Assume that the carrier in the receiver have either a frequency error or a phase error, what will be the effect of these errors on the demodulated signal??

To answer this question we can consider each case separately

* Phase error

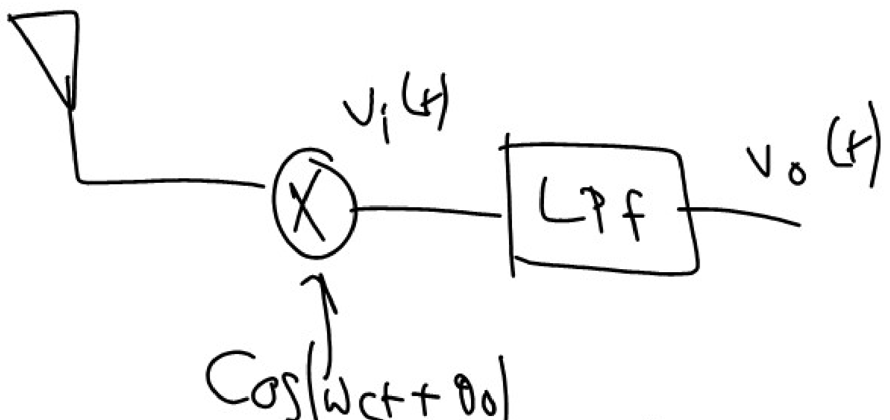
To treat the phase error assume that the carrier in the receiver is given by

$\cos(\omega_c t + \theta_0)$

where θ_0 is the phase error

* The modulated signal is given by

$\underset{DSB-SC}{\phi(t)} = f(t) \cos \omega_c t$



$$v_i(t) = f(t) \cos \omega_c t \cos(\omega_c t + \theta_0)$$

$$= f(t) \left[\tfrac{1}{2} \cos(2\omega_c t + \theta_0) + \tfrac{1}{2} \cos \theta_0 \right]$$

The signal detected at the LPF output

$$v_o(t) = \tfrac{1}{2} f(t) \cos \theta_0$$

If θ_0 is small value then the detected signal amplitude is reduced

If $\theta_0 \approx 90$ then the detected signal is wiped out

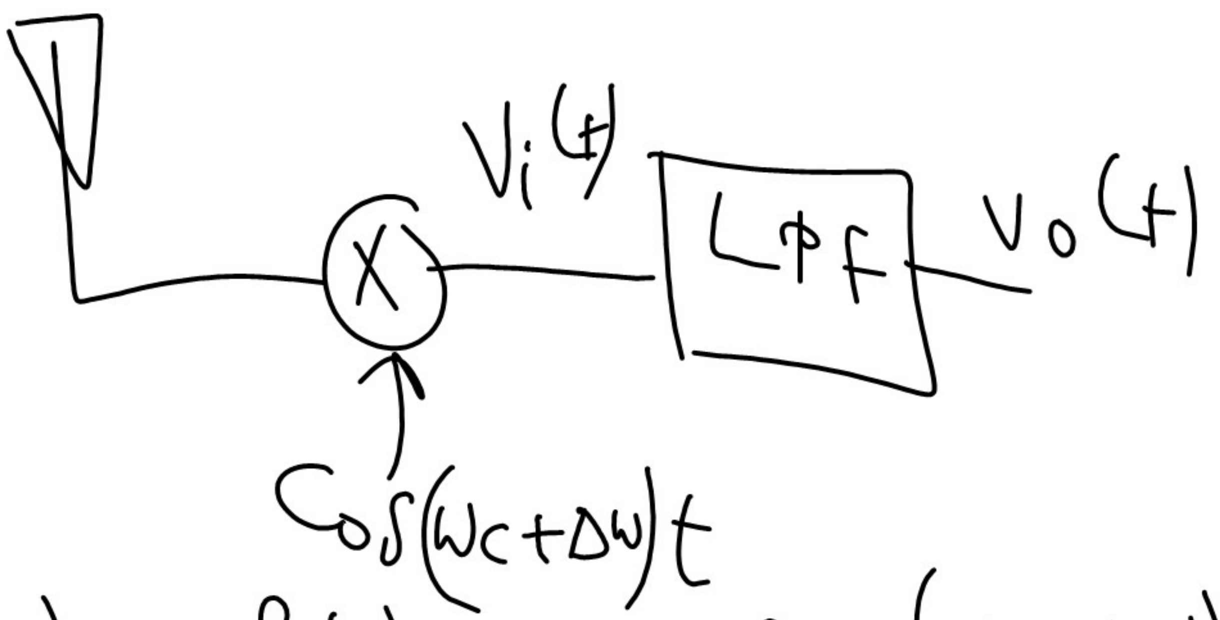
θ_0 can be made small by using a synchronization circuit

