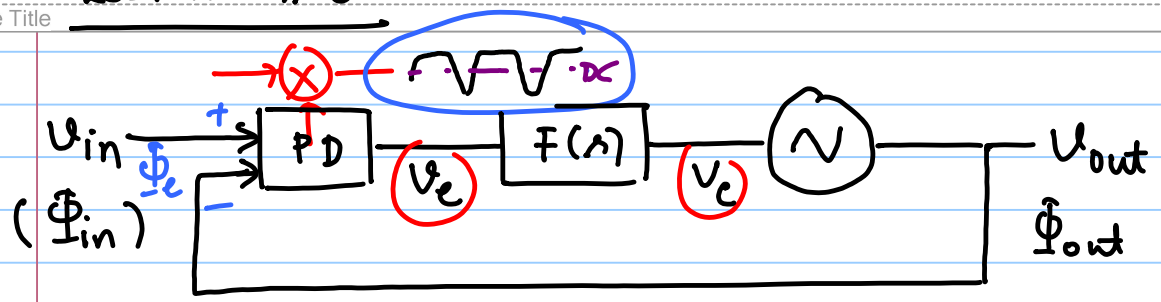
Note Title 09-08-2018

Lecture #6



ω_{in} : Input freq.

ω_{out} : O/p freq.

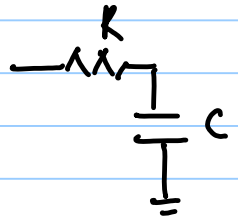
$\omega_{out} = \omega_{free} + 2\pi K_{VCO} \cdot v_c$

at $t=0$, $v_c = 0$

$\Delta\omega = \omega_{in} - \omega_{out} = \omega_{in} - \omega_{free}$

$\Delta\omega > 2\pi K_{VCO} \cdot K_{pd} F(0)$

Case 1: $F(s) = \dfrac{1}{1+s/\omega_p}$

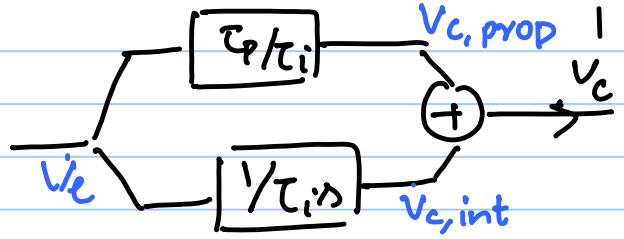


Case 2: $F(s) = \dfrac{1}{s}$ ✓

$K = 2\pi K_{VCO} \cdot K_{pd} F(0) \to \infty$

At $t \to \infty$, $\omega_{out} = \omega_{in}$

Case 3: $F(s) = \dfrac{1}{\tau_i}\left(\dfrac{1}{s}\right) + \dfrac{\tau_p}{\tau_i}$



$\Delta\omega_p < K\sqrt{\dfrac{2K_{DC}}{K} - 1}$

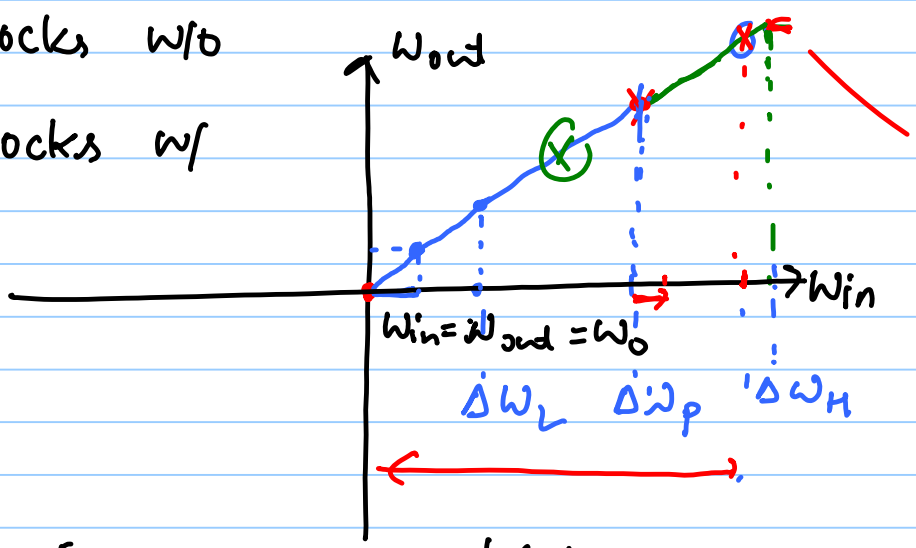
$K_{DC} = 2\pi K_{pd} K_{VCO} F(0)$, $K = 2\pi K_{pd} K_{VCO} F(\infty)$

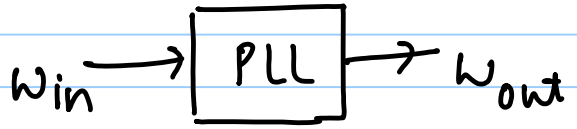
$$\Delta\omega = 2\pi K_{VCO} \cdot v_c = 2\pi K_{VCO}\,(v_{c,prop} + v_{c,int})$$

