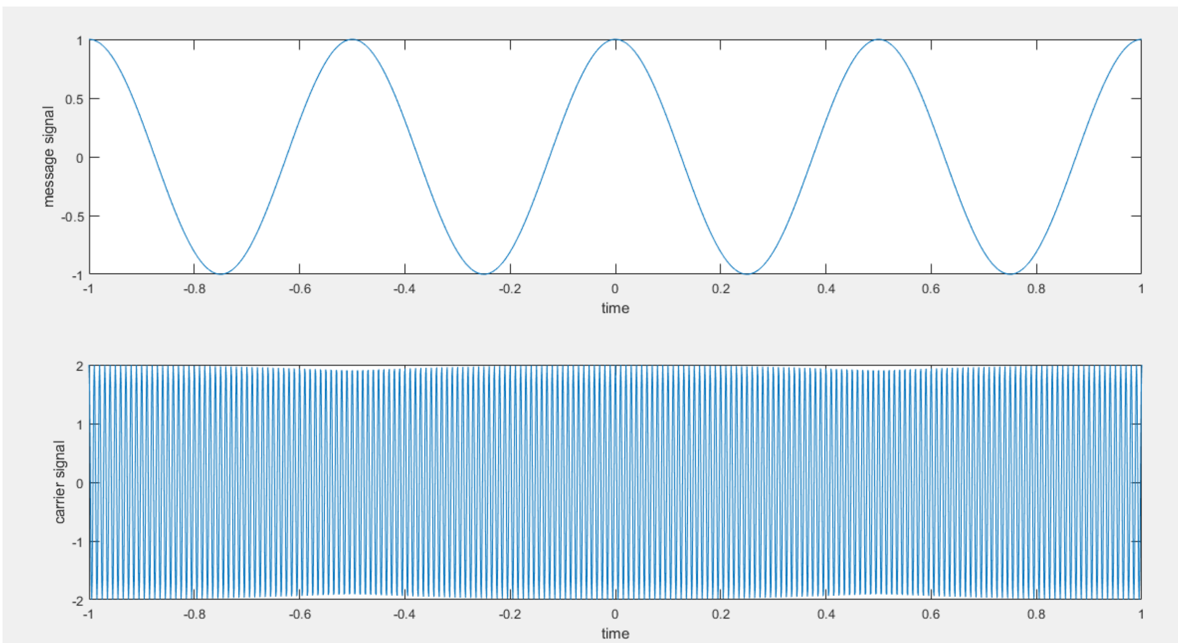
CT-Assignment-2

Simulations Report:

a. I have generated a sinusoidal message signal (m) of frequency (fm) 2KHz and an amplitude(A1) of 1. The carrier signal (c) of frequency (fc) 100KHz and amplitude (A2) of 2.
   They are plotted from -1 to 1 with the sampling frequency of 1001(fs) . The plots are below:

