# Lecture # 18

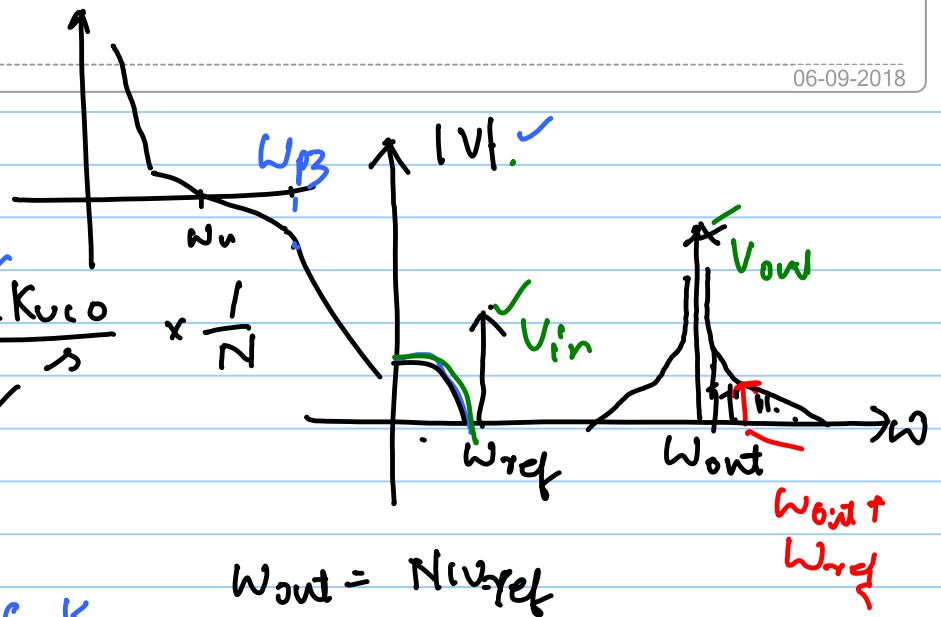
Note Title 06-09-2018

$V_{in}$ → PLL → $V_{out}$

$\Phi_{in}$ $\Phi_{out}$

Type-II, Order -3

$$\frac{\Phi_{out}}{\Phi_{in}}\bigg|_{closed\ loop} = LG = \frac{1}{2\pi} I_{cp} \frac{1}{s(C_1+C_2)} \frac{(1+sRC_1)}{\left(1+sR\frac{C_1C_2}{C_1+C_2}\right)} \frac{2\pi K_{VCO}}{s} \times \frac{1}{N}$$




$\omega_{out} \neq \omega_{ref}$

$$\omega_u \leq \frac{\omega_{ref}}{10}$$

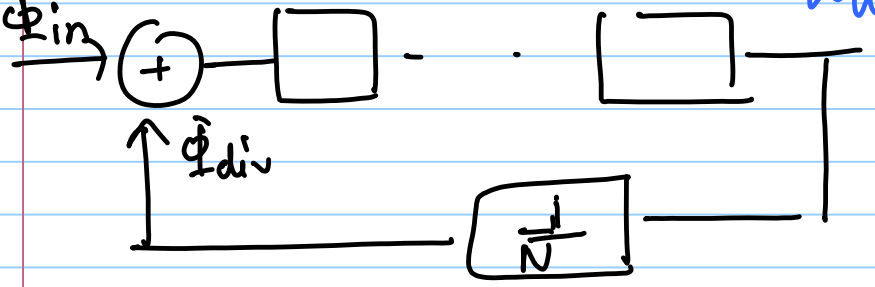
$|LG|\,\omega_u \approx 1$

$$\Rightarrow \frac{I_{cp}}{\omega_u^2 (C_1+C_2)} \frac{\omega_u \cdot RC_1 K_{VCO}}{N} = 1$$

