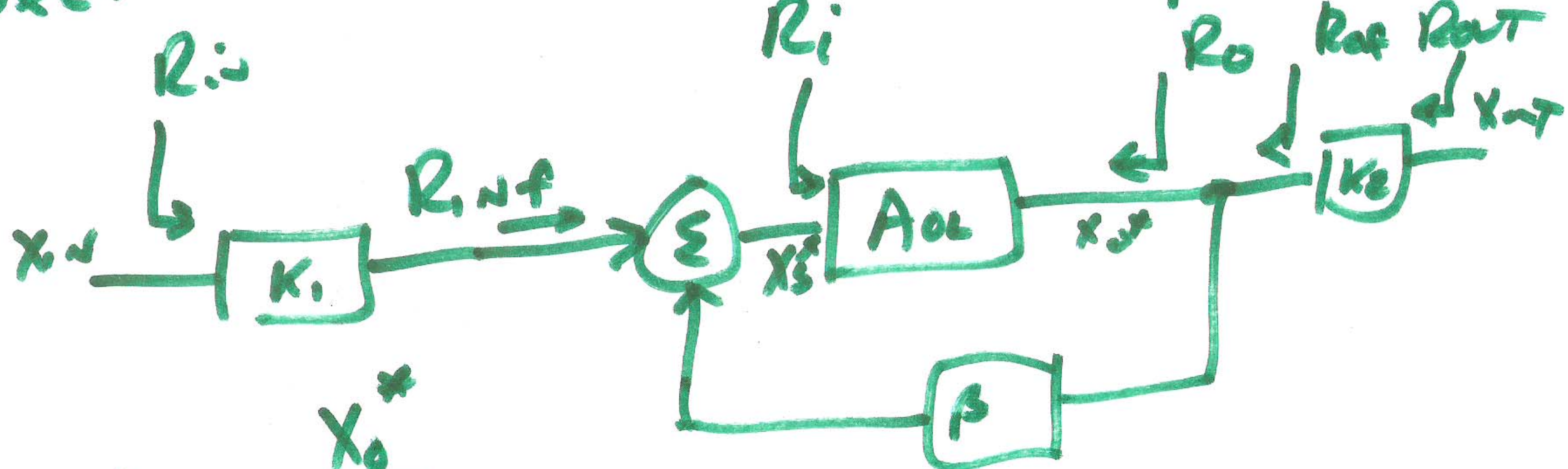
Sec. 31.3.4 Calculating open-loop parameters

