3 Labwork (Conventional Amplitude Modulation/Demodulation)

3.1 Preliminaries

In order to modulate a message signal with conventional AM, first multiply the message signal $m(t)$ with modulation factor k_a. Then, add to this signal one. After the addition of one, multiply this signal with a carrier signal $c(t) = A_c cos(2\pi f_c t)$ to obtain the modulated signal.

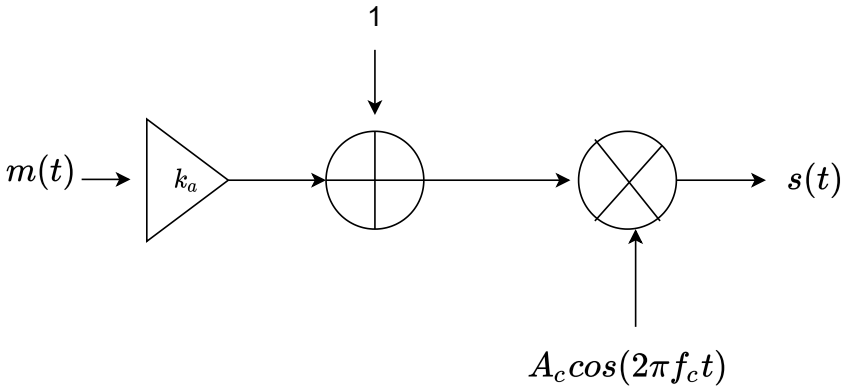

Figure 1: Modulation of Conventional AM

In order to demodulate this signal, first, take the square of the modulated signal. Then, filter this squared signal with a low pass filter (LPF). After taking the square root of the filtered signal, reach an estimate of the message signal. This technique is called Square-Law detector.

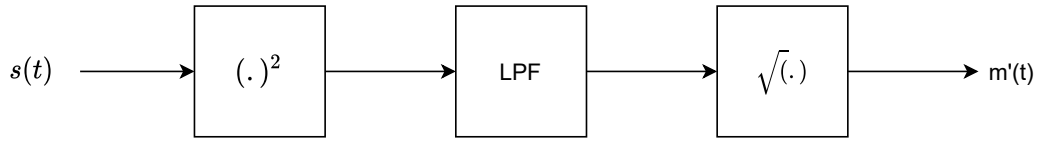

Figure 2: Demodulation of Conventional AM

3.2 Conventional Amplitude Modulation

(a) Obtain the time vector with the duration of $t = 0.1$ seconds and with the sampling frequency of $F_s = 10000$ Hz.

(b) Generate a carrier signal $c(t) = A_c cos(2\pi f_c t)$ and a message signal $m(t) = A_m cos(2\pi f_m t)$ where $A_m = A_c = 1$ and $f_m = 100$ Hz and $f_c = 1000$ Hz with respect to time vector obtained in (a).

(c) Obtain the modulated signal, $s(t)$.

(d) Plot the modulated signal $s(t)$ for three modulation factors namely 0.5,1 and 2 in the same figure by using *subplot*.

(e) Comment on the effects of the modulation factors.

(f) Plot the magnitude of the frequency responses of $m(t), c(t)$ and $s(t)$ for $k_a = 0.5$ in the same figure by using *subplot*.

3.3 Conventional AM Demodulation

(a) Demodulate the modulated signal $s(t)$ when $k_a = 0.9$ and $k_a = 2$ by following the steps given in the preliminaries. *Hint*: You can use *butter(.)* with the suitable filter order and cut off frequency and *filter(.)* functions.

(b) Comment on your choice of the filter order and the cut off frequency.

(c) Plot the demodulated signals in the same figure by using *subplot*.

(d) Comment on the the results that you obtain in (c).