

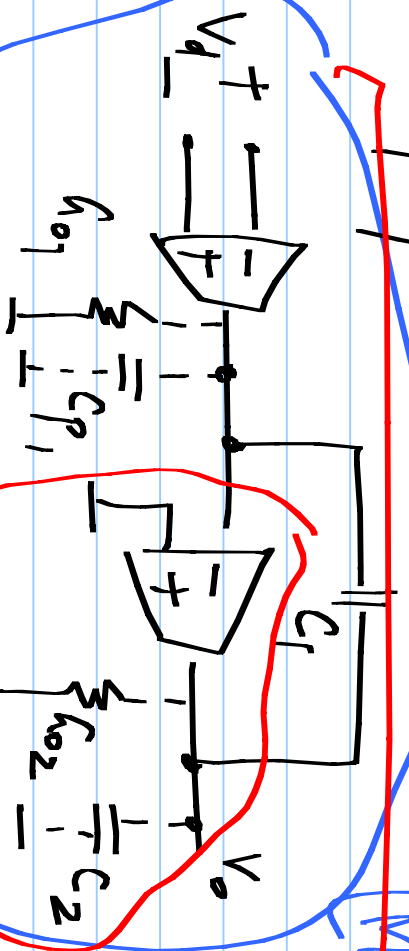
Lecture 28

15/3/2016

Beltz integrator

(Miller compensation)

Two stage

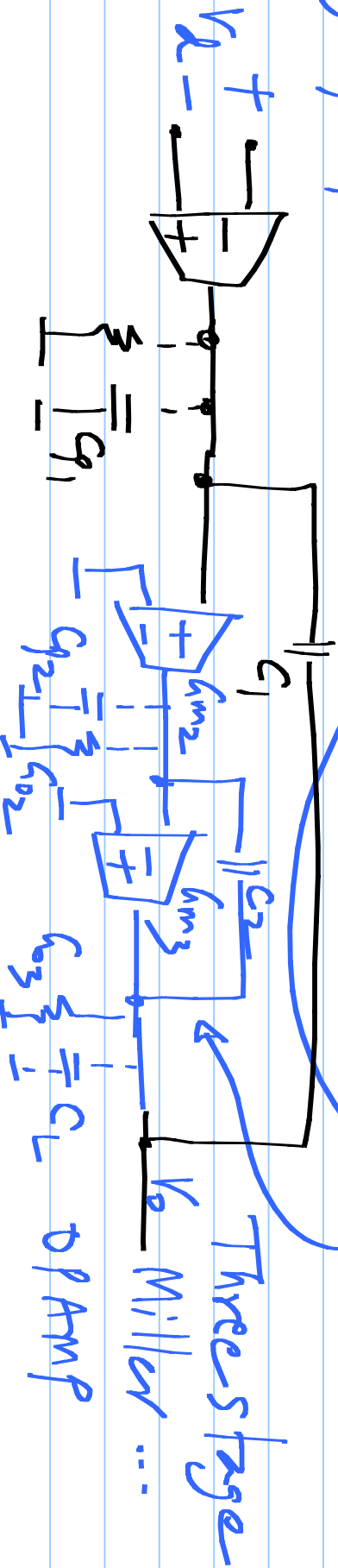
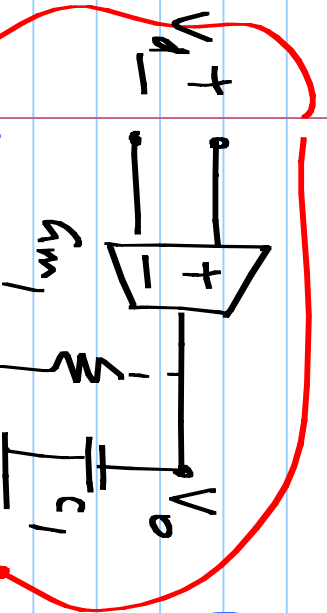


