# (Week 11 Friday)



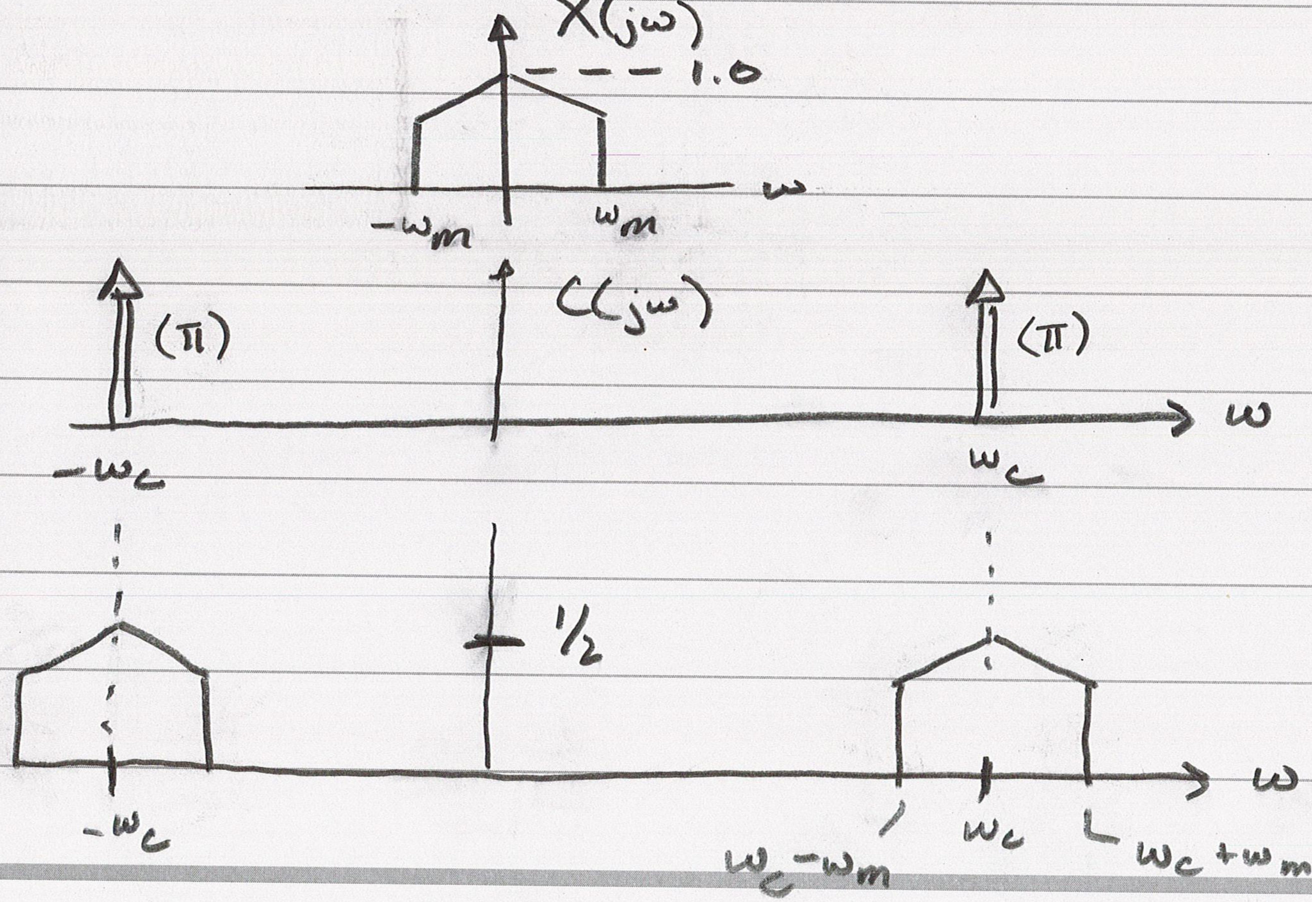
Last time: AM with $c(t) = e^{j\omega_c t}$

AM with $c(t) = \cos(\omega_c t) \longleftrightarrow C(j\omega) = \pi\left[\delta(\omega - \omega_c) + \delta(\omega + \omega_c)\right]$

$$\Longrightarrow \quad y(t) = c(t)\,x(t)$$

$$\updownarrow$$

$$Y(j\omega) = \frac{1}{2}X(j(\omega - \omega_c)) + \frac{1}{2}X(j(\omega + \omega_c))$$




Picture here assumes $\omega_c > \omega_m$

There are two types of demodulators:

① synchronous (or coherent) = receiver has exact Knowledge of carrier phase & freq.

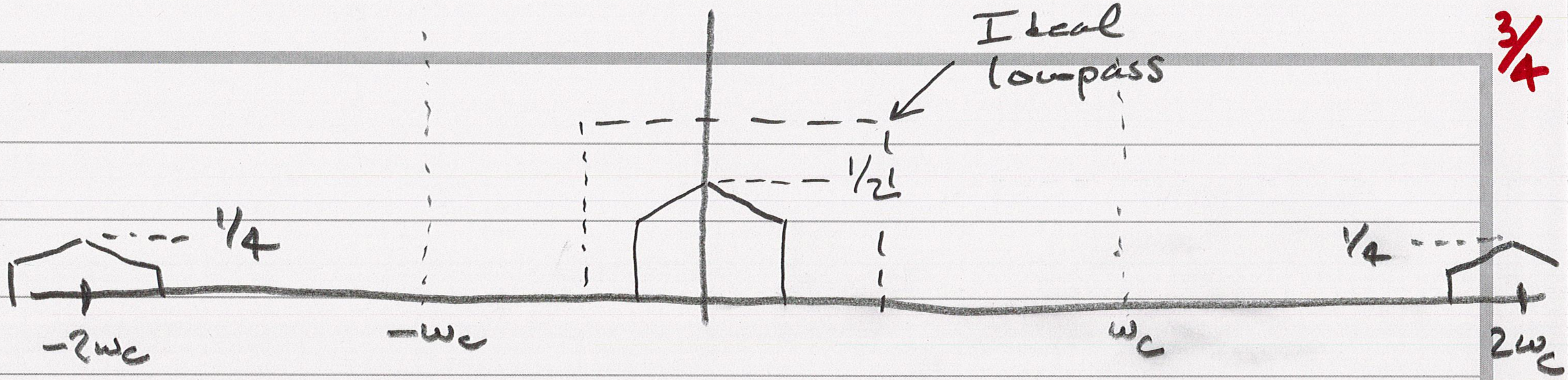
② asynch. or non-coherent ... where it does not.

Coherent: At receiver we can get a local copy $\cos w_c t$

$$y(t) = \text{received sig.} = x(t) \cos w_c t$$

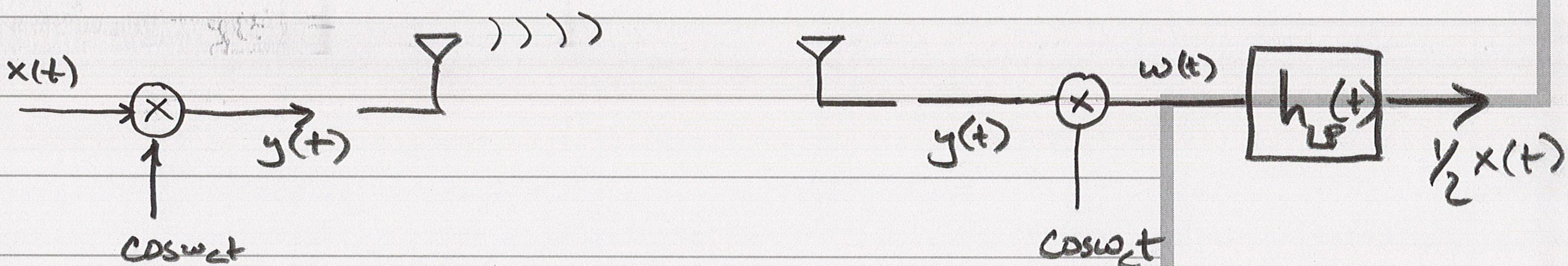
$$w(t) = y(t) \cos w_c t = x(t) \cos^2 w_c t = x(t) \left[ \frac{1 + \cos 2w_c t}{2} \right]$$

$$= \underbrace{\frac{1}{2} x(t)}_{\text{a scaled version of Info desired}} + \underbrace{\frac{1}{2} x(t) \cos 2w_c t}_{\text{AM modulated on twice orig.}}$$




Let $h_{LP}(t) \longleftrightarrow H_{LP}(j\omega)$

$$\frac{1}{2}X(j\omega) = H_{LP}(j\omega)\,W(j\omega)$$




Aside if my local ref was $\cos(\omega_c t + \theta)$ then I get

$$w(t) = \frac{1}{2}\cos\theta\, x(t) + \frac{1}{2}x(t)\cos(2\omega_c t + \theta)$$

Non coherent demod This is how AM radio still works.

540 – 1600 KHZ

Imagine $x(t) > 0$ and $\omega_c >> \omega_m$

Here the modulated signal $y(t) = x(t) \cos \omega_c t$