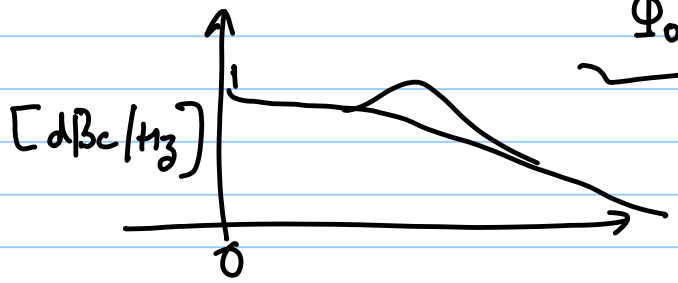
$\omega_{out} = N\omega_{ref}$

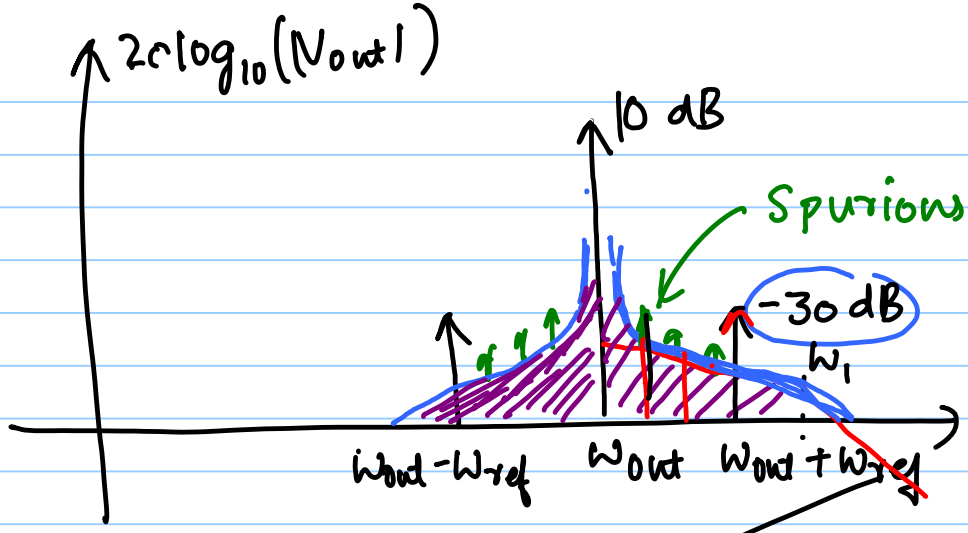
$V_{in} = \sin(\omega_{in} t)$ $\Phi_{in}$

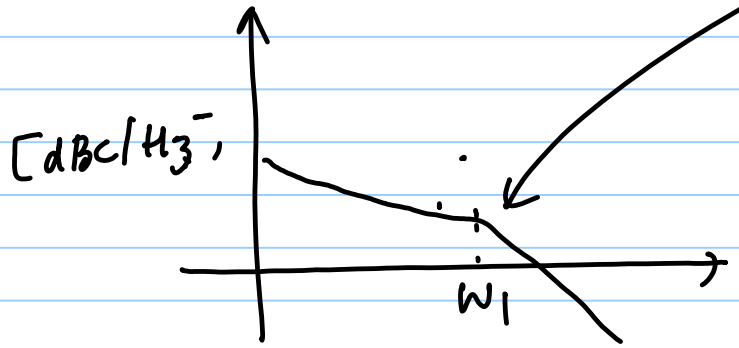
$V_{out} = \sin(\omega_{out} t)$ $\Phi_{out}$




$\Phi_{out} = \omega_{free} t + 2\pi K_{VCO} \int v \cdot dt$






Ref. spur = Mag. of voltage signal @ $w_{out} \pm w_{ref}$

$= -30 - (10) = -40$ [dBc]

Fractional - spur

$V_{c1} + V_{c2}$

$\sin(w_0 t + 2\pi K_{vco} \int v_c \, dt)$

$a_1/a_2$ $a_1/a_2$

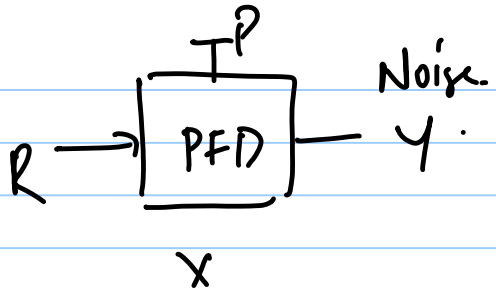
$\rightarrow (\;)\sin(w_0 + w_{ref}) + (\;)\sin(w_0 - w_{ref})$

