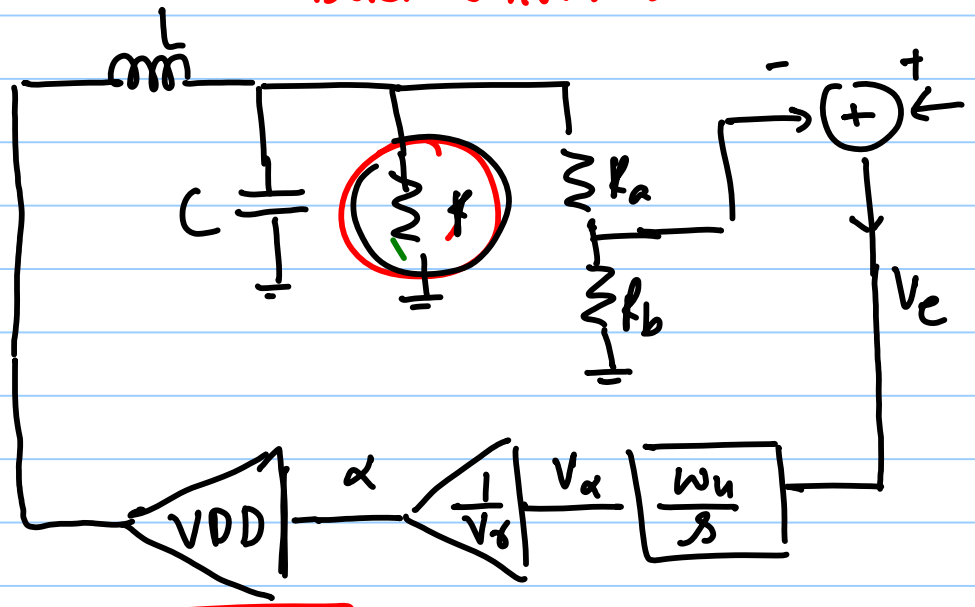
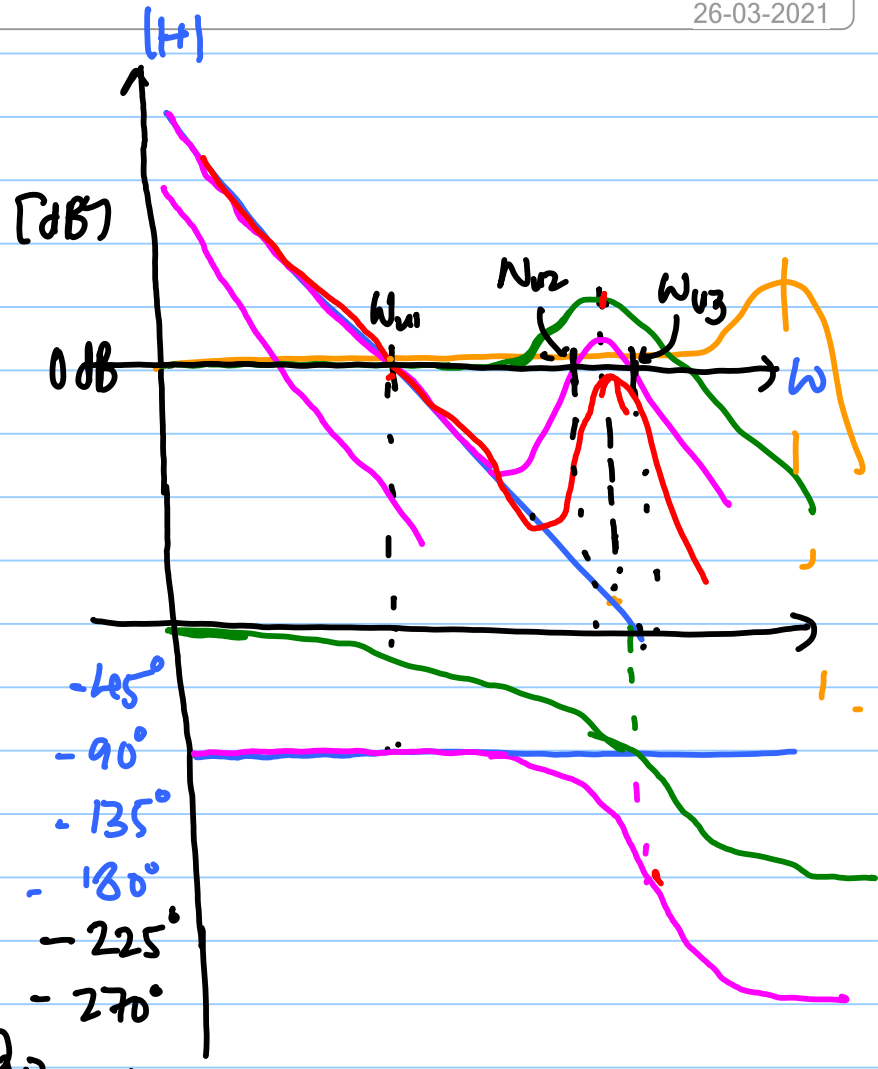
Note Title

