6 Labwork (VSB and SSB Modulation)

6.1 SSB and VSB Modulation

(a) Obtain a time vector whose duration is $d = 0.04$ seconds and sampling frequency is $F_s = 19kHZ$.

(b) Obtain a message signal $m(t) = 5cos(2\pi f_m t)$ with $f_m = 300$HZ.

(c) Obtain also a carrier signal $c(t) = cos(2\pi f_c t)$ with $f_c = 6000$HZ.

(d) Obtain double side band suppress carrier (DSB-SC) signal $s(t)$ by applying necessary operation.

(e) Design two Butterworth filters. First one has the order of $n_1 = 4$. Second one has the order of $n_2 = 23$. Make a decision on the filter types (LPF or HPF) and the cutoff frequencies so as to get lower side band (LSB) signals.

(f) Plot the filter responses that you obtained above on the same Figure by using *hold on* command. **Hint:** Use *butter()*, *freqz()* and *abs()* functions.

(g) Get the LSB signals $s_{LSB,1}(t)$ and $s_{LSB,2}(t)$ by using the designed filters in (e).

(h) Plot the magnitudes of the frequency responses for $s(t)$, $s_{LSB,1}(t)$ and $s_{LSB,2}(t)$ using 3×1 *subplot*. (*Hint*: Choose a suitable fft length as the length of the signal)

6.2 SSB Demodulation

(a) Decide which one ($s_{LSB,1}(t)$ and $s_{LSB,2}(t)$) is single side band (SSB) modulated signal (the other one is the vestigial side band (VSB) modulated signal).

(b) Apply on the chosen signal the demodulation operation with multiplication and filtering operations.

(c) Plot the magnitudes of the frequency responses for $m(t)$ and $m_d(t)$ which are the message signal and the demodulated signal respectively using 2×1 *subplot*.

(d) Obtain the demodulated signal $m_d(t)$ in the time domain. Plot $m(t)$ and $m_d(t)$ in the time domain in the same Figure by using *hold on*.