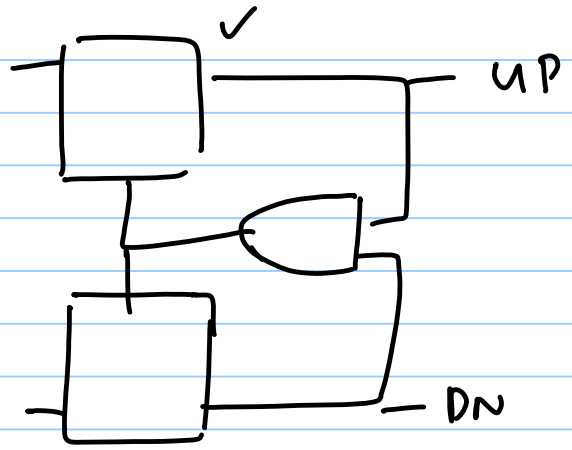
$-40$ $-40$

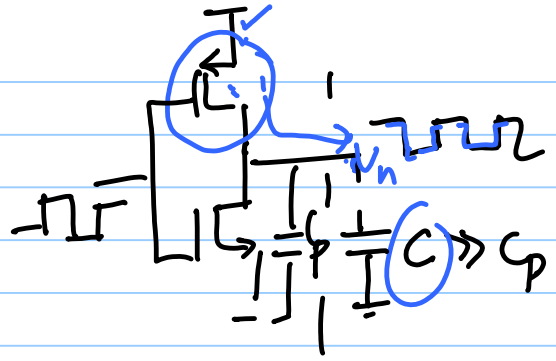
$V_{c1} = a_1 \sin(w_{ref}/10 \cdot t)$

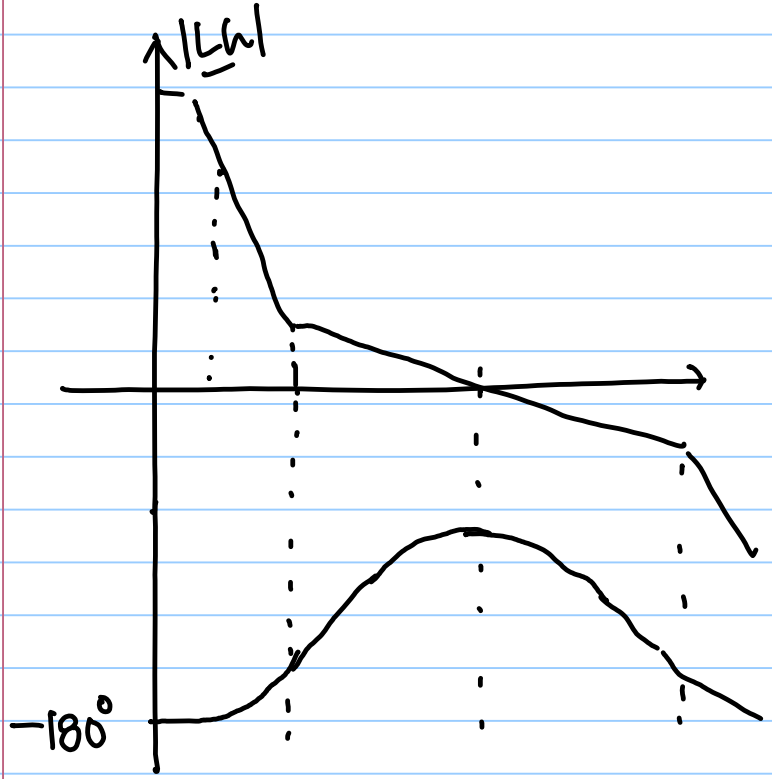
$V_{c2} = a_2 \sin(w_{ref}/10 \cdot t)$

$w_{dl} = w_{ref}/20$




$$LG(w) = A \angle 180^\circ = -A$$

$$|LG| > 1$$

$|LG| > 1$ , $\angle LG = 180^\circ$ ⊘ Sustained Oscillation

$|LG| = 1$