Lecture # 28

"Buck Converter"





$$L_h = \underbrace{\frac{1}{K}\,\frac{\omega_u}{s}\,\frac{VDD}{V_r}}_{H_1}\ \checkmark \qquad \underbrace{\frac{1}{1+\frac{sL}{R}+s^2LC}}_{H_2}\ \checkmark$$

$$\frac{1}{1+\frac{s}{\omega_p Q_p}+\frac{s^2}{\omega_p^2}}\ \checkmark$$

will have peak value of Q_p.

and $\omega_0 = \omega_p\sqrt{1-\frac{1}{2Q_p^2}}$

$$\omega_p = \frac{1}{\sqrt{LC}}$$

$$\omega_{u1} = \frac{\omega_u\, VDD}{K\, V_r}\ \checkmark$$

Peak value of H_2 is Q_p.

Value of $|H_1|$ at peak freq. ω_0 $= \dfrac{\frac{\omega_n}{K}\frac{VDD}{V_Y}}{\omega_0} = \dfrac{\omega_{n1}}{\omega_0}$

$$\left[\frac{\omega_{n1}}{\omega_0} \times Q_p\right] < 1$$

$$\omega_{n1} < \frac{\omega_0}{Q_p}$$

$$\frac{\omega_n}{K}\frac{VDD}{V_Y} < \frac{\omega_0}{Q_p}$$

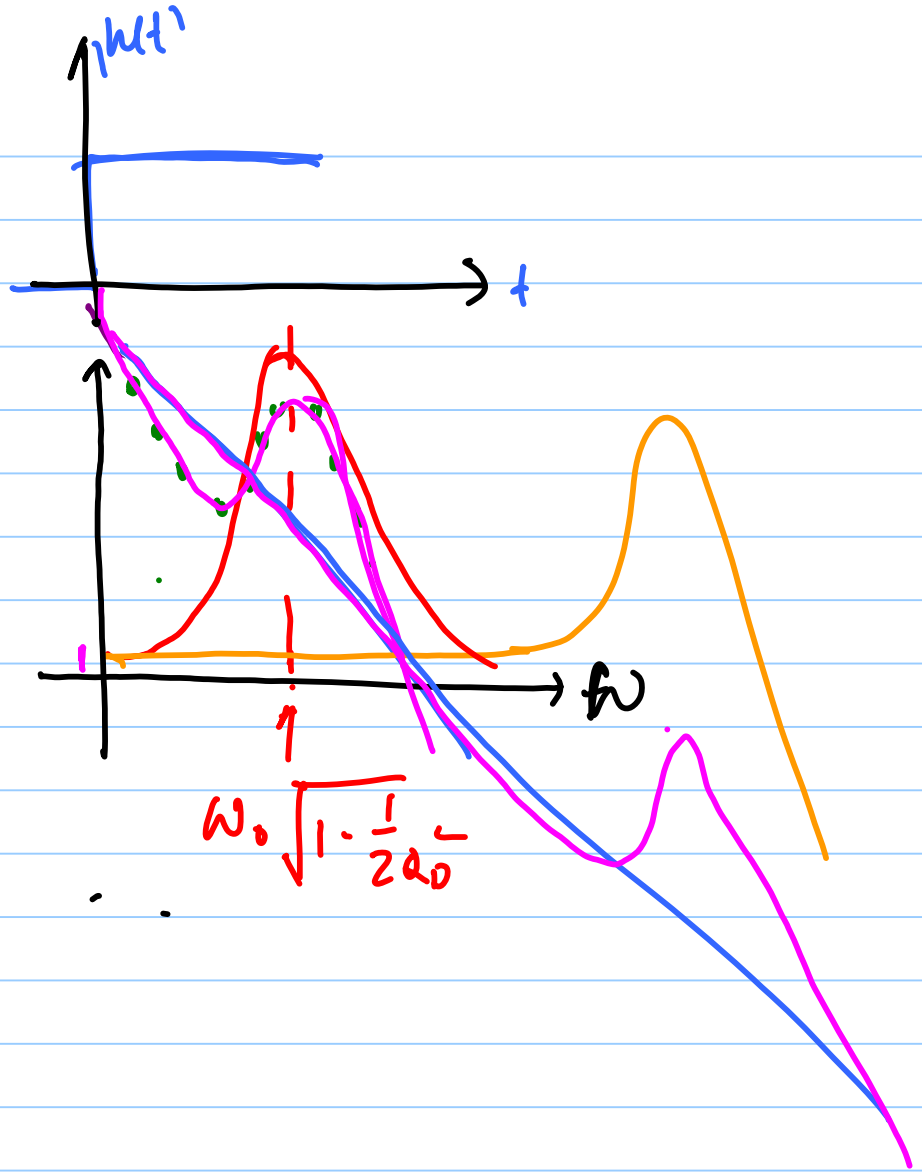
$$\frac{1}{1 + \frac{sL}{R} + s^2LC}$$

$$= \frac{1/LC}{s^2 + \frac{s}{RC} + \frac{1}{LC}}$$

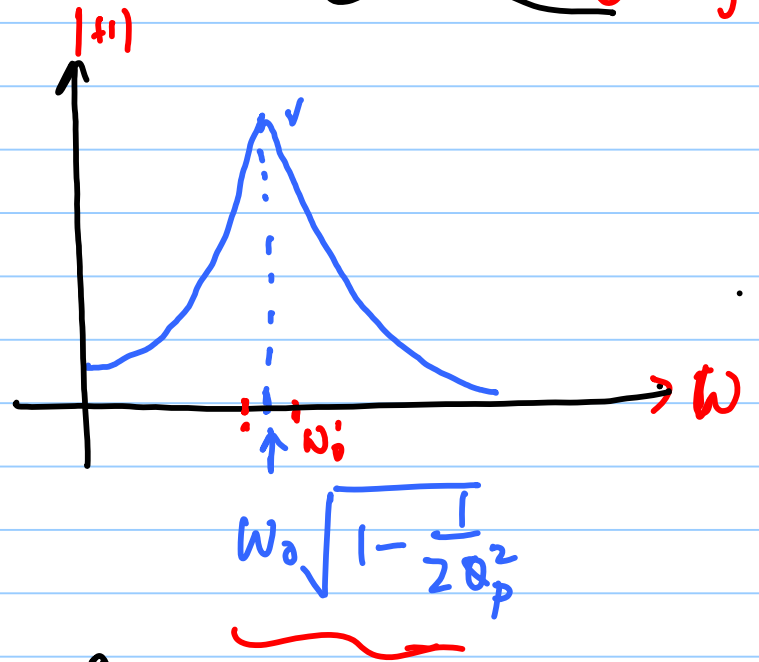
$$= \frac{1}{\left(s+\frac{1}{2RC}\right)^2 + \frac{1}{LC} - \frac{1}{4R^2C^2}}$$