opamp

Integrator for realizing

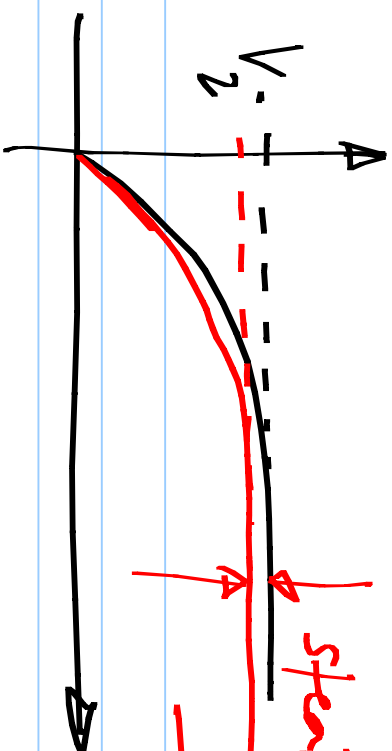
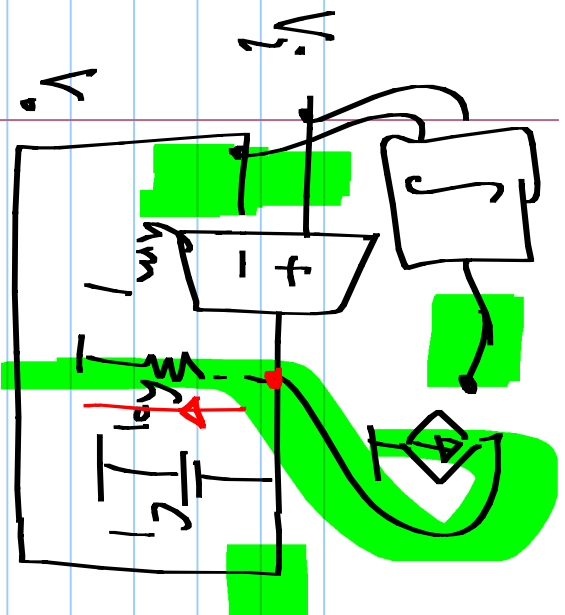
-ve feedback

Single stage opamp



Three stage

Miller ...



steady state error $\propto \frac{1}{A_0}$

$$A_0 = \frac{g_{m1}}{h_{o1}}$$



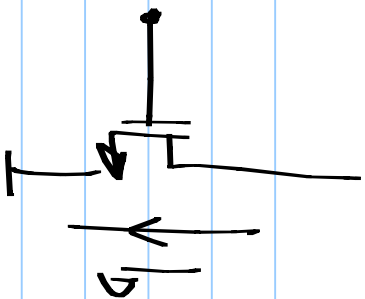
$h_c > 0$

$$V_0 =$$

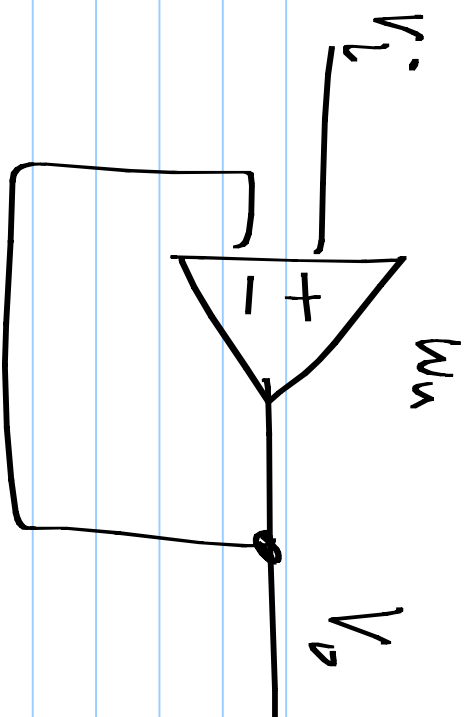
$$\left(g_{m1} + g_{m3} \cdot \frac{g_{m2}}{h_{o2}} \right)$$

