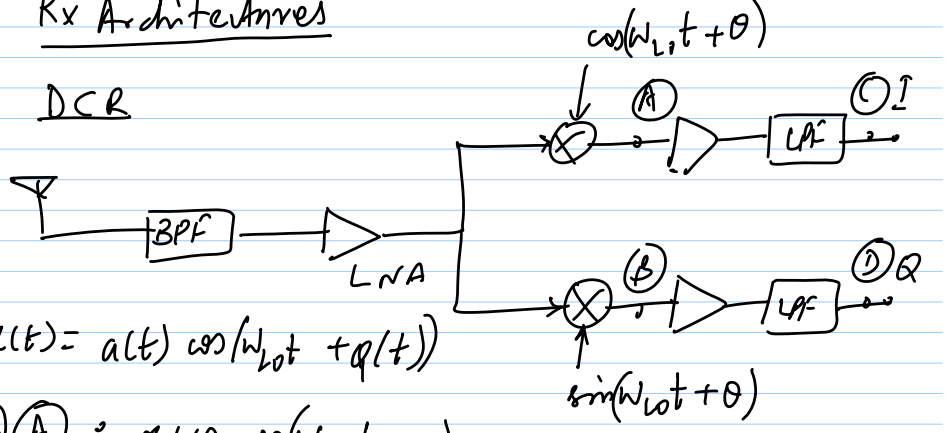
14-10-13

Lec 30

Rx Architectures

1) DCR



$x(t) = a(t)\cos(\omega_{LO}t + \varphi(t))$

@ (A) : $x(t)\cos(\omega_{LO}t + \theta)$

$= \frac{1}{2}a(t)\left\{\cos(\varphi(t)+\theta) + (2\omega_{LO})\right\}$

Assume $\theta = 0$ (for now)

@ C $\Rightarrow \frac{1}{2}a(t)\cos\varphi(t)$

@ D $\Rightarrow -\frac{1}{2}a(t)\sin\varphi(t)$

Demod. algo : $\sqrt{C^2+D^2} = \frac{1}{2}a(t)$ ← AM

four quadrant $\tan^{-1}$ → $-\tan^{-1}\left(\frac{D}{C}\right) = \varphi(t)$ ← PM

* why both I & Q

a) I & Q can be independently mod.

b) $\theta \neq 0$

we are trying to transmit AM ($\varphi(t)=0$)

$x(t) = a(t)\cos(\omega_{LO}t)$

(C) : $\frac{1}{2}a(t)\cos\theta$ $\quad \theta = 90^\circ$ ✗

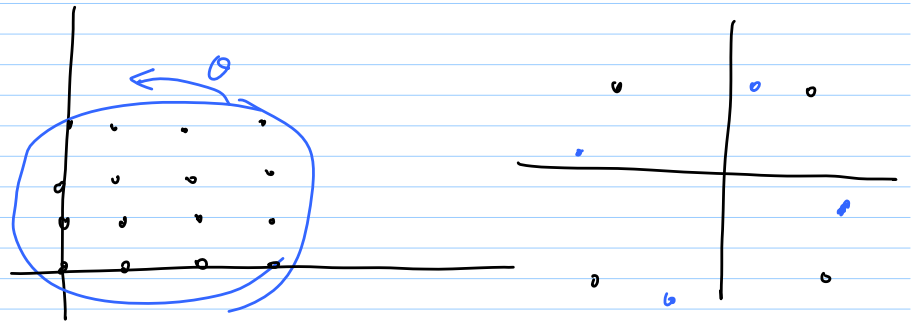
(D) : $\frac{1}{2}a(t)\sin\theta$ $\quad \theta = 0^\circ$ ✗

c) PM

$x(t) = A\cos(\omega_{LO}t + \varphi(t))$

$x_I(t) = A\cos\varphi(t)$

$x_Q(t) = A\sin\varphi(t)$



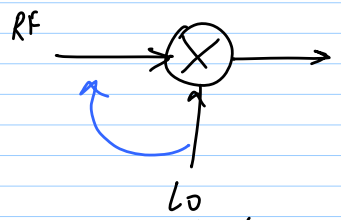
Advantages of DCR

* Simplest Rx arch.
* No image problem ($\omega_{IF} = 0$)
* Highly integrable, no IR filter, no source drive
* filtering is easy
* ADC is easy
* Only 1 PLL needed.

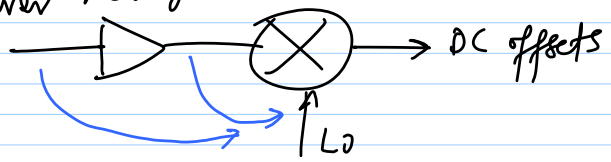
Disadvantages of DCR

i) 1/f noise of BB blocks — large devices

ii) DC offsets : —

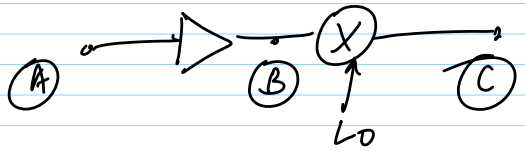
iii) 

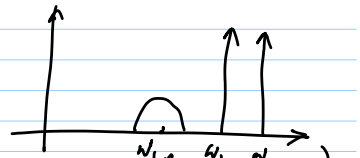
iv) Interferer leakage



v) LO pulling — RF signal becomes too large & pulls LO signal

vi) Even order Distortion





@ (A)

@ (B)