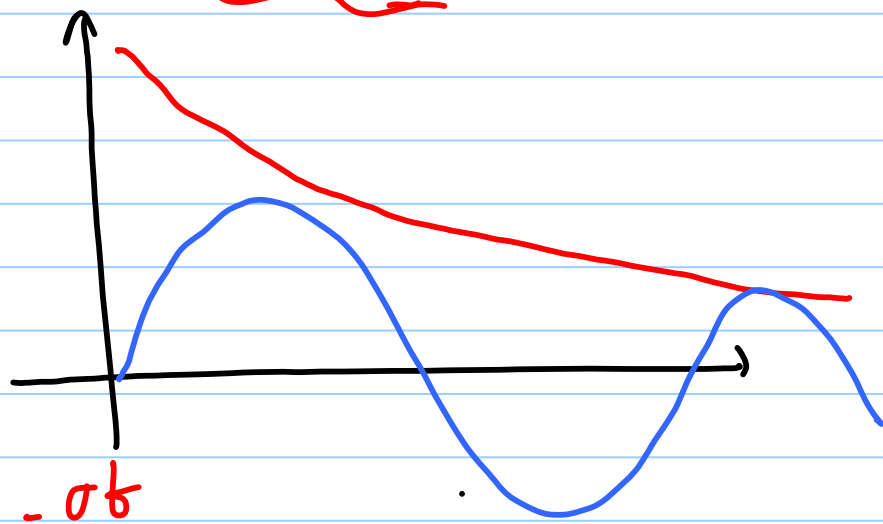
$$= \frac{1}{\left(s+\frac{1}{2RC}\right)^2 + \frac{1}{LC}\left(1 - \frac{L}{4R^2C}\right)}$$