$$h_{o1} + h_{o3}$$

$$g_m = \sqrt{2 I_D \cdot \mu_n C_{ox} W/L}$$



$$g_{ds} = 1/r_D$$



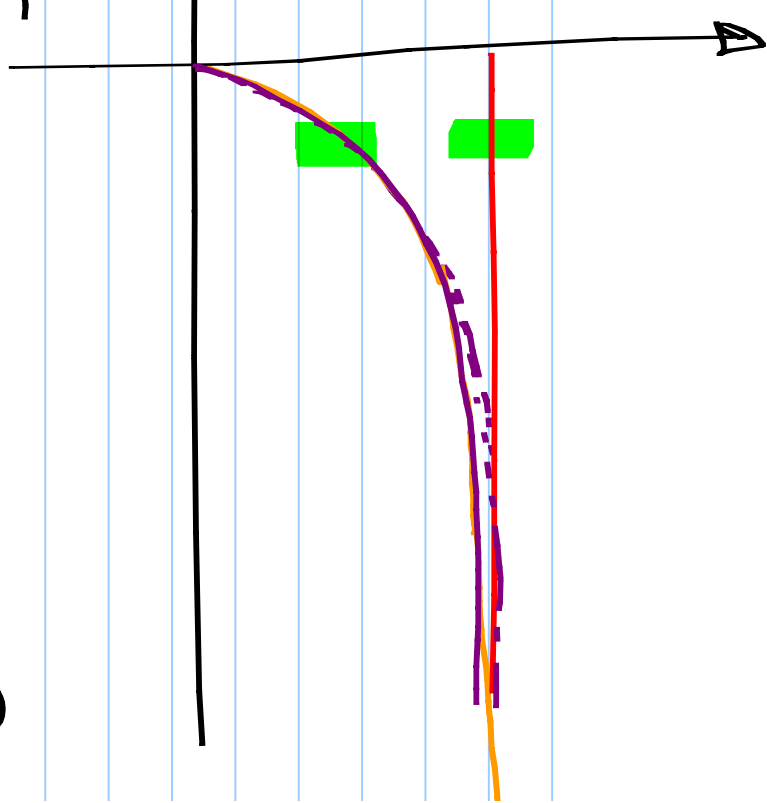
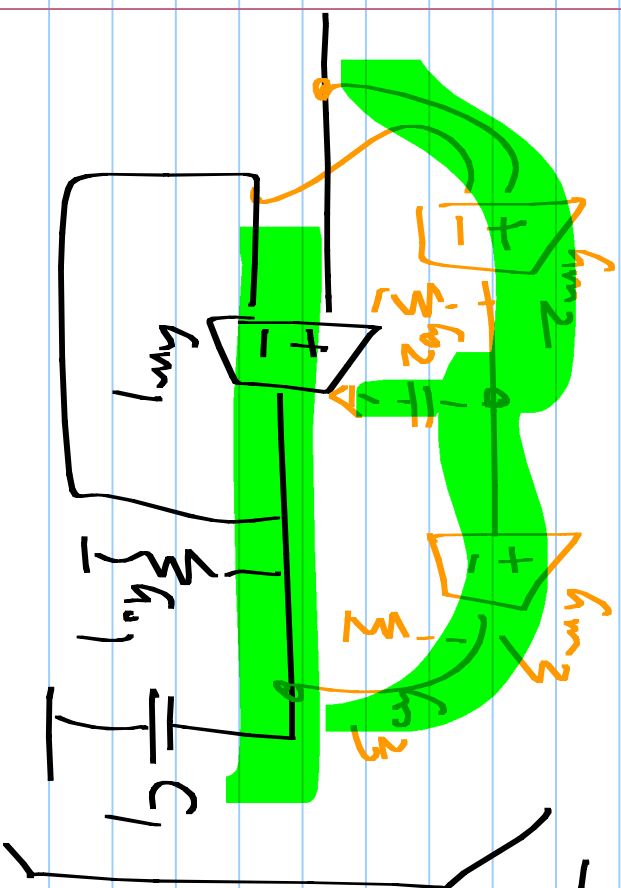
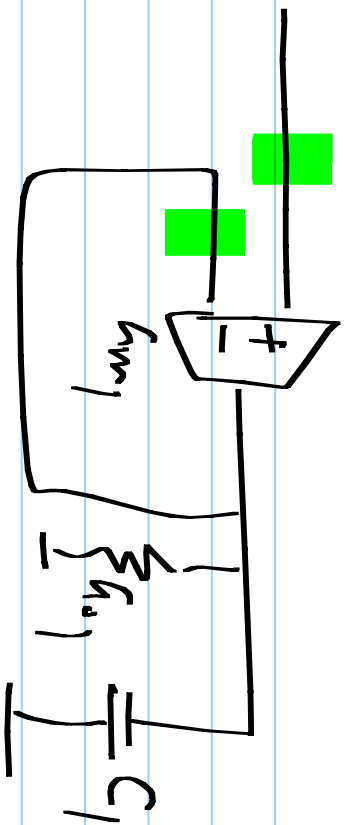
$$\frac{V_p}{V_l} = \frac{1}{1 + \frac{S}{m\omega_n^2}}$$

$$V_l = V_p \cos \omega_n^2 t$$

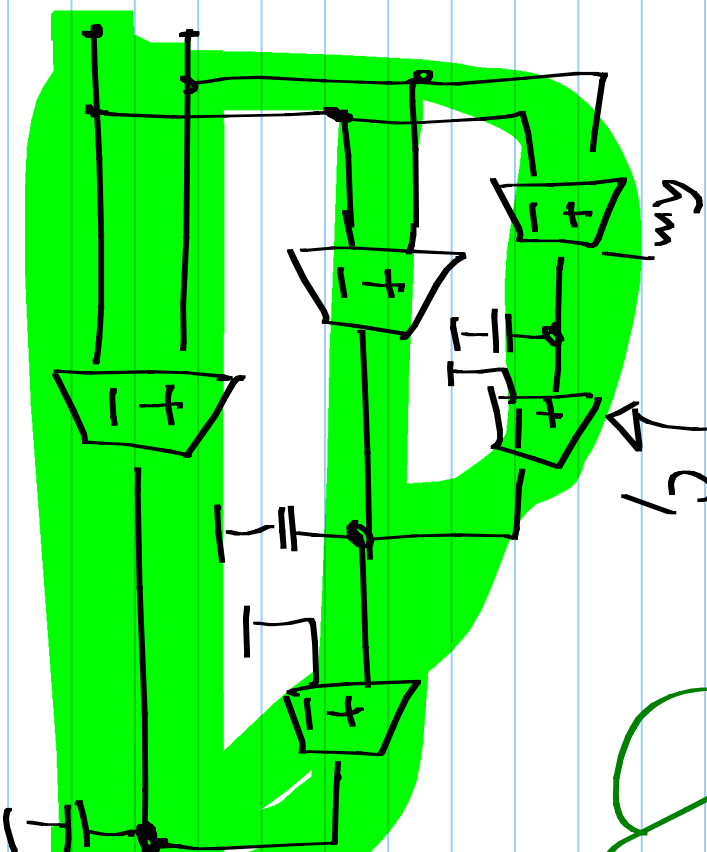
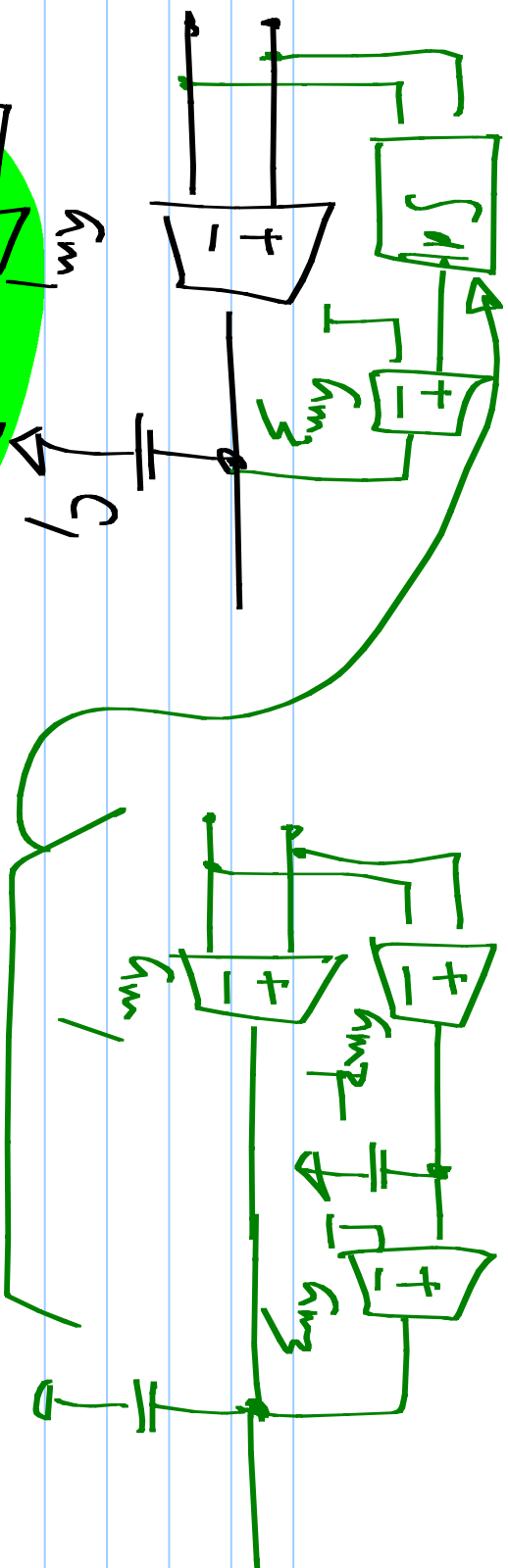
$$\omega_l^2 \ll \omega_n^2$$

$$V_p \approx V_p \cos \left(\omega_l^2 \left(t - \frac{1}{\omega_n^2} \right) \right)$$

$$V_p \sqrt{1 + \left(\frac{\omega_l^2}{\omega_n^2} \right)^2}$$



(Feedforward compensated)
open



or
Three stage ff
opamp