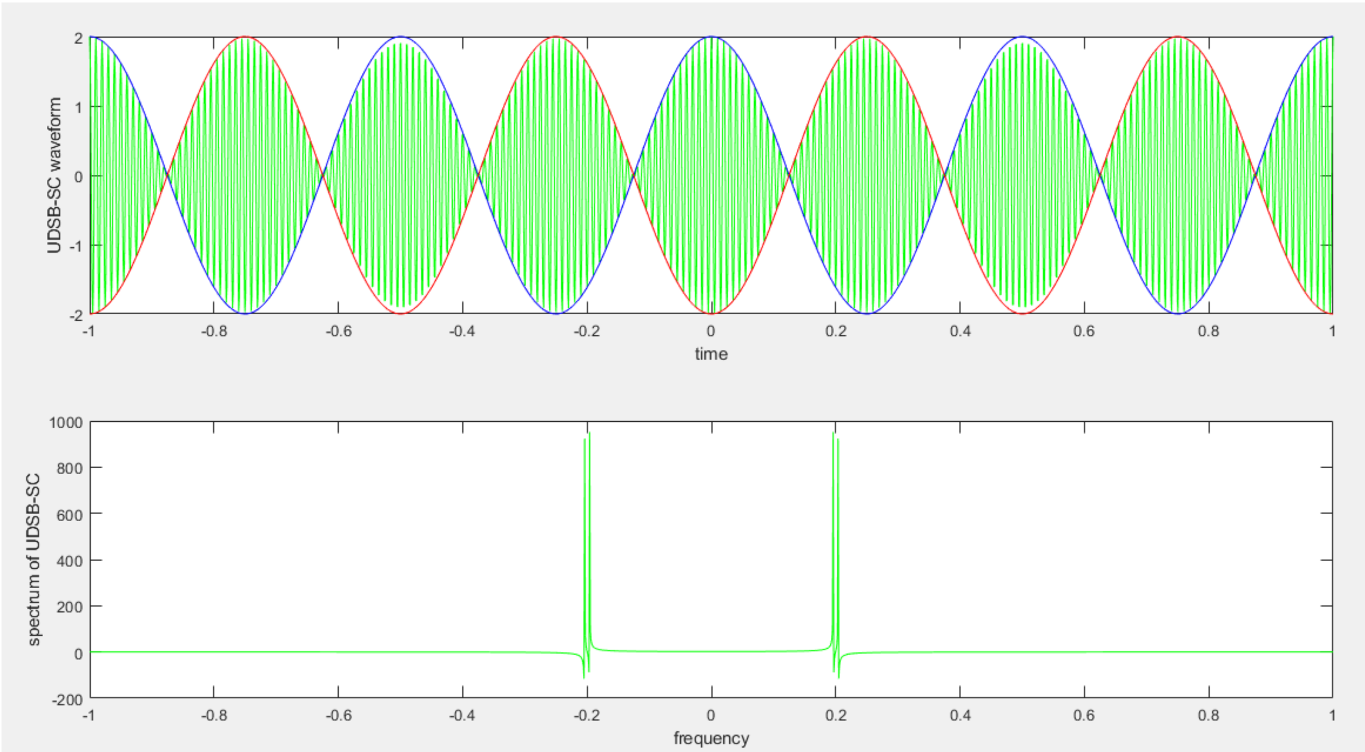


b. Now using these two signals we construct the DSB-SC waveform Which we get by modulating the amplitude of the carrier signal with the message signal.

$$S(t) = A1*A2*m*c$$

Now taking the Fourier transform of this waveform we get the spectrum of this DSB-SC waveform.

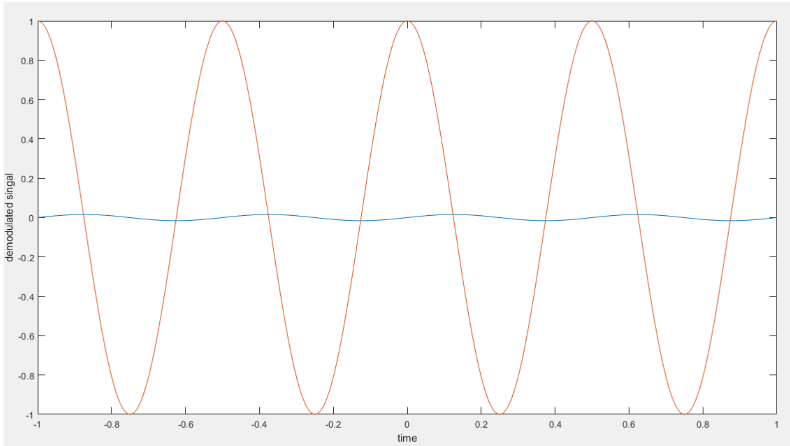
The plot of this is:



