1 Preliminaries

In this week, we continue amplitude modulation with double sideband suppressed carrier amplitude modulation (DSB-SC AM) method. In laboratory works, we will construct the message and carrier signals as we did in the previous labworks. In order to construct a signal in Matlab, it is essential to generate a time vector by using various parameters such as the sampling period (T_s) which is given by $T_s = 1/f_s$ where f_s is the sampling frequency, message frequency (f_m) and the signal duration (t). Then, the message and carrier signals can be generated by using this time vector.

In DSB-SC AM, the modulated signal is created by using a product modulator that multiplies the message signal with a carrier wave. As a result, the phase of modulated signal is reversed each time message signal crosses zero. Therefore, the DSB-SC modulated signal has a different envelope than the message signal and we should observe this in the labwork.
In demodulation part of the lab, a coherent detection is employed to recover the message signal from DSB-SC modulated signal. Modulated signal is multiplied with a sinusoidal wave coherent/synchronized with the carrier wave and filtered to obtain the message signal. The overall block diagram of DSB-SC modulation and demodulation is given in Figure 1.

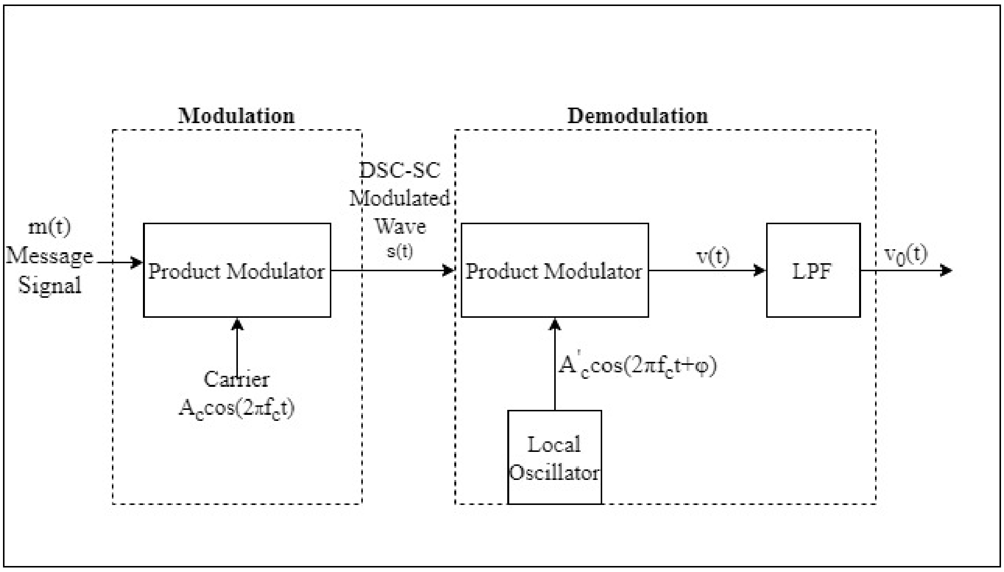

Figure 1: DSB-SC Modulation and Demodulation System Design

2 Labwork

Read the preliminaries given above carefully before doing the experiment given below.

2.1 DSB-SC Modulation

a. Construct a message signal $m(t) = cos(2\pi f_m t)$ where $f_m = 100Hz$ and a carrier signal $c(t) = cos(2\pi f_c t)$ where $f_c = 1kHz$. The sampling frequency is $f_s = 100kHz$ and the durations of the both signals ($m(t)$ and $c(t)$) is 0.08 s.

b. Employ the DSB-SC modulation for message signal $m(t)$.

c. Plot $m(t)$, $c(t)$ and the **modulated**signals in time domain in the same figure using the *subplot( )* function.

d. Plot the message and **modulated signal** in the frequency domain in the same figure using the *subplot( )* function. Comment on the frequency content and magnitude of the obtained signal.

2.2 DSB-SC Demodulation

a. The overall DSB-SC system is presented in Figure 1. Follow the block diagram to obtain the demodulated signal $v(t)$ (before filtering). (*Hint:* Pay attention to the magnitude of your signals and adjust your operations accordingly.)

b. Plot the frequency response of $v(t)$. Comment on the frequency content and magnitude of the obtained signal.

c. Construct a non-ideal low pass filter (LPF) by using *butter()* function to obtain the message signal. Choose the cut-off frequency and filter order accordingly. Comment on your filter design.

d. Plot **the recovered signal after filtering**, $v_o(t)$, in time and frequency domain using *subplot()* function. Compare and comment on the frequency content and magnitude of the obtained signal.