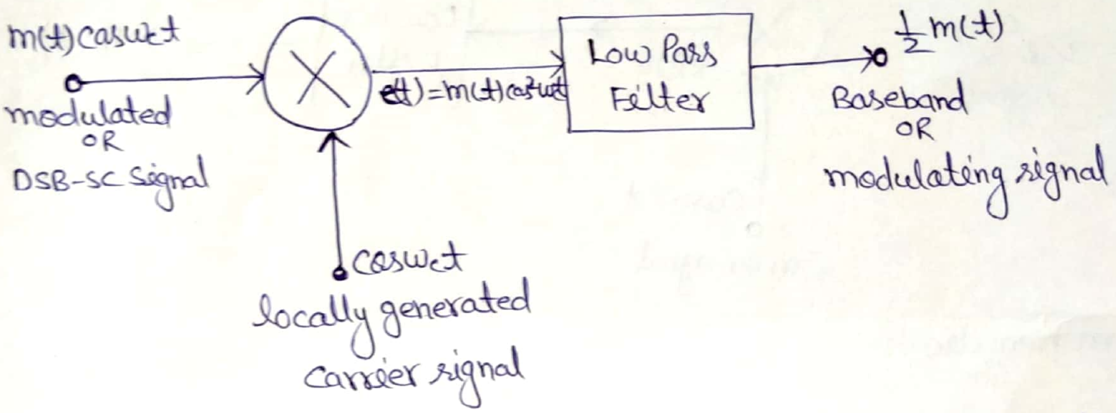
Demodulation:⇒

The DSB-SC and SSB-SC signals may be demodulated by following two methods:-

1. Synchronous detection OR coherent detection method.
2. Using envelope detector after carrier re-insertion method.

Synchronous Detection OR Coherent detection:⇒

* Demodulation of DSB-SC signals



The DSB-SC signal is first multiplied with a locally generated carrier signal cosωct and then passed through a LPF. At the output of a low-pass-filter, the original modulating signal is recovered. mathematically,

$$e(t) = m(t)\cos\omega_c t \cdot \cos\omega_c t$$

$$= m(t)\cos^2\omega_c t$$

$$= \frac{1}{2}m(t)[2\cos^2\omega_c t]$$

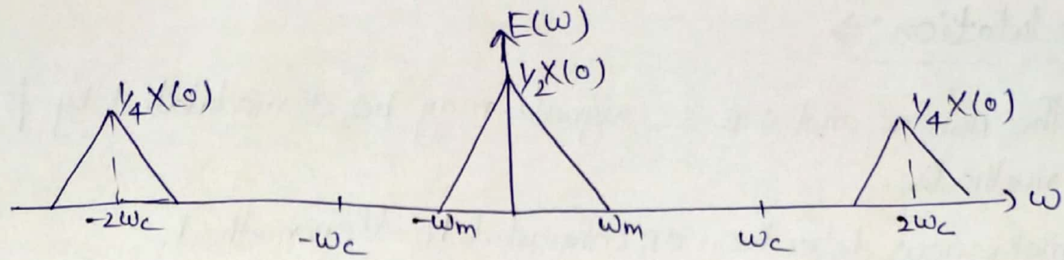
$$= \frac{1}{2}m(t)[1+\cos 2\omega_c t]$$

$$= \frac{1}{2}m(t) + \frac{1}{2}m(t)\cos 2\omega_c t$$

when $e(t)$ is passed through a L.P.F, the the term $\frac{1}{2}m(t)\cos 2\omega_c t$, centred at $\pm 2\omega_c$ is suppressed by L.P.F and therefore the output of LPF, the original modulating signal $\frac{1}{2}m(t)$ is obtained.

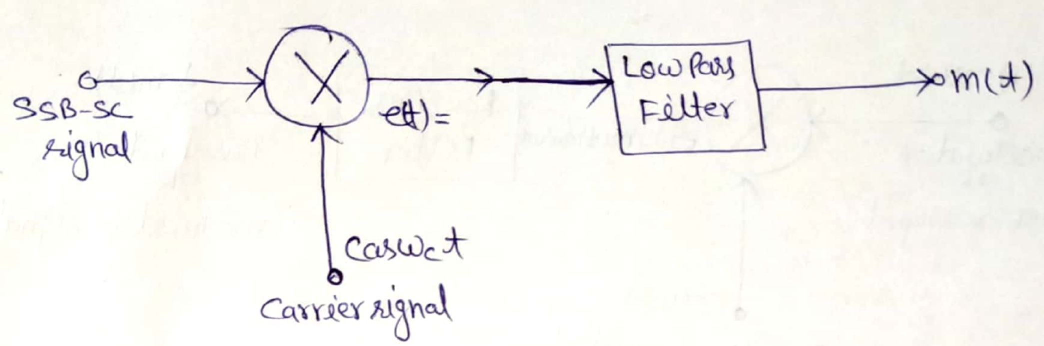
$$m(t)\cos^2\omega_c t \longleftrightarrow \frac{1}{2}X(\omega) + \frac{1}{4}[X(\omega+2\omega_c) + X(\omega-2\omega_c)]$$

Scanned with CamScanner



* It may be noted $\omega_c >> \omega_m$ and $2\omega_c$ is still greater then ω_m and thus is easily filtered out.

** Demodulation of SSB-SC signal



mathematically,

$$e(t) = [m(t)\cos\omega_c t \pm \hat{m}(t)\sin\omega_c t]\cos\omega_c t$$

$$= m(t)\cos^2\omega_c t \pm \hat{m}(t)\sin\omega_c t\cos\omega_c t$$

$$= \frac{1}{2}m(t)[1+\cos 2\omega_c t] \pm \frac{1}{2}\hat{m}(t)\sin 2\omega_c t$$

$$= \frac{1}{2}m(t) + \frac{1}{2}[m(t)\cos 2\omega_c t \pm \hat{m}(t)\sin 2\omega_c t]$$

Now, when $e(t)$ is passed through a low-pass filter, then the terms centered about $\pm 2\omega_c$ are filtered out and we get at the output detector, signal $e(t)$ which is given as

$$e(t) = \frac{1}{2}m(t)$$