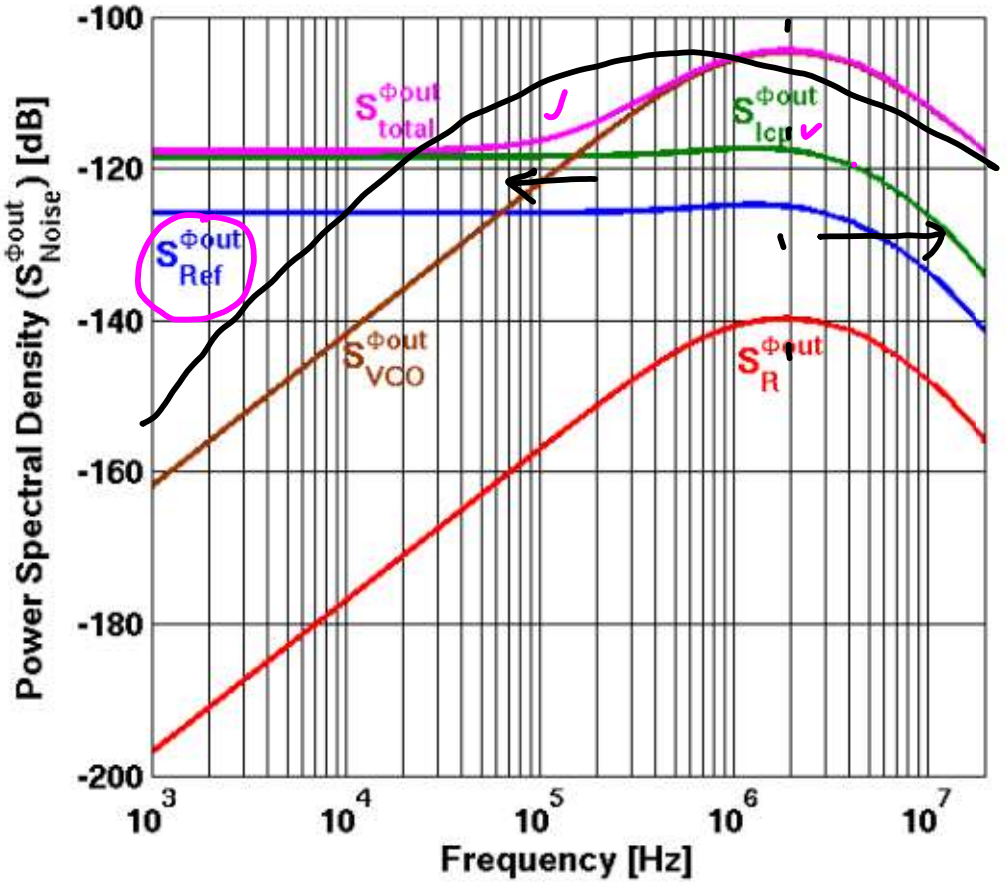
Lecture # 23

Note Title 22-10-2020

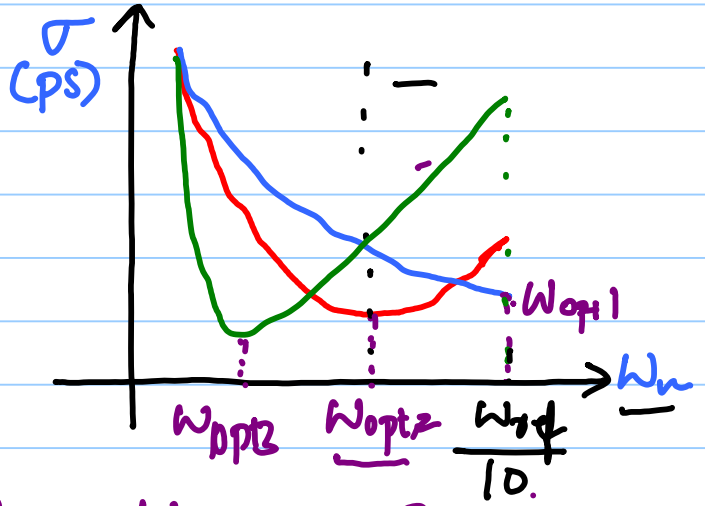
Noise Analysis in PLL



$$S_x^{\Phi out} = S_n^x \times |NTF_x|^2$$

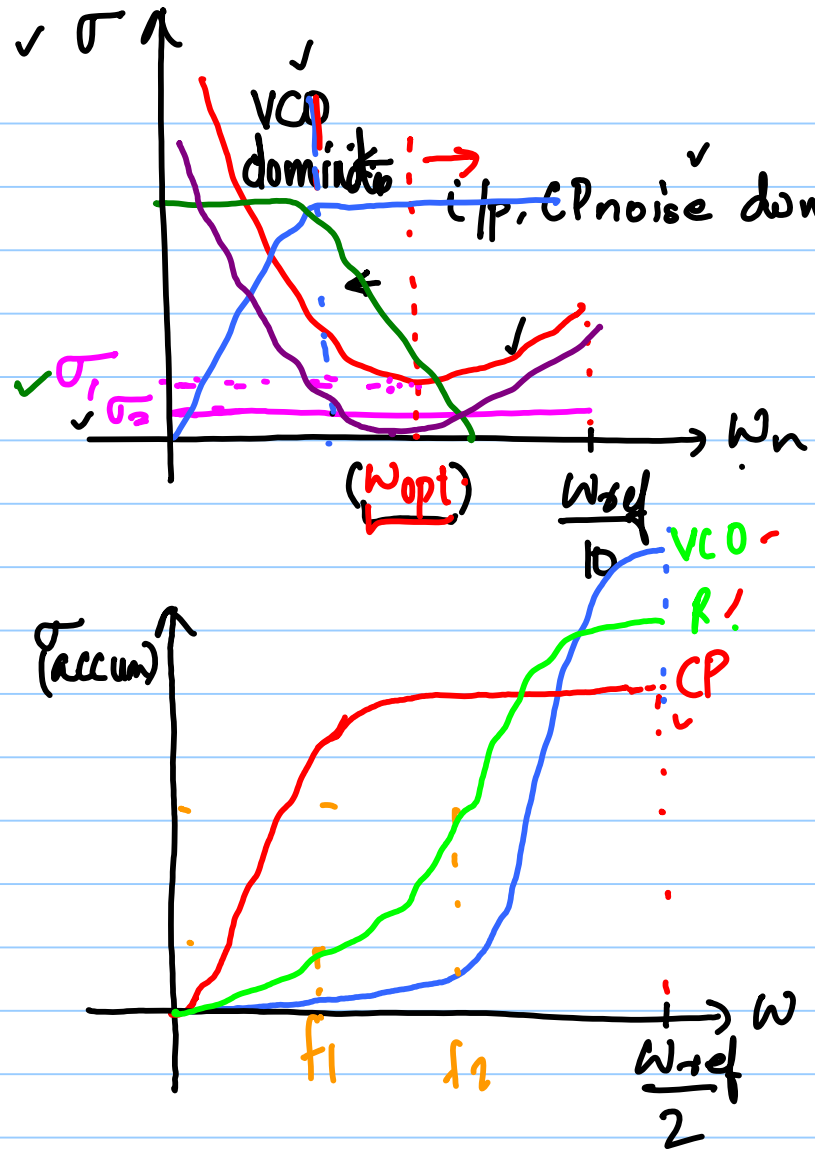
- $\omega_u, \phi_m \Rightarrow I_{cp}, R, C_1, C_2$ ✓
- NTF_x, S_n^x
- $S_{total}^{\Phi out} = \sum S_{x_i}^{\Phi out}$
- Long term absolute jitter

$$\sigma = \frac{T}{2\pi}\sqrt{\int S_{total}^{\Phi out}\cdot df}$$



- $\omega_u = \omega_{opt,2} \Rightarrow I_{cp}, R, C_1, C_2$ ✓

$\Rightarrow$ An optimum unity gain frequency (ω_u) based on output noise.