$v_{c,prop} = 0$, $v_{c,int} \neq 0$

$\Delta\omega = 2\pi K_{VCO} \cdot v_{c,int} \rightarrow v_e = 0$

1. Lock-in Range ($\Delta\omega_L$): Range of freq. ($\Delta\omega$) PLL locks w/o cycle slipping. ✓
2. Pull-in Range ($\Delta\omega_P$): Range of freq. ($\Delta\omega$) PLL locks w/ cycle slipping.
3. Hold-in Range ($\Delta\omega_H$):





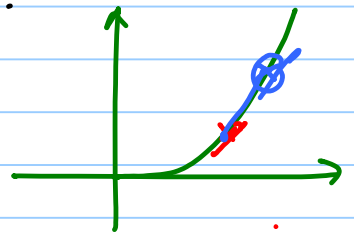
$t=0$, $\omega_0 = \omega_{out} = \omega_{in} \Rightarrow \Delta\omega = 0$

$\omega_{in} = \omega_0 + \Delta\omega \rightarrow \omega_{out} = \omega_0 + \Delta\omega$

eg: $\omega_{in} = \omega_{out} = 1\ GHz$.

$\Delta\omega_L = 50\ MHz$.

$\Delta\omega_P = 200\ MHz$.



$\omega_{in} = \omega_{out}$

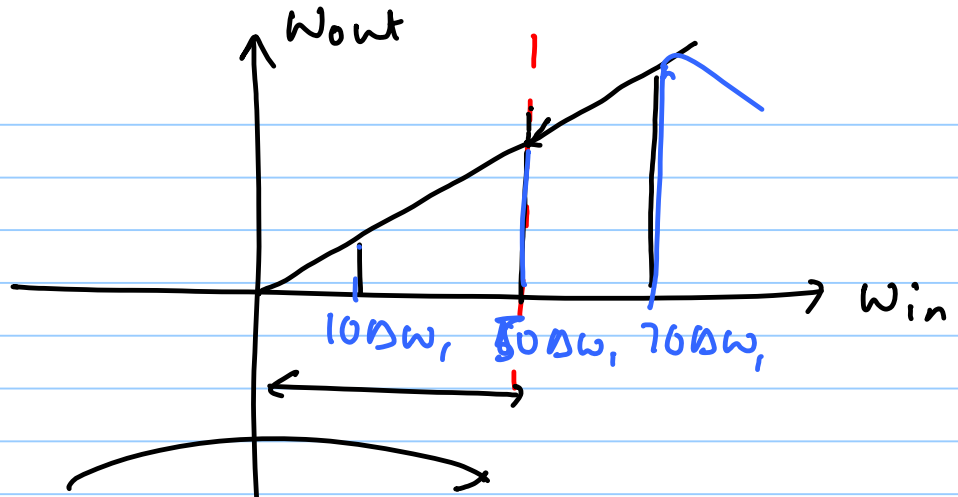
$v_e = 0$, $v_c = \dfrac{\Delta\omega}{2\pi K_{VCO}} \rightarrow \dfrac{\Delta\omega'}{2\pi K_{VCO}}$

$\Delta W_L = 10\,\Delta W_1$

$\Delta W_P = 50\,\Delta W_1$

$\Delta W_H = 70\,\Delta W_1$

at $t=0$, $W_{in} = W_{out}$



Case1 $t = t_1$, $W_{in}: W_0 + 49\Delta W_1 \longrightarrow W_0 + 50\,\Delta W_1 < \Delta W_P$

Case2 $t = t_1$, $W_{in}: W_0 \longrightarrow W_0 + 50\,\Delta W_1$

$\Delta W > \Delta W_P$

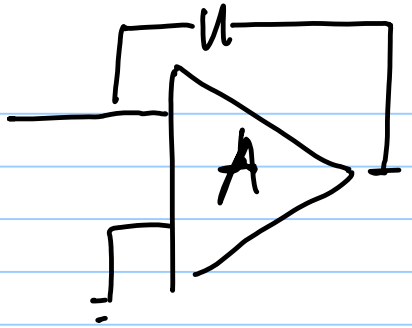
$\Delta W = 50.1\,\Delta W_1$

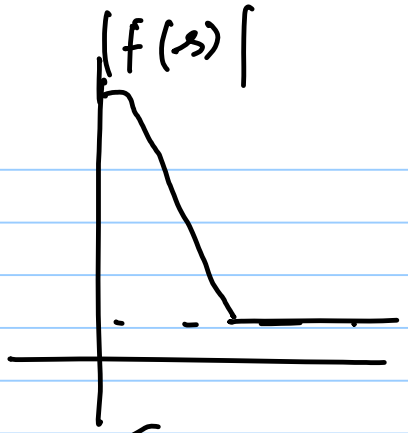
$50\Delta W_1 \longrightarrow 50.001\,\Delta W_1$

φ_e	V_e	V_c	ΔW
	0.49	~~V_{c1}~~	$50\,\Delta W_1$
		V_c	$50.001\,\Delta W_1$

$$V_c = V_{c,prop} + V_{c,int}$$

$$V_c = \frac{\tau_p}{\tau_i} V_e + V_{c,int}$$





$$\Delta\omega = 60\Delta\omega_1 \longrightarrow V_c = \frac{60\Delta\omega_1}{2\pi K_{VCO}} \longrightarrow V_e \longrightarrow \phi_e$$