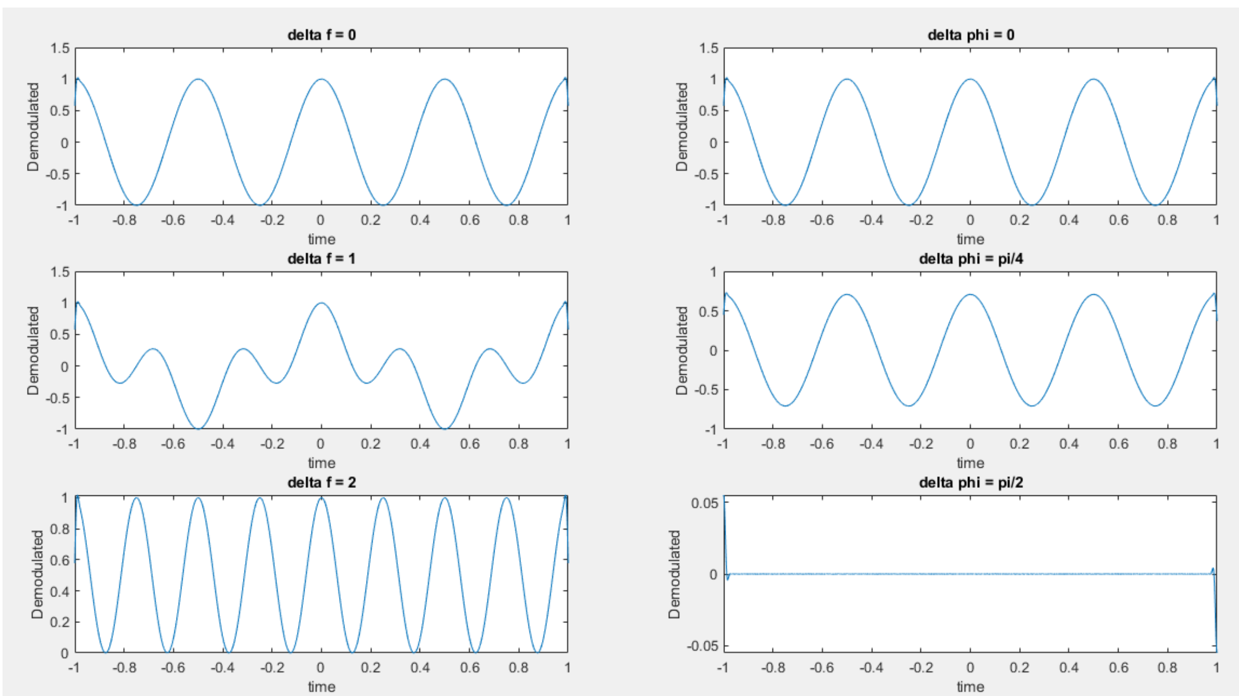
c. Now for the DSB-SC waveform we obtained above we perform the demodulation where we multiply the waveform with carrier signal and then we pass it through a low pass filter to obtain a scaled version of the message signal.

$$m'(t) = s(t)*c$$

To filter it we are making a butter filter and then passing the coefficients of the transfer function to the filter command we get our filtered output. The filtered output is:



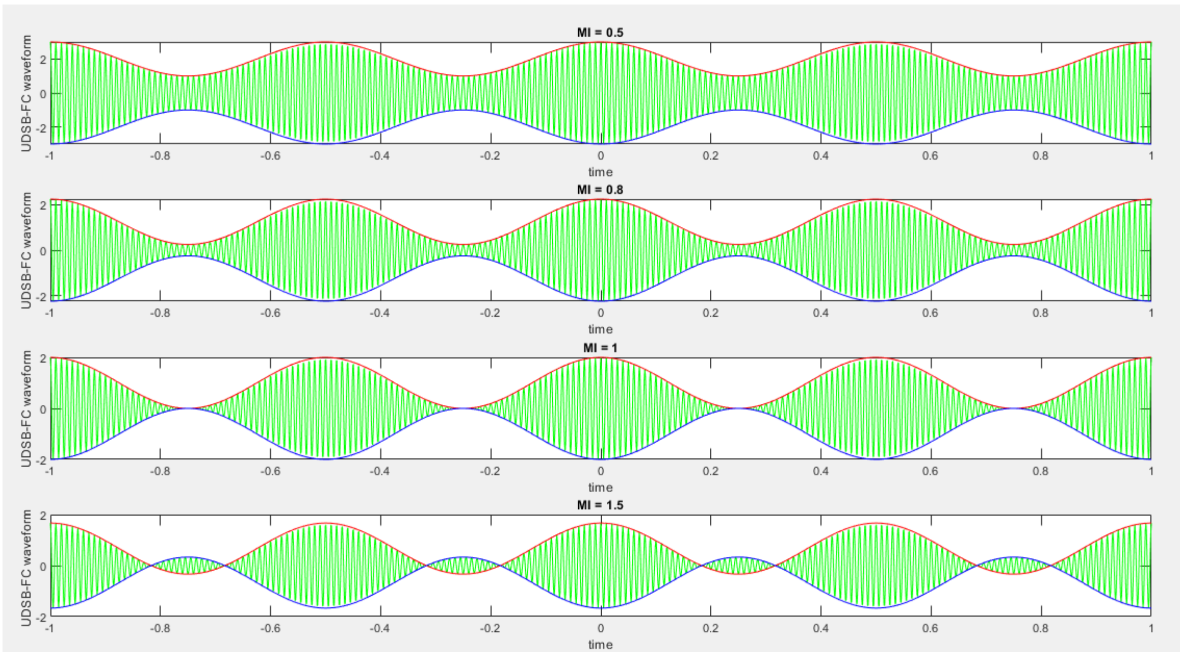
d. Now we bring forth the frequency and phase offsets in the coherent demodulation.
<u>Quadrature Null effect:</u> It states that when the phase offset is either +pi/2 or -pi/2 then the peak value at zero is zero and when the phase offset is zero has maximum value at the zero.