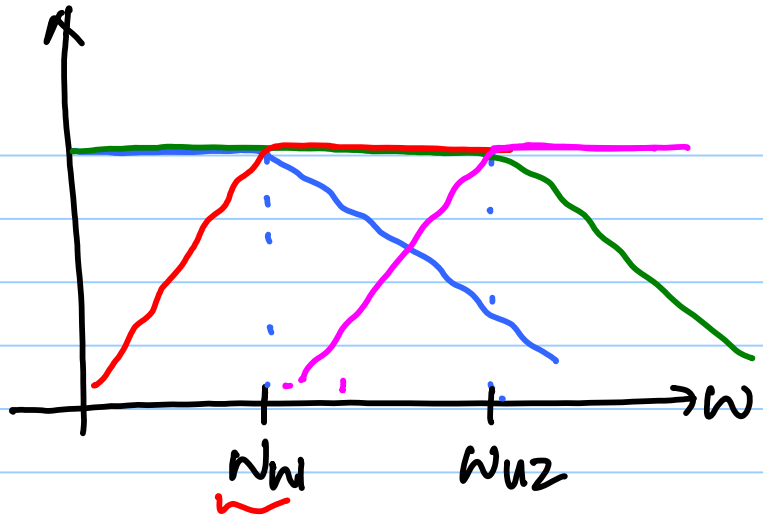


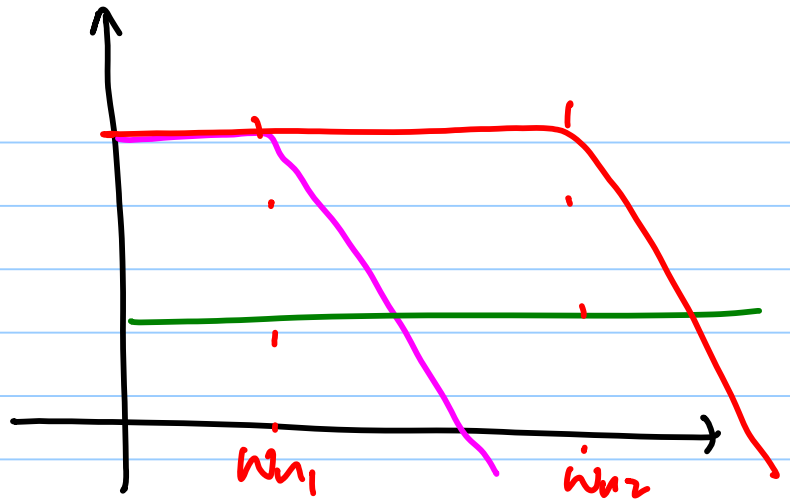
- Fixed : K_{VCO}, R
- Variable : I_{cp}, C_1, C_2

$$\left(\sigma_{acc.}^{CP}\right) = \left(\frac{T}{2\pi}\right)^2 \int_0^f S_{CP}^{\phi_{out}} \cdot df.$$ cumtrapz

- R noise dominates $\Rightarrow R \downarrow \Rightarrow C_1 \uparrow$
- CP noise dominates $\uparrow$

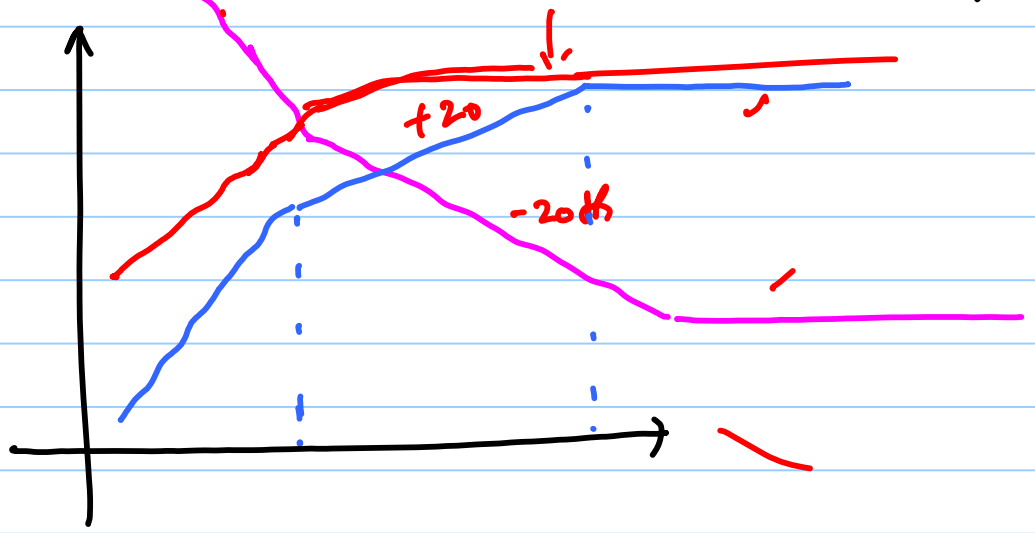
for given ω_n - VCO noise dominates



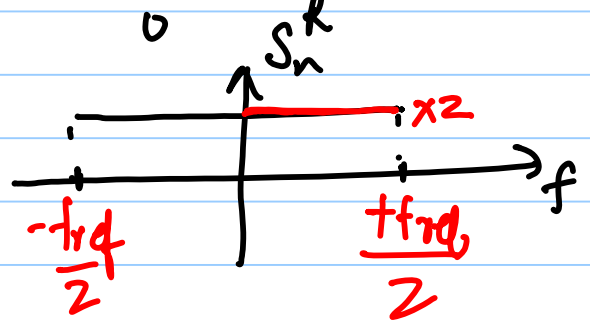


ω_{n1}: CP noise is filtered more as compared to ω_{n2}

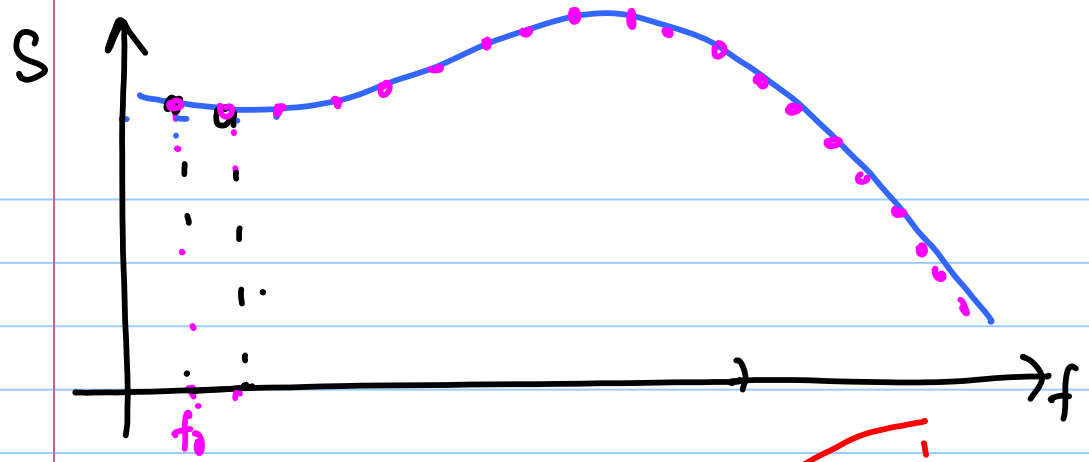
and VCO noise is less filtered as compared to ω_{n2}



$$\int_0^{f_{ref}/2} S_{total}^{out} \cdot df$$



$S_n^R = 4kTR$



$\int S_{total}^{fout} \cdot df \quad : \quad \Sigma$

— trapz.

- cumtrapz.

- tf