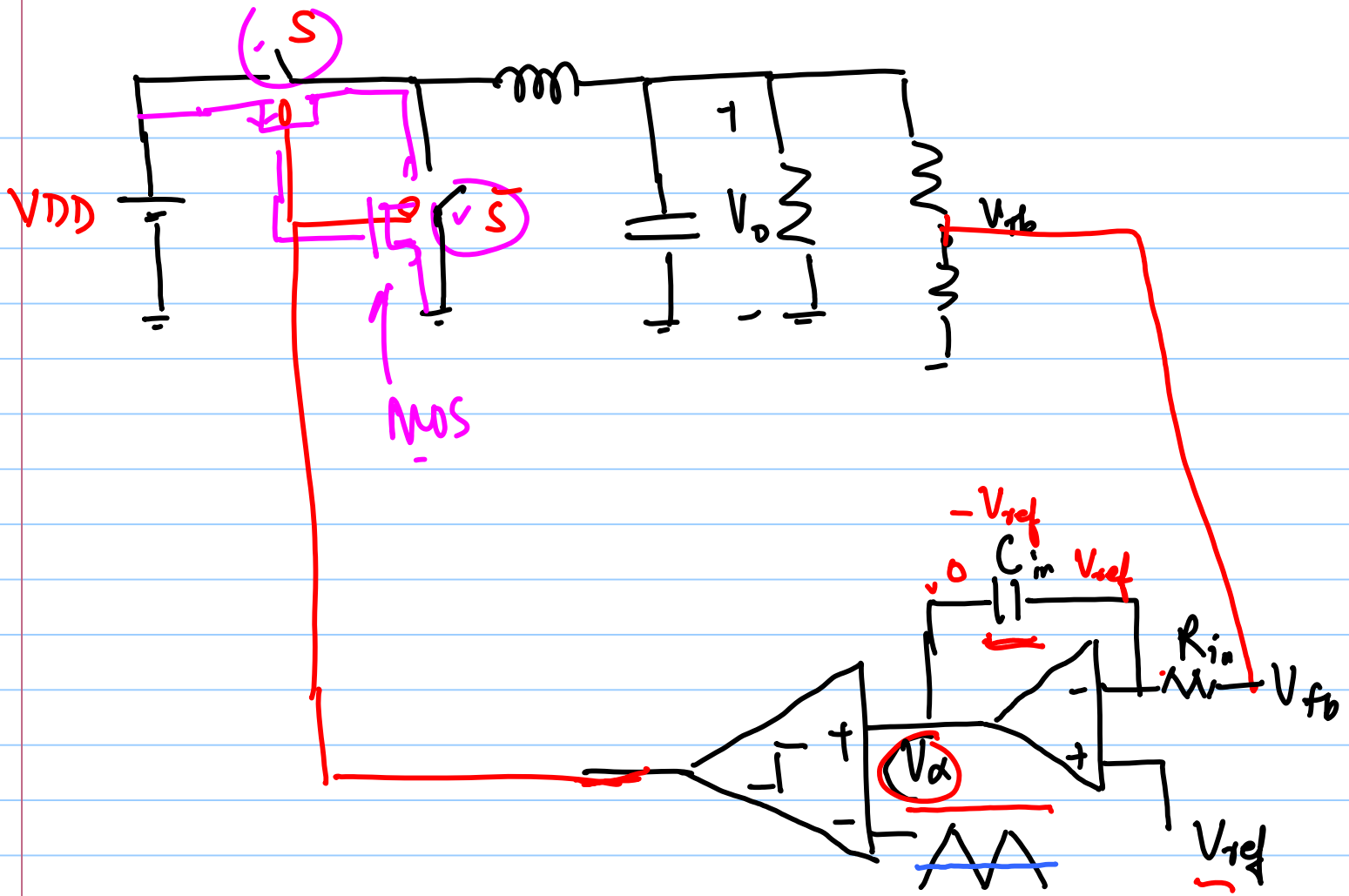
$$= \frac{1}{(s+\sigma)^2 + \omega_p^2\left(1 - \frac{1}{(2Q_p)^2}\right)}$$



$$\omega_0' = \omega_p\sqrt{1-\frac{1}{2Q_p^2}}$$





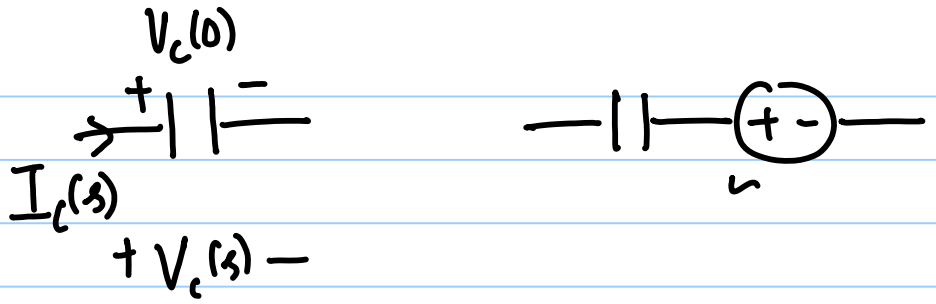


$$\left(V_{ref} - \frac{V_{fb}}{k}\right)\frac{W_u}{s}$$

$$\frac{(V_{fb} - V_{ref})}{R_{in}} = (V_{ref} - V_\alpha)\, s C_{in}$$

$$V_\alpha = V_{ref} + \left(\frac{V_{ref} - V_{fb}}{s C_{in} R_{in}}\right)$$

$= V_{\text{[illegible]}} + \left(V_{ref} - \frac{V_0}{K}\right)\left(\frac{1/C_{in}K_{in}}{s}\right)$



$$i_c = C \frac{dV}{dt}$$

$$\int dV = \frac{1}{C} \int i_c \, dt$$