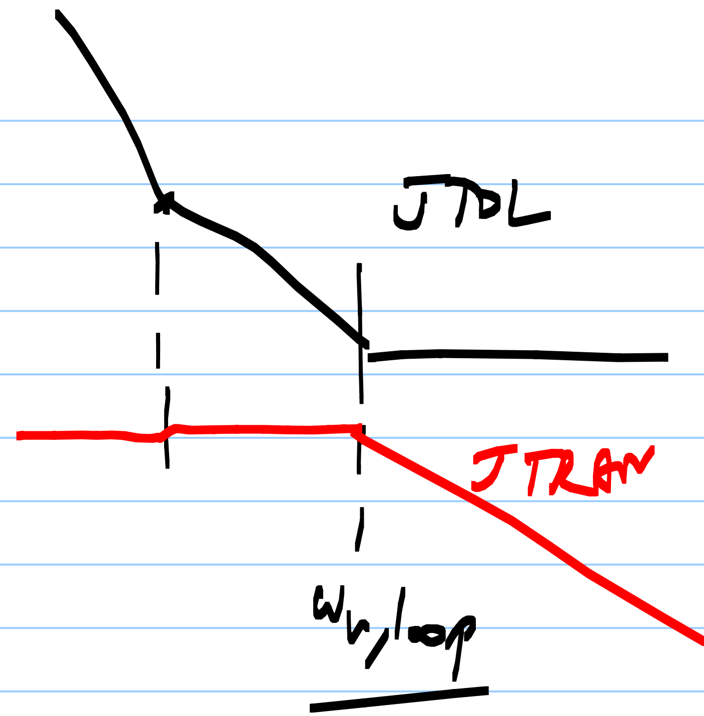
EE6322

9/2/2018

JTRAN

JTOL



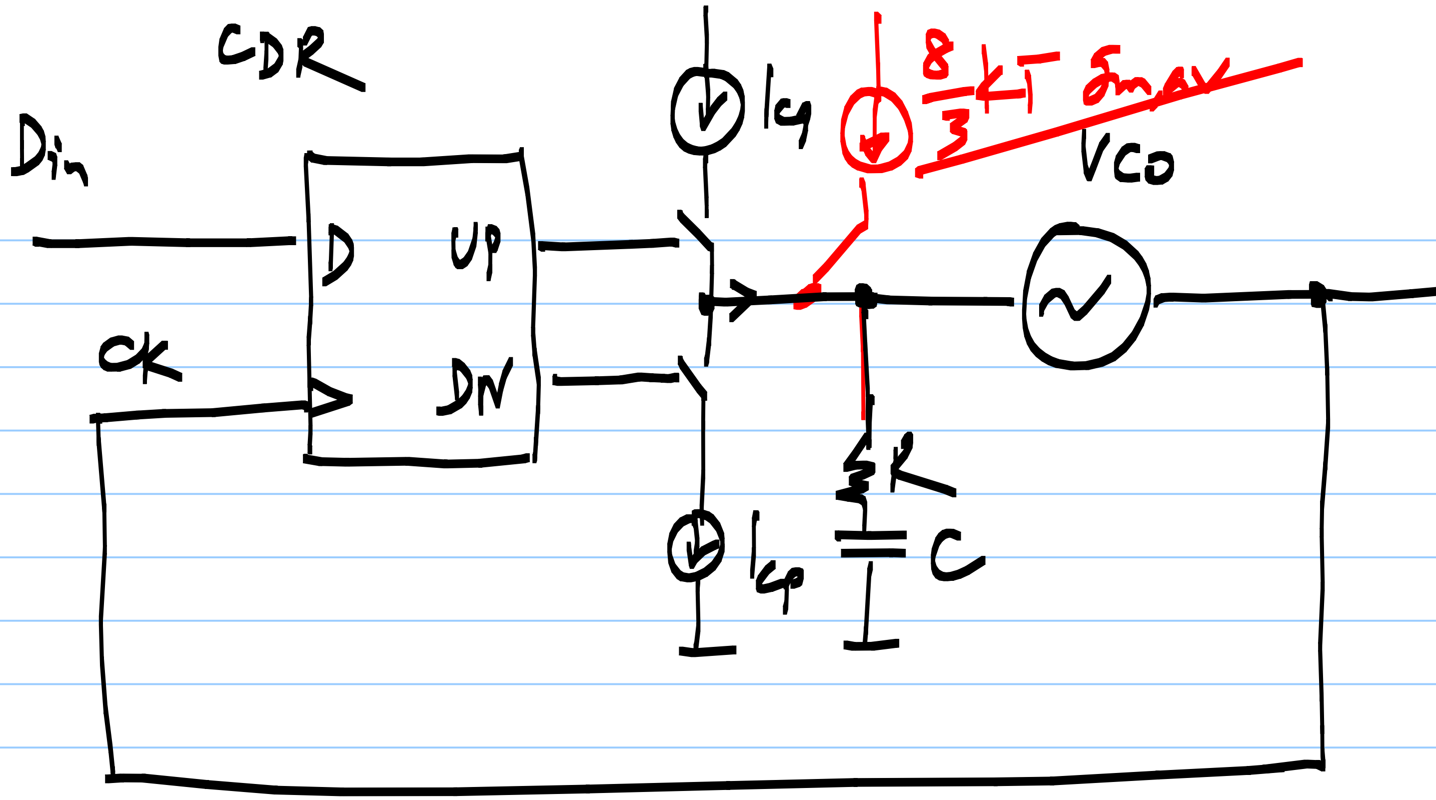
For a binary PD, gain depends on input jitter

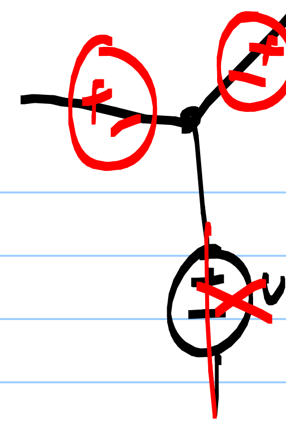
Linear PD

JGEN : Jitter generation

(output jitter, with a jitter-free input data)

CDR



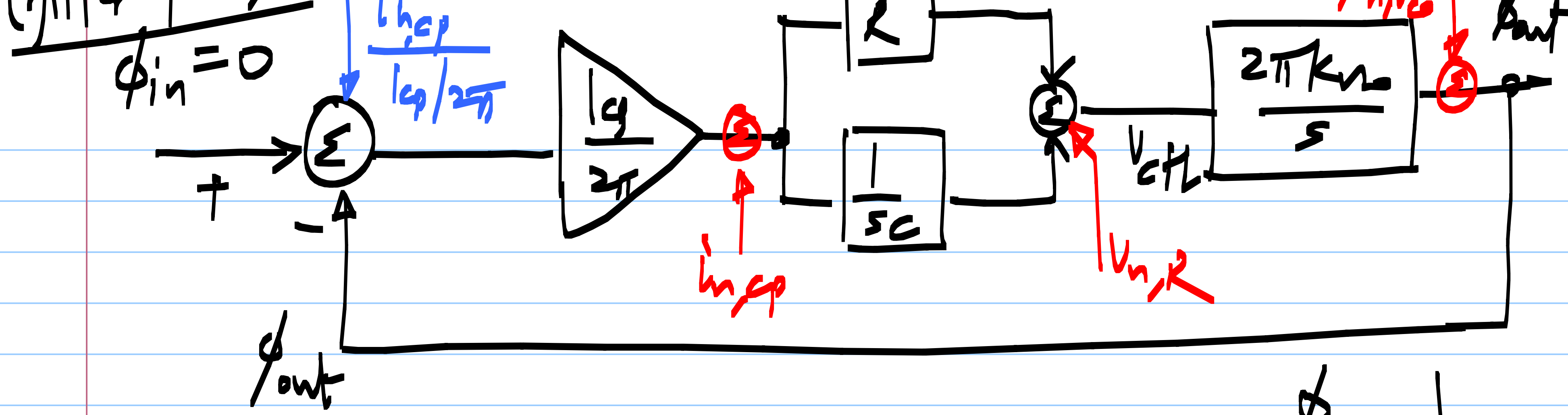


more significant for BB PD

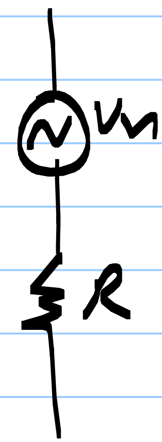
Random jitter: ① Phase noise of the VCO
② Noise in R, I_{cp}

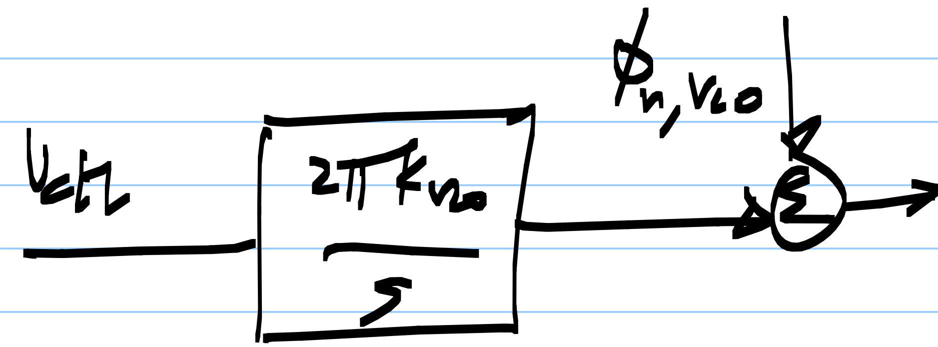
Systematic jitter: Instantaneous pulsing of I_{cp}

(jitter free)



$S_{v_n} = 4kTR$

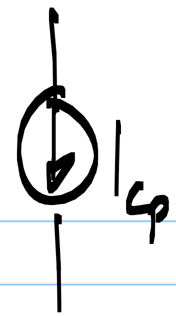
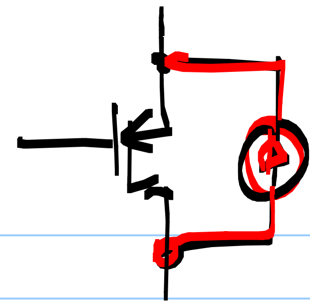




$i_{n,cp}$ ________

$v_{n,R}$ ________ ϕ_{out}

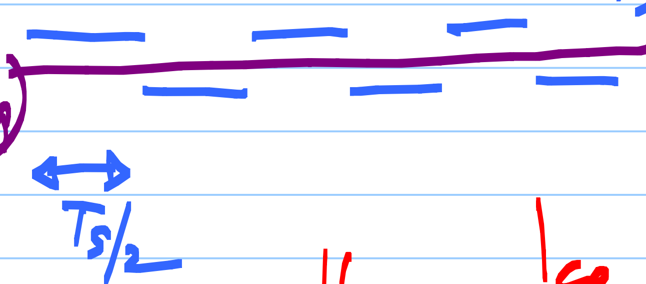
$\phi_{n,vco}$ ________

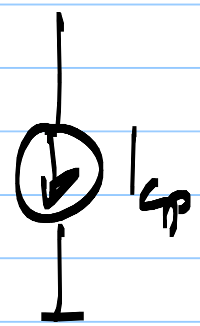
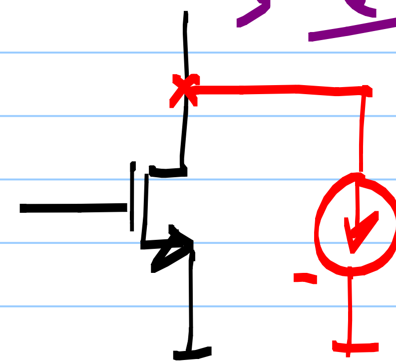
 I_{cp} = 

$$\frac{8}{3}kT g_{mp} = \frac{16}{3}kT \frac{I_{cp}}{V_{GS}-V_T\big|_p}$$

pMOS in sat.

$$\frac{8}{3}kT\frac{(g_{mn}+g_{mp})}{2}$$



 I_{cp} = 

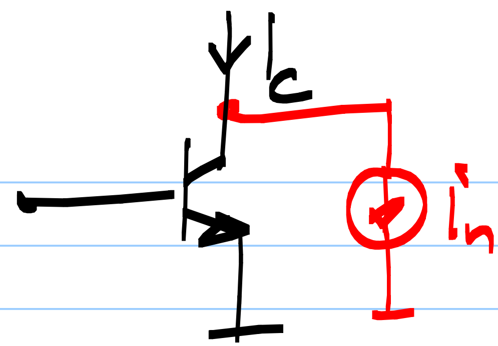
$$\frac{8}{3}kT g_{mn} = \frac{16}{3}kT \frac{I_{cp}}{V_{GS}-V_T\big|_n}$$

nMOS in sat.

$$g_m = \frac{2I_D}{V_{GS}-V_T}$$

Noise from the two current sources have different spectral densities.

→ Consider the average spectral density (OK when we look at output phase noise at low frequencies)



$S_{i_n} =$

$= 2q \cdot g_m \cdot \frac{kT}{q} = 2kT g_m$

$g_m = \frac{I_c}{kT/q}$

$2kT \cdot \frac{q}{kT} \cdot I_c$

$\sim \frac{8}{3} kT g_m$

$\sim \frac{16}{3} kT$

$$\frac{\phi_{out}}{\phi_{in}} = \frac{1+sCR}{1 + sCR + s^2 \frac{C}{I_{cp} \cdot K_{vco}}}$$

$i_{n,cp} / (I_{cp}/2\pi)$

$$\frac{\phi_{out}}{i_{n,cp}} = \frac{2\pi}{I_{cp}} \cdot \frac{1+sCR}{1 + sCR + s^2 \frac{C}{I_{cp} \cdot K_{vco}}}$$

$$\frac{\phi_{out}}{\ } = \frac{\frac{2\pi K_{vco}}{s}}{1 + \frac{I_{cp}}{2\pi}\left(R + \frac{1}{sC}\right) \cdot \frac{2\pi K_{vco}}{s}}$$

$$\frac{\phi_{out}}{[illegible]} = \left[\frac{2\pi}{I_{cp} \cdot R}\right]\left[\frac{sCR}{1 + sCR + s^2 \frac{C}{I_{cp} \cdot K_{vco}}}\right]$$

$$\frac{\phi_{out}}{[illegible]} = \frac{s^2 \frac{C}{I_{cp} K_{vco}}}{1 + sCR + s^2 \frac{C}{I_{cp} K_{vco}}}$$