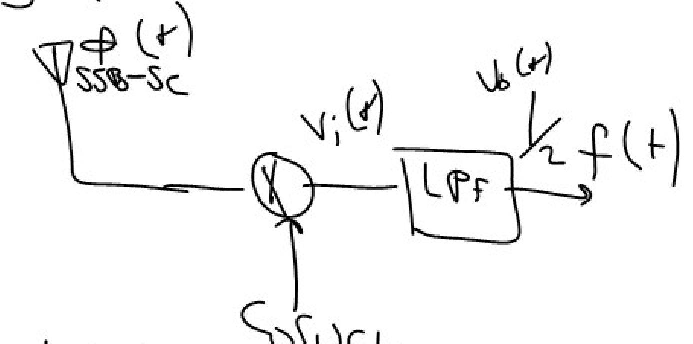
5.4.3 Demodulation of SSB signals

* SSB-SC signal can be demodulated by the synchronous detector as shown below



$$V_i(t) = \phi(t)_{SSB\text{-}SC} \cos w_c t$$

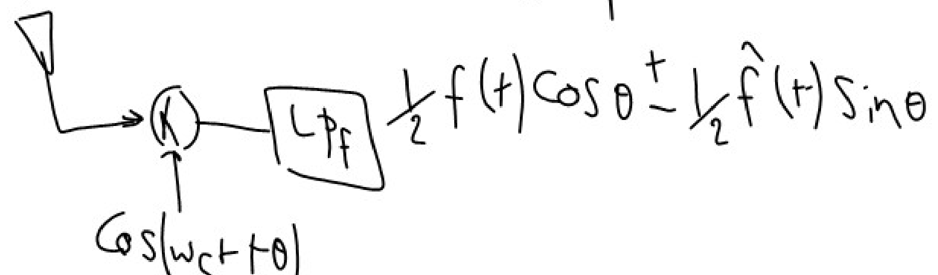
$$= \left[f(t) \cos w_c t \pm \hat{f}(t) \sin w_c t \right] \cos w_c t$$

$$= \frac{1}{2} f(t) + \frac{1}{2} f(t) \cos 2w_c t \pm \frac{1}{2} \hat{f}(t) \sin 2 w_c t$$

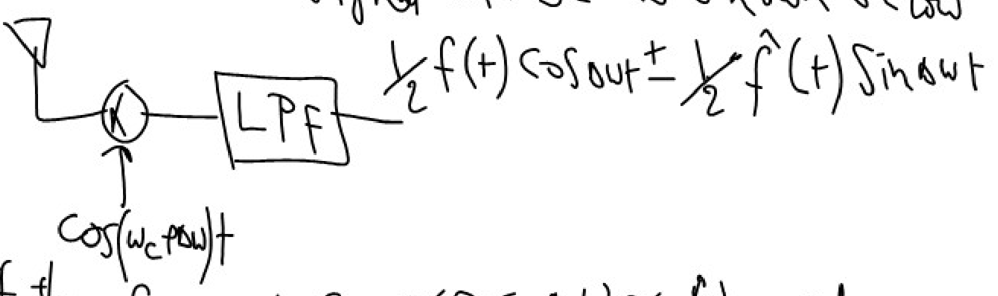
* The signal detected at the LPF is

$$V_o(t) = \frac{1}{2} f(t)$$

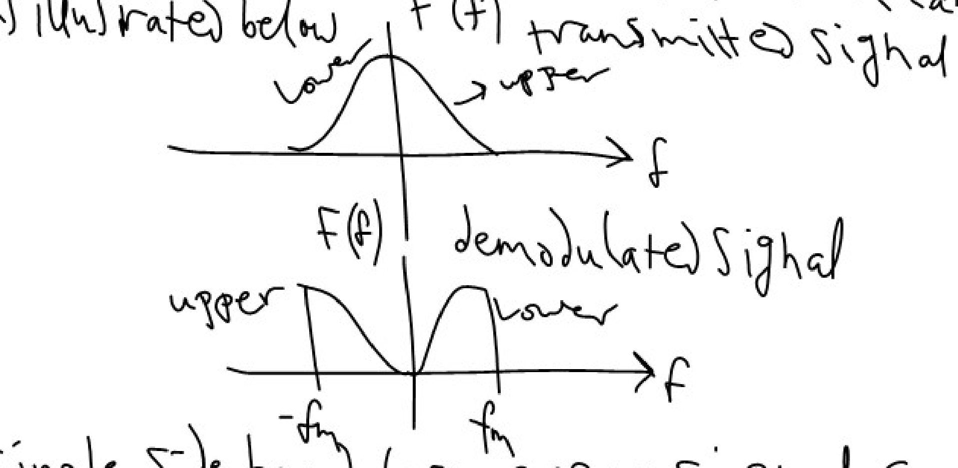
* If there is a phase between the carriers in the transmitter and the receiver, (i.e the receiver is as shown below)



* If there is a frequency in the receiver, then the demodulated signal will be as shown below



* If the frequency error $\Delta w \simeq w_m$, then an effect known as scrambling will be noticed
* Scrambling means that the upper side band became lower and the lower side band became upper as illustrated below



* Single side band large carrier signal can be demodulated by using an envelope detector.

5.5 Vestigial side band modulation

* Vestigial side band modulation is used when the bandwidth of the information signal f(t) is very large and contains frequency down to zero as in vedio signals
* If the bandwidth is very large, then ~~there~~ is no practical circuit, that will give 90° phase shift over large frequency band
  ∴ Hilbert transform will not work
* If the signal contains frequency down to zero, then the side band filter will take the upper side band plus vestige from the lower side band
* This kind of modulation is called vestigial side band modulation
* Vestigial side band modulation can be illustrated by the following spectrum sketch