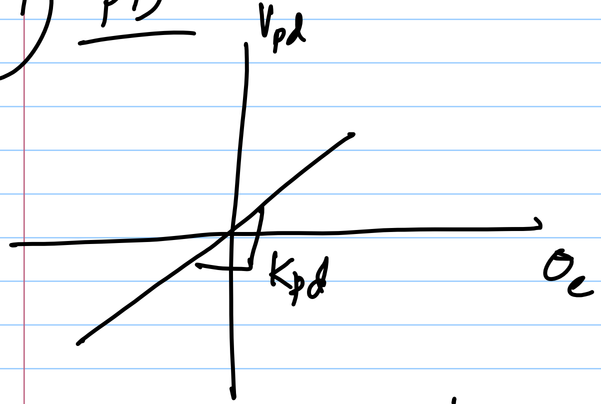
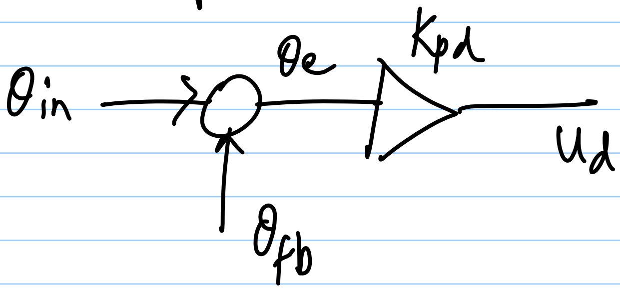
15/4/13

Lec 42

$$\frac{U_d}{\theta_e}(s) = K_{pd}$$

1) PD





2) VCO

$$W_o = W_{free} + K_{vco} \cdot V_c(t)$$

$$w = \frac{d\theta}{dt} \; ; \; \theta = \int w \, dt$$

$$\theta_o = \int K_{vco} V_c(t)$$

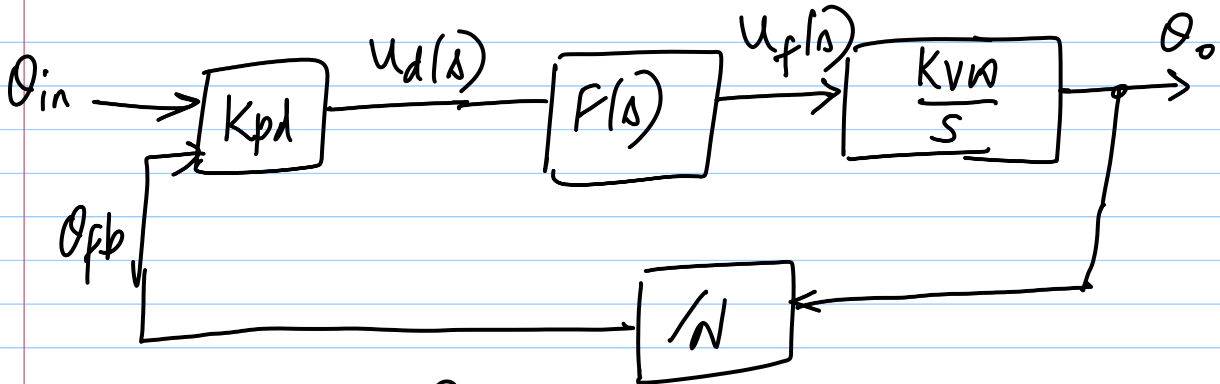
$$\theta_o(s) = \frac{K_{vco}}{s} \cdot V_c(s)$$

$$\frac{\theta_o}{V_c}(s) = \frac{K_{vco}}{s}$$

3) Divider

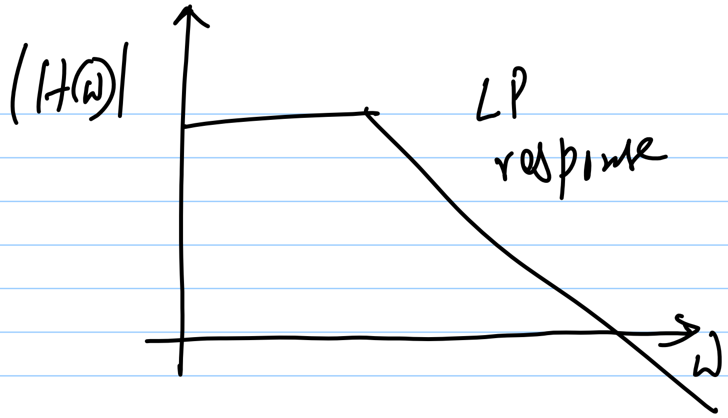
$$\frac{\theta_{fb}}{\theta_o}(s) = \frac{1}{N}$$

Linear PLL model



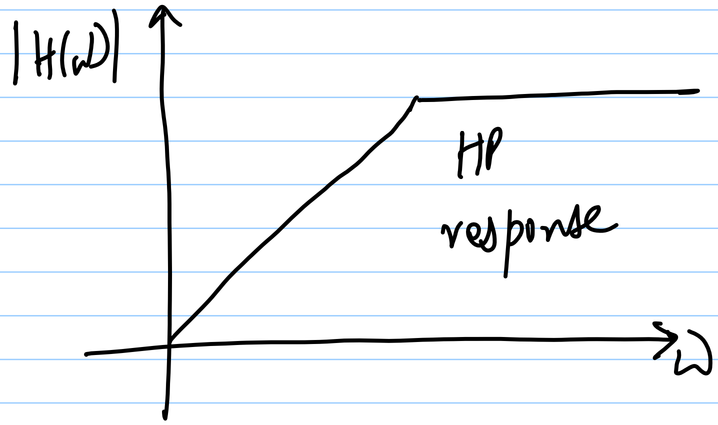
$\star$ $$H(s) = \frac{\theta_{fb}}{\theta_{in}}(s)$$

$$= \frac{K_{pd} K_{vco} F(s)/N}{s + K_{pd} K_{vco} F(s)/N}$$



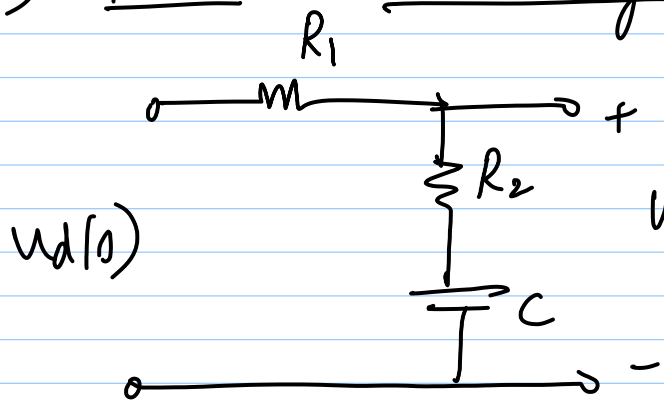
$$* \; H_e(s) = \frac{\theta_e(s)}{\theta_{in}(s)} = 1 - H(s)$$

$$= \frac{s}{s + K_{pd} K_{vco} F(s)/N}$$



Loop Filters F(s)

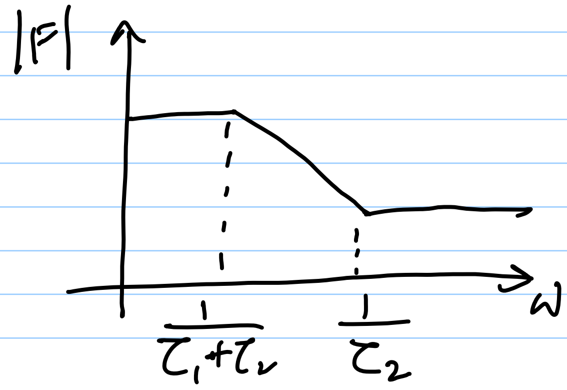
1) Passive Lead-lag filter



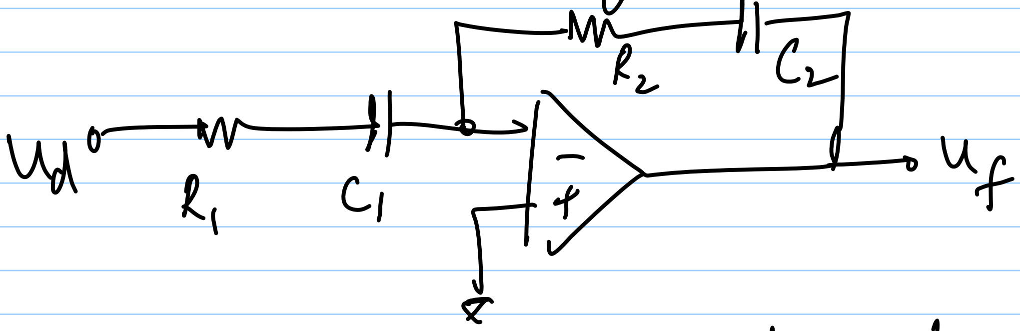
$\tau_1 = R_1 C$

$\tau_2 = R_2 C$

$$F(s) = \frac{1 + s\tau_2}{1 + s(\tau_1 + \tau_2)} \quad \begin{matrix}\text{(lead)} \\ \text{(lag)}\end{matrix}$$

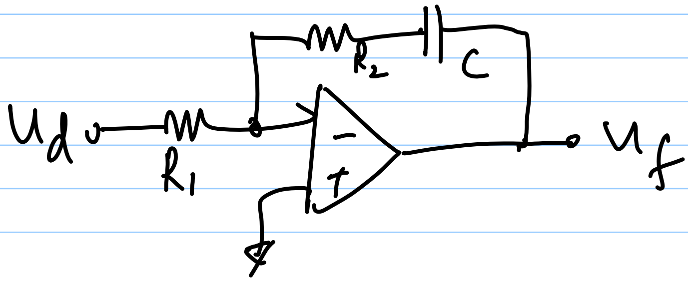


2) Active lead lag filter



$$K_a = C_1/C_2 \; ; \quad F(s) = K_a \cdot \frac{1 + s\tau_2}{1 + s\tau_1}$$

3) Active PI filter (proportional + Integral)



$$F(s) = \frac{+1}{R_1}\left[\frac{1 + sCR_2}{sC}\right] = + \frac{1 + s\tau_2}{s\tau_1}$$

* for the PI filter

$$H(s) = \frac{\dfrac{K_{pd} K_{vco}}{N} \cdot \dfrac{(1 + s\tau_2)}{\tau_1}}{s^2 + s \cdot \dfrac{K_{pd} K_{vco} \tau_2 / N}{\tau_1} + \dfrac{K_{pd} K_{vco} / N}{\tau_1}}$$

$$(s^2 + 2\zeta\omega_n s + \omega_n^2)$$