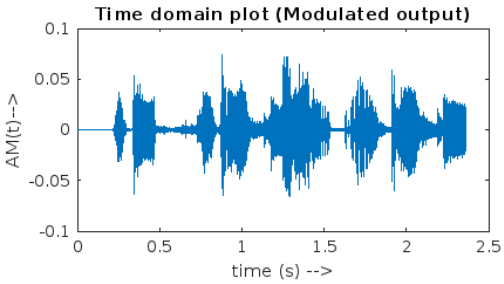
$$y(t) = s(t).c(t)$$

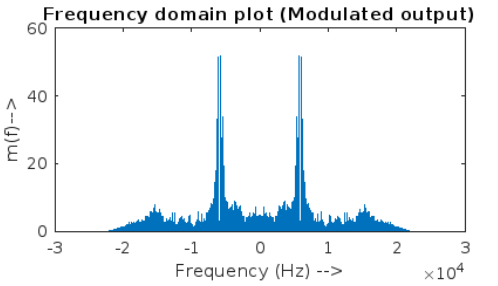
Envelope detector:

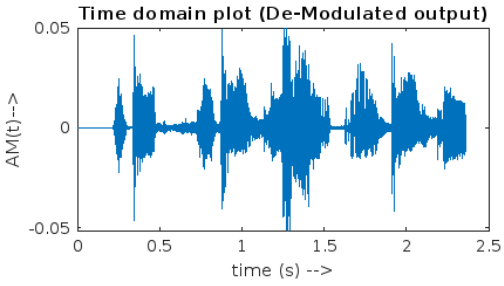
For envelope detection we take the Hilbert transform of the modulated signal and plot its absolute value.

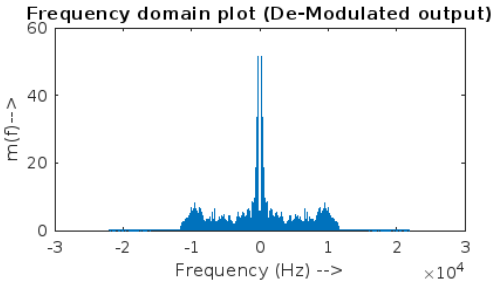


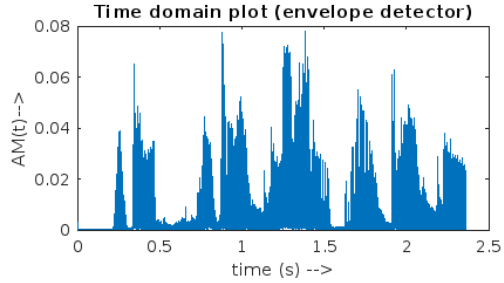
Plots for modulation index (m=0.1)

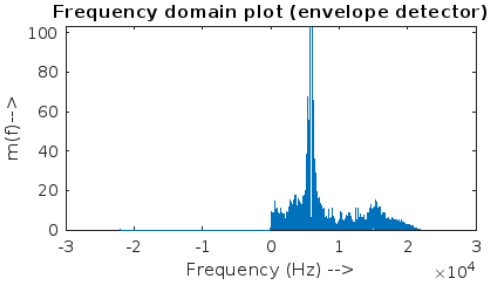




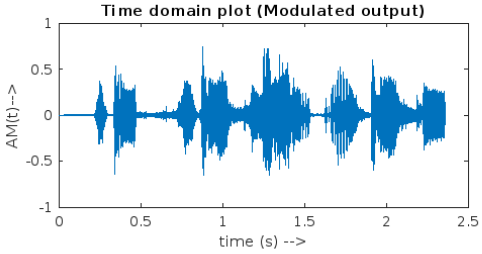


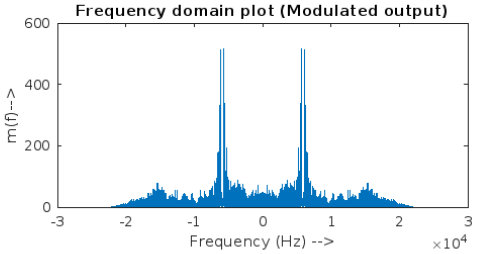


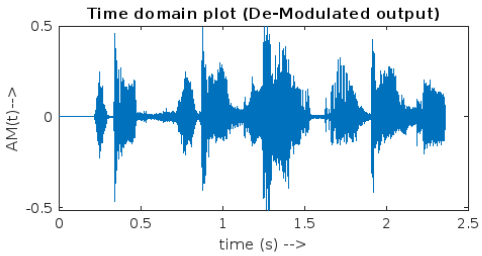


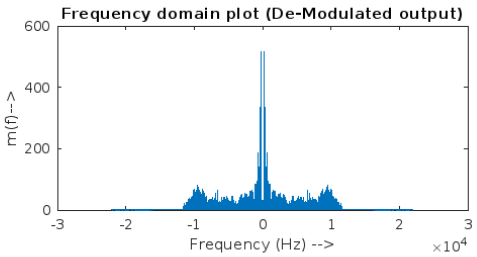


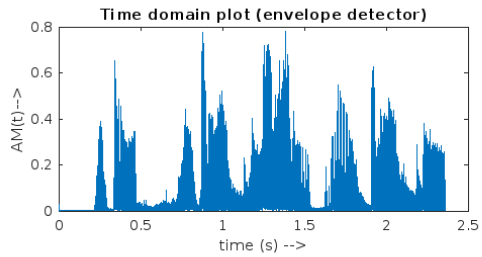
Plots for modulation index (m=1)

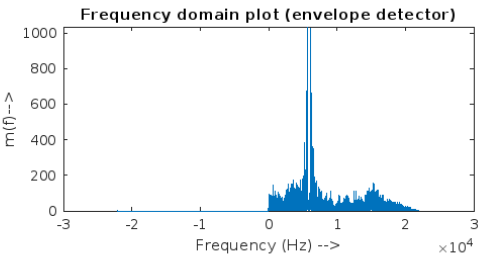


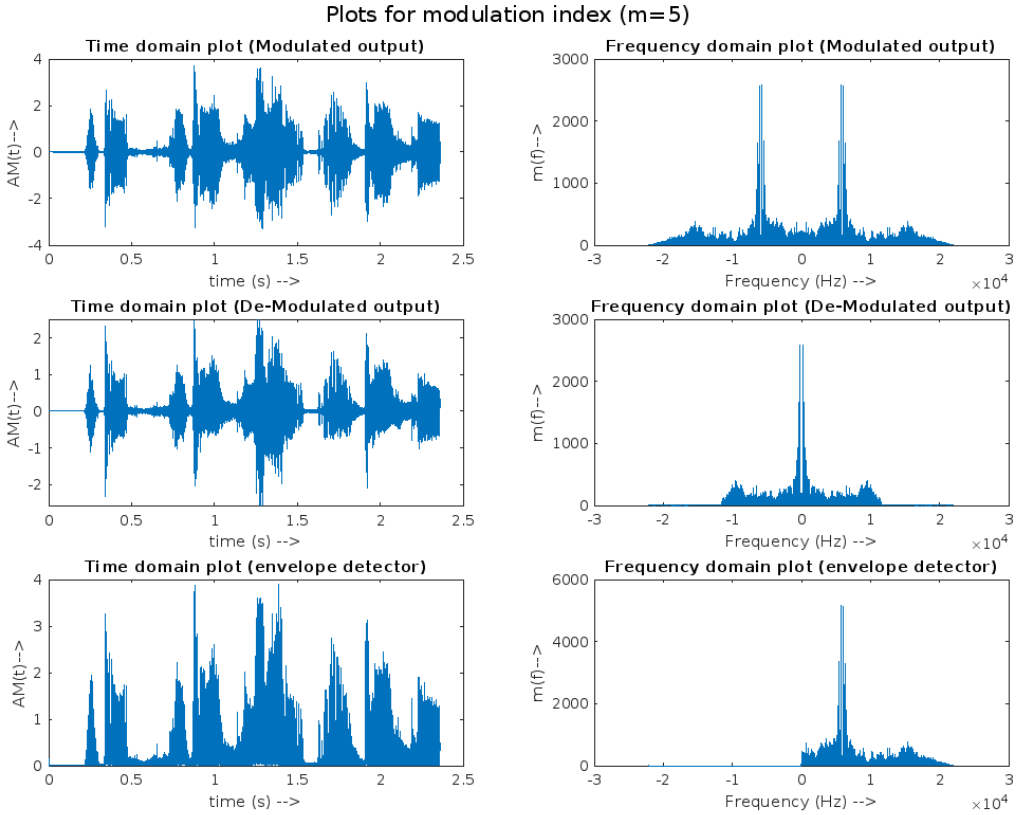












- By the above plots we can clearly see that the amplitude of the signal varies as per the modulation index and the strength of the signal has been increased as affected by the carrier wave.
- We can also see in the demodulated output that we retrieve back the original message signal with frequency approximately equal to the input audio signal but varied amplitude as per the modulation index
- We can observe that the envelope detector only traces the positive peaks of the modulated signal and hence by fft plot we can see than the negative frequencies has been removed.
- The quality of the audio is better when critically modulated. When under-modulated then the clarity has been reduced.
- When over modulated the quality of audio is observed to be distorted i.e. some information has been lost.