10/27/2009

1. voltage amplifier → series-shunt

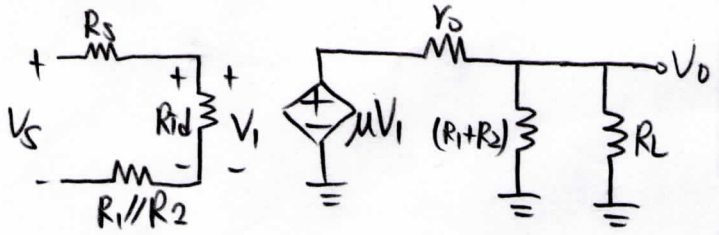
current amplifier → shunt-series

transconductance amplifier → series-series

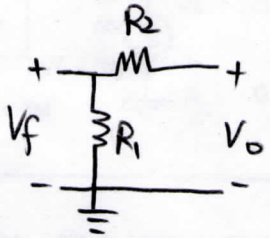
transresistance amplifier → shunt-shunt

2. P.808

(a) A circuit



B circuit



(b)

$$A=\frac{V_o}{V_{in}}=\mu\frac{(R_1+R_2)\,//\,R_L}{(R_1+R_2)\,//\,R_L+r_o}\times\frac{R_{id}}{R_s+R_{id}+R_1\,//\,R_2}=10^4\times\frac{(1k+1M)\,//\,5k}{(1k+1M)\,//\,5k+2k}\times\frac{50k}{2k+50k+1k\,//\,1M}\doteq 6729.0681\ \left(\frac{V}{V}\right)$$

$$\beta=\frac{R_1}{R_1+R_2}=\frac{1k}{1k+1M}\doteq 9.99\times10^{-4}=\frac{1}{1001}\left(\frac{V}{V}\right)$$

$$A_f=\frac{A}{1+A\beta}=871.3769\ \frac{V}{V}$$

3.

$$A=\frac{10^4}{(1+j\frac{f}{10^4})(1+j\frac{f}{10^5})(1+j\frac{f}{10^6})}$$

(a) $-\tan^{-1}(\frac{f}{10^4})-\tan^{-1}(\frac{f}{10^5})-\tan^{-1}(\frac{f}{10^6})=-180°$

$\Rightarrow f=3.35\times10^5$

(a) 使用 $\frac{1}{\beta}$，讓 $\phi=-180°$, gain = 0

$\therefore \frac{1}{\beta}=40dB \Rightarrow 40=20\log\frac{1}{\beta} \Rightarrow \beta=10^{-2}$

(b) $\phi=-135°$, gain = 0

$\frac{1}{\beta}=60dB \Rightarrow \beta=10^{-3}$

$A_f\simeq\frac{10^4}{1+10}=909.091$

5. (a).

$V_{OV} + V_{OV} + V_{TN} = 1.2 \leq V_{cm} \leq$ ~~$V_{DD} - V_{OV} + V_{TN}$~~

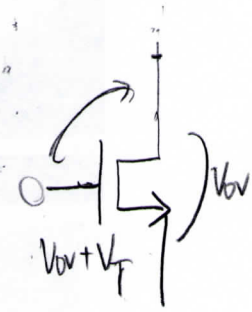
$0.2 \quad 0.2 \quad 0.8$

~~$3.3 - 0.2 + 0.8$~~

$V_{cm} - (V_{DD} - V_{ov4}) \leq V_{TN}$

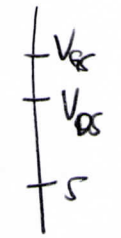
$3.3 - 0.2$

$V_{cm} \leq 3.9$ V

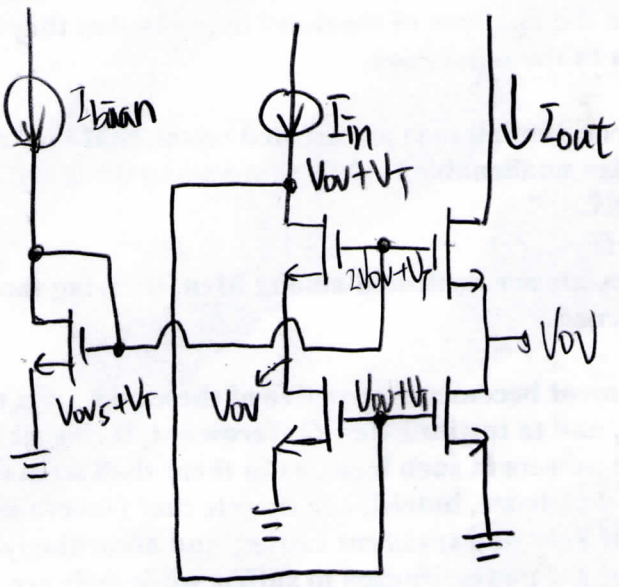


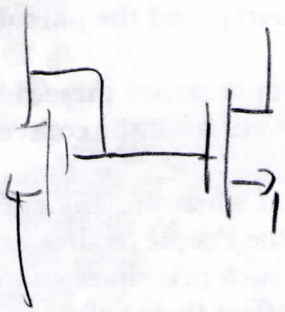
~~$1.2 = 0.2 + 0.8 + 0.2 + 0.8 - 0.8$~~ $\leq V_o \leq V_{DD} - V_{OV10} - V_{OV4}$

$3.3 - 0.2 - 0.2 = 2.9$



6.





$2 \times 0.2 + 0.8 = V_{ov5} + 0.8 \Rightarrow V_{ov5} = 0.4$

$I_{bias} = \frac{1}{2} k_n' \cdot \left(\frac{W}{L}\right)_5 \times V_{ov5}^2 = I_{out} = \frac{1}{2} k_n' \left(\frac{W}{L}\right)_4 \times 0.2^2$

$\left(\frac{W}{L}\right)_5 \times 0.16 = \left(\frac{W}{L}\right)_4 \times 0.04$

$\therefore \frac{4}{1} = \frac{0.16}{0.04} = \frac{n_2}{n_1} = \frac{\left(\frac{W}{L}\right)_4}{\left(\frac{W}{L}\right)_5}$

$V_{bias} = 2 \times 0.2 + 0.8 = 1.2\,V$