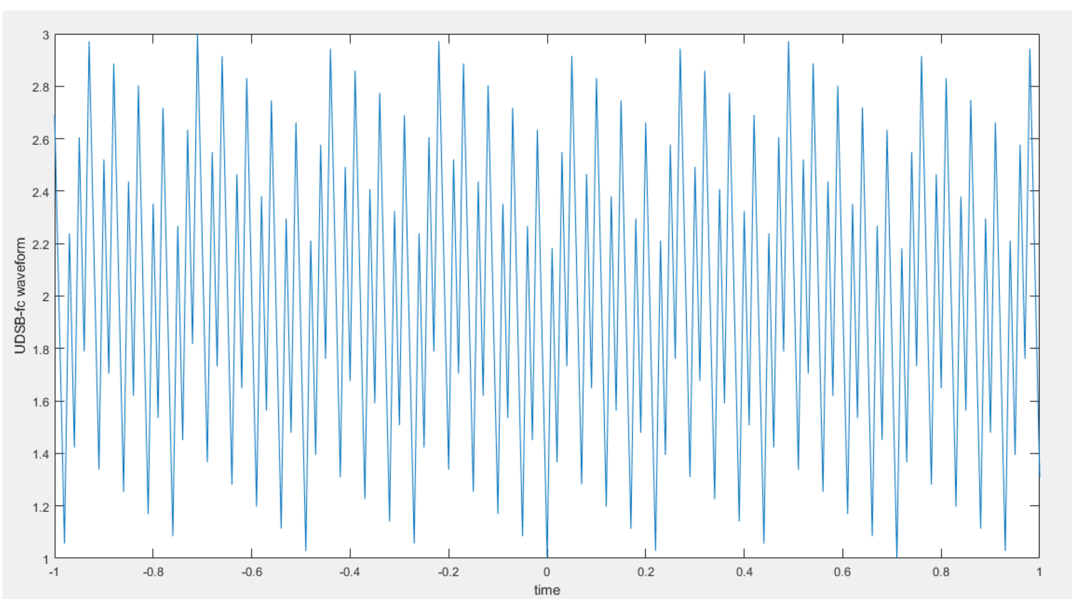
e. Here we do the conventional amplitude modulation to our message signal by adding the amplitude of the carrier signal to the message signal and multiplying the whole with the carrier signal.

$$S(t) = (A2+A1*m)*c$$

Now for this based on the ratio of A2 to A1(modulation index) we get different modulated waveforms. They have been plotted below:



f. Now let us take the message signal to be a sawtooth signal and modulate it using the same carrier sinusoidal signal using DSB-FC modulation.



g. Now the spectrum of this UDSB-SC and the UDSB-FC waveforms are: