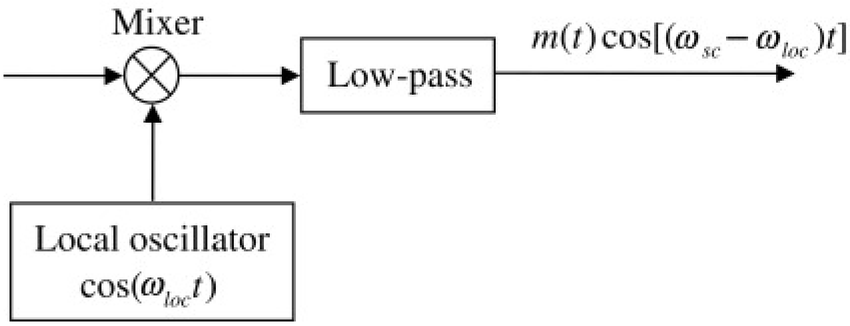
DSBSC

- More effiecient
- Higher cost
- More complex

Coherent detection

It will be used to detect DSBSC.



DSBLC

- less efficient
- lower cost

Noise in AM systems

Mean noise power in demodulator where a noise **voltage** is input into our demodulator

$$N_i = \lim_{T\to\infty}\frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}}\frac{n_i^2}{R}dt$$

If the noise is in the form of a **current**, then the mean noise will be

$$Ni = \lim_{T\to\infty}\frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}}n_i(t)^2 R dt$$

Ususally we will assume that the noise power will flower into $R = 1\Omega$. But it is noticable that in most cases R is matached to 50 Ω.

random noise

$$n_i(t) = n_c\cos{(w_ct)} - n_s(t)sin(w_ct)$$

where the noise is defined in terms on **in-phase** and **out-of-phase**.

in-phase:**If two waves coincide with peaks and troughs matching they are** said to be in phase.

out-of-phase:A phrase used to characterize two or more signals whose phase relationship with each other is such that when **one is at its positive peak the other is at** (or near) its negative peak.

So the final noise will be:

$$N_i = \frac{1}{2T}\int_{\frac{-T}{2}}^{\frac{T}{2}} n_c(t)^2 + n_s(t)^2[1-\cos{(w_ct)}] - 2n_c(t)n_s(t)\sin{(2w_ct)}dt$$

And it bascially used the trigonometry:

$$\cos^2\alpha = \frac{1+cos2\alpha}{2}$$

where the **R** is assumed to be **1**Ω.

the cos and sin terms average to zero to give,

$$N_i = \frac{1}{2T}\int_{\frac{-T}{2}}^{\frac{T}{2}} n_c^2(t) + n_s^2(t)dt = \frac{1}{2}n_c\hat{(t)}^2 + \frac{1}{2}n_s(t)^2$$

Which is the additon of two mean value of power.

If the noise is random, then the nosie spikes will occur in-phase and out-of phase with equal frequency and so we can see

$$n_c\hat{(t)}^2 = n_s\hat{(t)}^2 = n_i\hat{(t)}^2$$

- [ ] **Why?**

Signal

$$S_i = \frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}} s_i(t)^2dt$$

Amplitude demodulation

$$S_i(t) = f(t)\cos{(w_ct)}$$

Substitute it into the original equation:

$$S_i = \frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}} f^2(t)dt$$

since the double angles was 0 during the integral.

So as shown before, accoding to DSBSC demodulation:

$$S_i(t) = f(t)\cos(w_c t)$$
$$S_o(t) = si(t)\cos(w_c t) = Si_t cos^2(w_c t)$$

Since the $2w_c$ term will be filtered off. Then the obtained signal will be

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

- [ ] **Why**?

So the average power of the ouput signal will be

$$Sop = \frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}}(\frac{1}{2}f(t))^2 = \frac{1}{4}f(\hat{t})^2$$

No matter what is at input both noise and signal will be demodulated accodingly:

so the output noise will be $n_o(t) = ni(t)cos(w_c t)$ which is the same as the input signal and output signal which is:

$$n_o(t) = \frac{1}{2}n_c(t)[1 + cos(2w_c t)] - \frac{1}{2}n_s(t)sin(2w_c t)$$

Again, after filtered off $n_o(t) = \frac{1}{2}n_c(t)$, so the corresponding average power will be:

$$N_o = \frac{1}{T}\int_{\frac{-T}{2}}^{\frac{T}{2}}(\frac{1}{2}n_c(t))^2 dt = \frac{1}{4}n_i^2\hat{(t)}$$

Final SNR Ratio

$$\frac{S_i}{N_i} = \frac{\frac{1}{2}f(\hat{t})^2}{n_i\hat{(t)}^2}$$
$$\frac{S_o}{N_o} = \frac{\frac{1}{4}f(t)^2}{\frac{1}{4}n_i(t)^2}$$

Hence $SNR_o = 2SNR_i$

Aim of this Course

FInd SNRi and SNRo which is SNR of input and SNR of output respectively