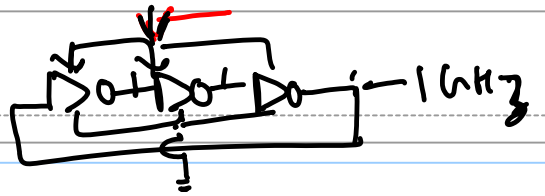
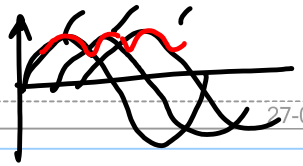
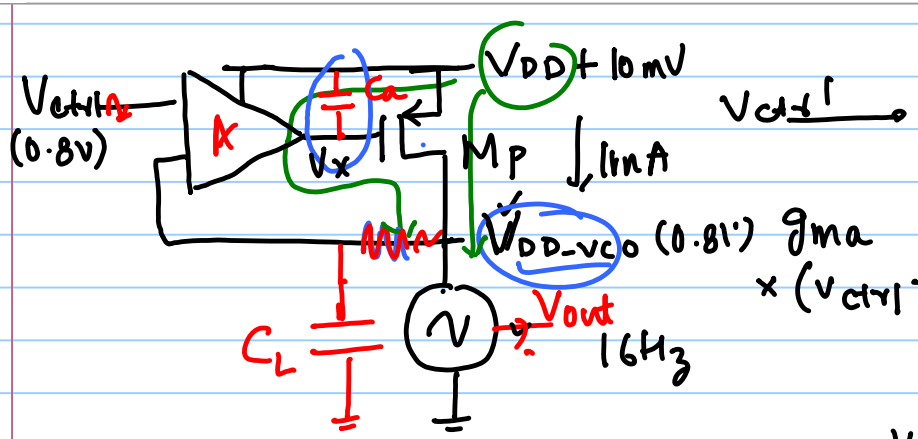
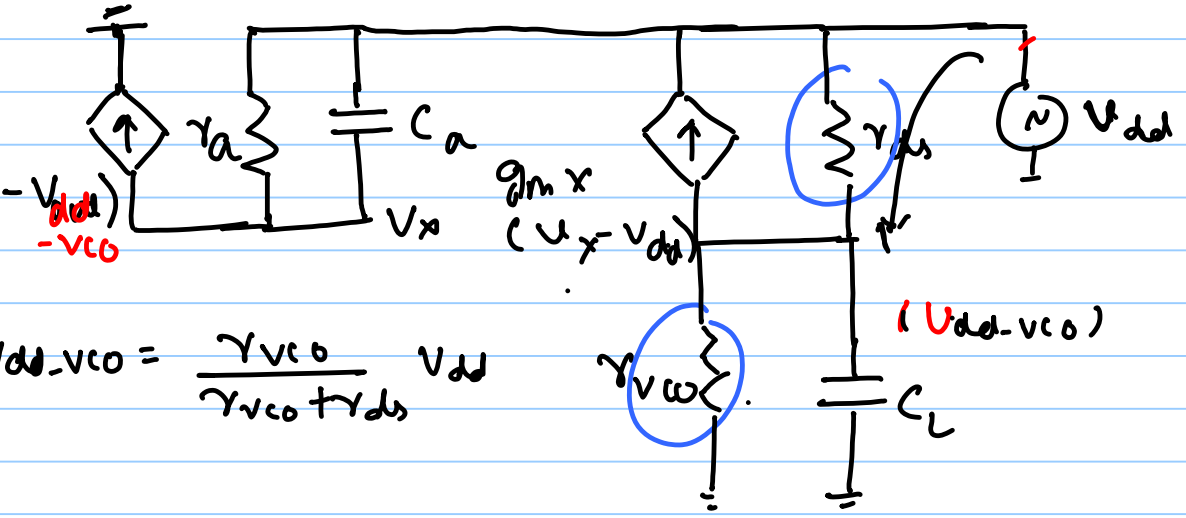
Lecture # 27

Note Title 27-09-2018









C_a: mostly from M_P.

r_a: O/p imp. of amplifier.

r_{VCO}: $\approx V_{DD\_VCO} / I$

C_L:

$$V_{dd\_VCO} = \frac{r_{VCO}}{r_{VCO} + r_{ds}} V_{dd}$$

$V_{ctrl} \longrightarrow V_x$, $I_{VCO} \longrightarrow V_{DD\_VCO} = V_{ctrl}$ [V]

$v_{ctrl} \longrightarrow v_{dd\_VCO} \longrightarrow \phi_{out}$ v_{dd} V_{out}

$$LG_{reg} = \frac{A_a A_0}{(1+s/\omega_a)(1+s/\omega_0)} \checkmark$$

$A_a = g_{ma} r_a$,

$A_0 = g_m (r_{ds} \| r_{VCO})$

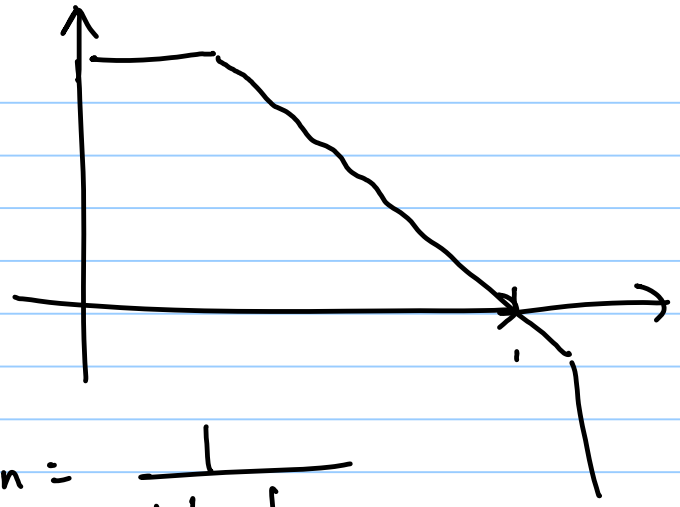
$$\omega_a = \frac{1}{r_a C_a}$$

$$\omega_0 = \frac{1}{r_0 C_L}$$

$V_{ctrl} \longrightarrow V_{dd\text{-}vco}$ | $\Delta f_{vco} = K_{vco} \cdot V_{dd\text{-}vco}$

$$\frac{V_{dd\text{-}vco}(s)}{V_{ctrl}(s)} = \frac{LH_{reg}}{1 + LH_{reg}} \approx \frac{1}{(1 + s/\omega_{reg})}$$

$$= \frac{1}{1 + \frac{1}{LH_{reg}}} = \frac{1}{1 + \frac{(1+s/\omega_a)(1+s/\omega_b)}{A_a A_b}}$$



$$DC.gain = \frac{1}{1 + \frac{1}{A_a A_b}}$$

$$1 + A_a A_b + s\left(\frac{1}{\omega_b} + \frac{1}{\omega_a}\right) + \frac{s^2}{\omega_a \omega_b}$$

$\omega_a \ll \omega_b$

$$\omega_{p1} \approx (1 + A_a A_b)\,\omega_a$$

$$\frac{\Phi_{out}(s)}{V_{ctrl}(s)} = \frac{\Phi_{out}(s)}{V_{dd\text{-}vco}(s)} \times \frac{V_{dd\text{-}vco}(s)}{V_{ctrl}(s)}$$

$$= \frac{2\pi K_{vco}}{s} \times \frac{1}{(1 + s/\omega_{reg})}$$

$$LH_{pll} = \frac{I_{cp}}{2\pi}\left(R + \frac{1}{sC_1}\right) \frac{2\pi K_{vco}}{s} \frac{1}{(1 + s/\omega_{reg})}$$

LH

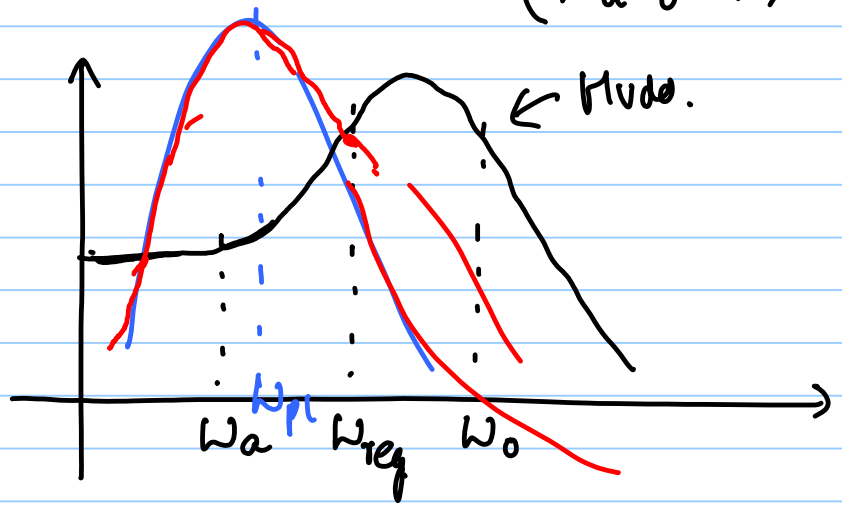
$$ax^2 + bx + c = 0$$

$$x_1 + x_2 = -b/a$$

$$x_1 x_2 = c/a$$

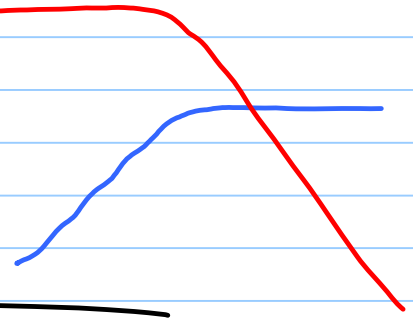
$$H_{vdd} = \frac{V_{dd\text{-}vco}(s)}{V_{dd}(s)} = \frac{S_{vdd}\ (1+s/\omega_a)}{A_a A_0 + (1+s/\omega_a)(1+s/\omega_0)} \qquad S_{vdd} = \frac{r_{vco}}{(r_{vco}+r_{ds})}$$

V_{dd} D.C. $= \dfrac{S_{vdd}(\quad)}{(A_a A_0 + 1)}$



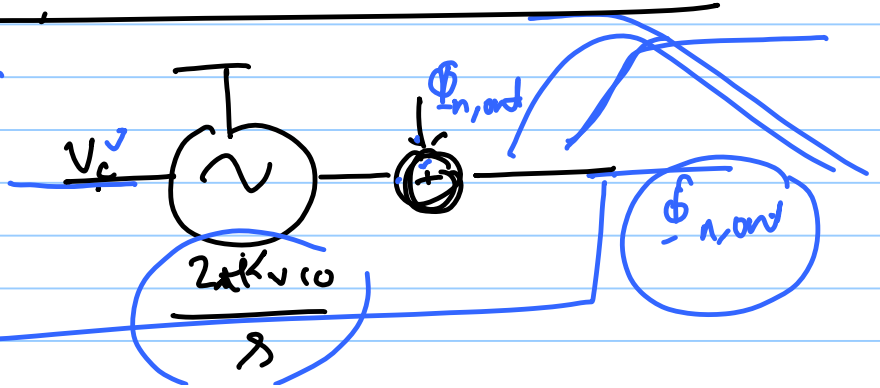
$$\frac{(V_{dd} - V_{dd\text{-}vco})}{r_{ds}} + g_m(V_x - V_{dd}) = \frac{V_{dd\text{-}vco}}{r_{vco}}$$

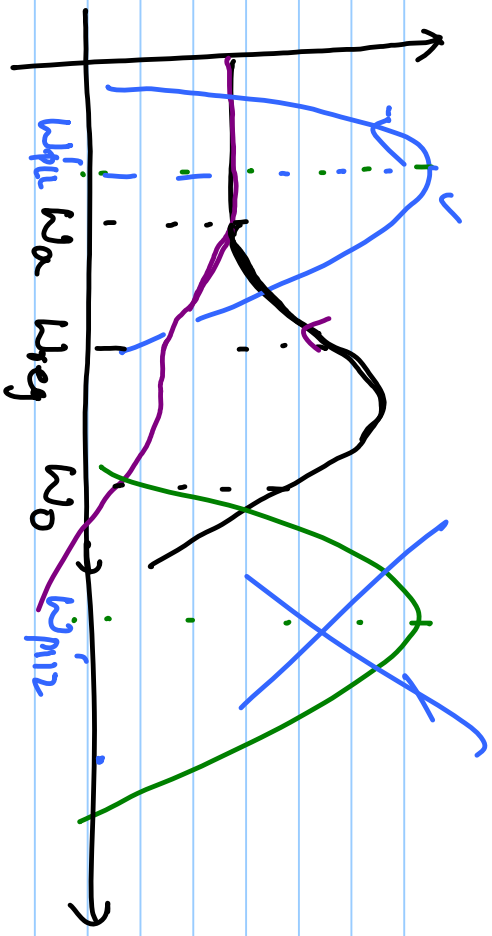
$V_x =$



$\omega_{reg} = \omega_a$

$f_{out} = K_{vco} \cdot V_c$





ω_0 ω_a