Sec. 31.3.5 Calculating closed-loop parameters



$$A_{OL} = \frac{x_o^*}{x_s^*}$$

$$R_i = \frac{v_i^*}{i_i^*}$$

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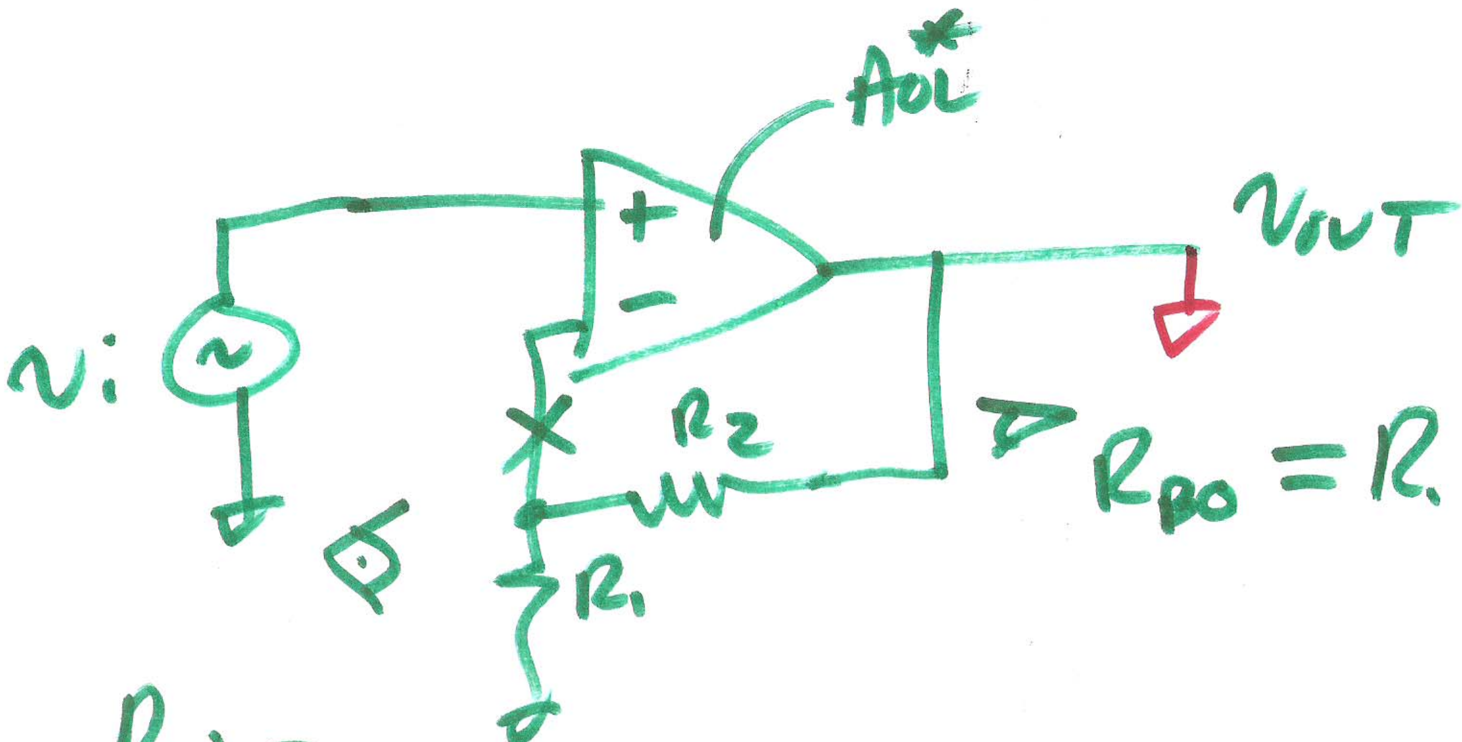
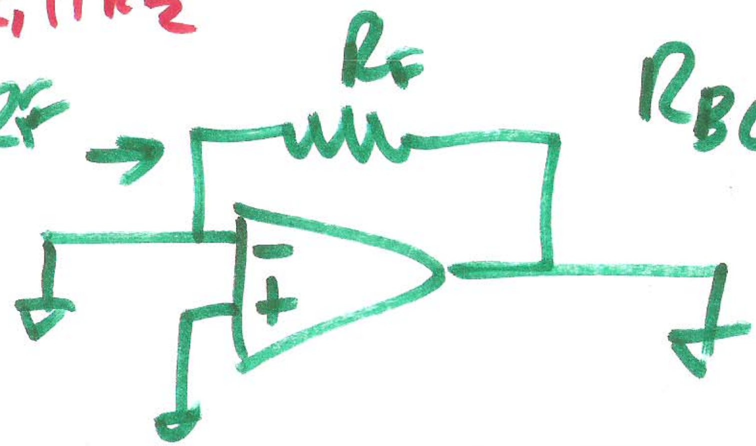