Frequency error Δf

Assume that the carrier in the receiver is given by $\cos(\omega_c+\Delta\omega)t$ and the modulated signal is given by

$$\phi(t) = f(t)\cos\omega_c t$$

DSB-SC

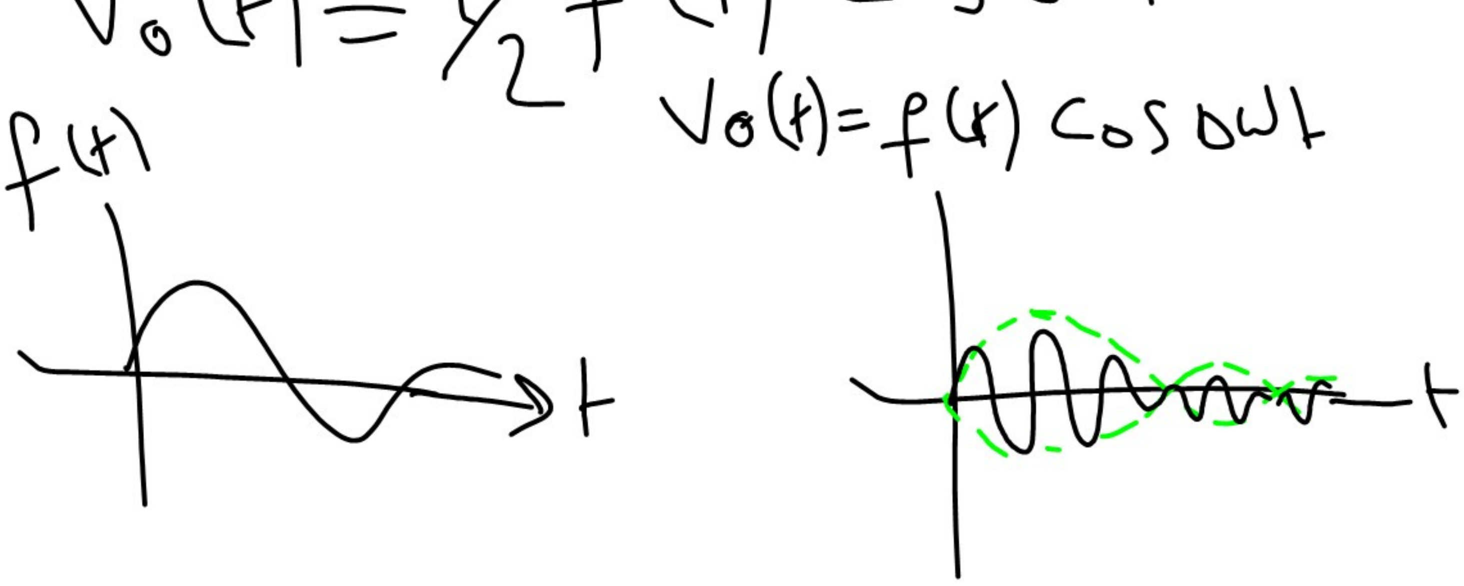


$$V_i(t) = f(t)\cos\omega_c t\cos(\omega_c+\Delta\omega)t$$

$$= f(t)\left[\tfrac{1}{2}\cos(2\omega_c+\Delta\omega)t + \tfrac{1}{2}\cos\Delta\omega t\right]$$

$$V_o(t) = \tfrac{1}{2}f(t)\cos\Delta\omega t$$

$V_o(t) = f(t)\cos\Delta\omega t$



5.1.1 Electronic circuit that can be use to perform the multiplication action

* Several circuits can be used for generating doubled side band suppressed carrier modulation, these are
  1. Chopper modulator
  2. Nonlinerity of the I-V curve of diodes
  3. Using FET or BJT transistor
  4. Gilbert cell mixer

chopper modulator

* The chopper modulator is shown below