$R_{BO} = R_1 + R_2$

$R_{Bi} = R_1 \| R_2$

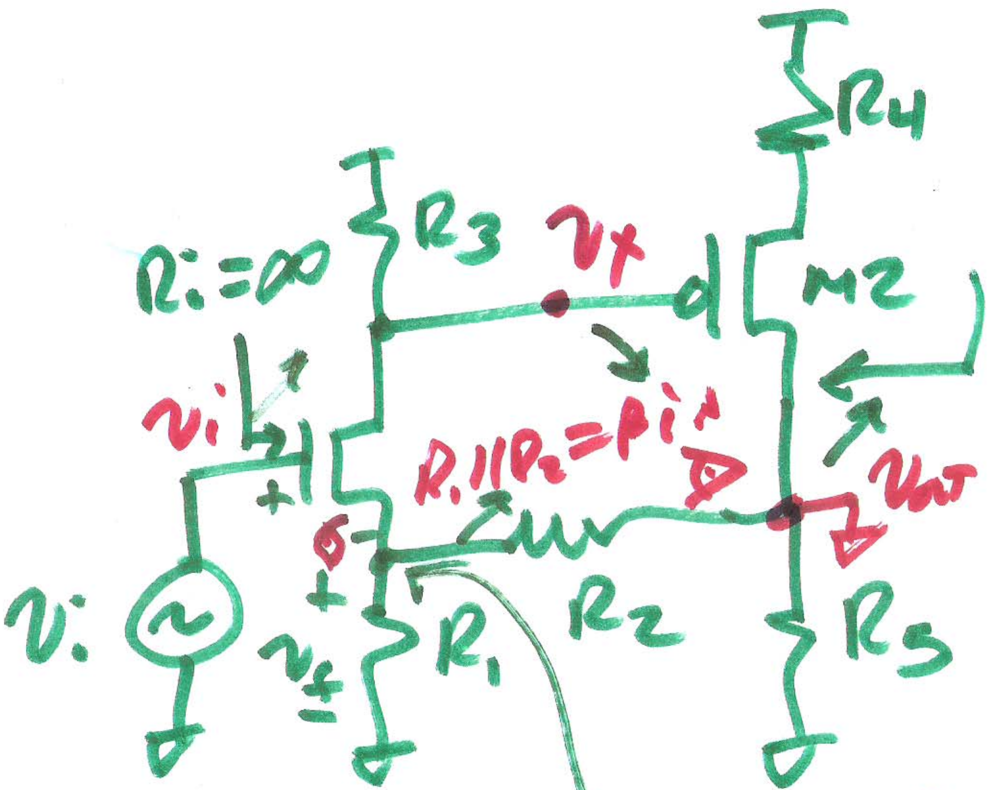
$R_{Bi} = R_F$



$R_{BO} = R_F$

Shunt-shunt
f.b. amp

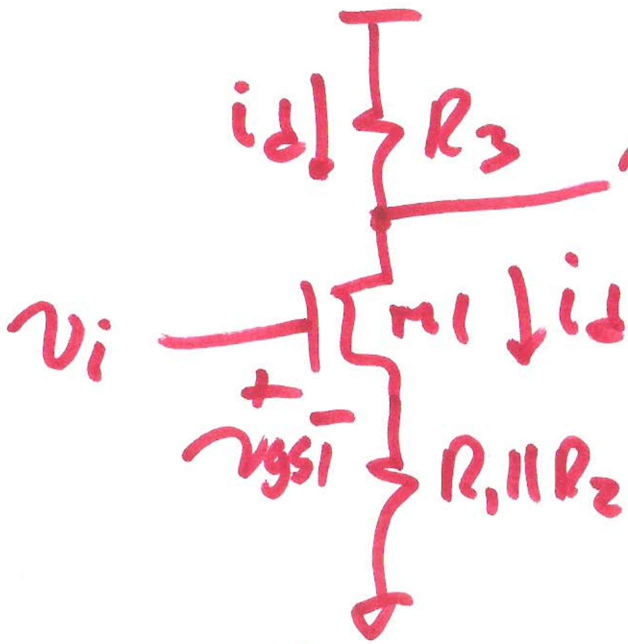
Series - shunt



$$R_o = R_5 \| \left(r_{o2}\left(1 + g_{m2} \cdot R_4\right)\right)$$

$$R_{BO} = R_1 + R_2$$

$$v_f = \underbrace{\frac{R_1}{R_1 + R_2}}_{=\beta} \cdot v_{out}$$



$$v_x = -i_d \cdot \left(R_3 \,\|\, r_{o1} \left(1 + g_{m1} \cdot R_1 \| R_2 \right) \right)$$

$$\approx -i_d \cdot R_3$$

A_{ol}^* calculation

$$g_m v_{gs} = i_d$$

$$v_i = v_{gs1} + i_d \cdot R_1 \| R_2$$

$$= i_d \left(\frac{1}{g_{m1}} + R_1 \| R_2 \right)$$

$$\boxed{\frac{v_x}{v_i} \approx \frac{-R_3}{1/g_{m1} + R_1 \| R_2}}$$

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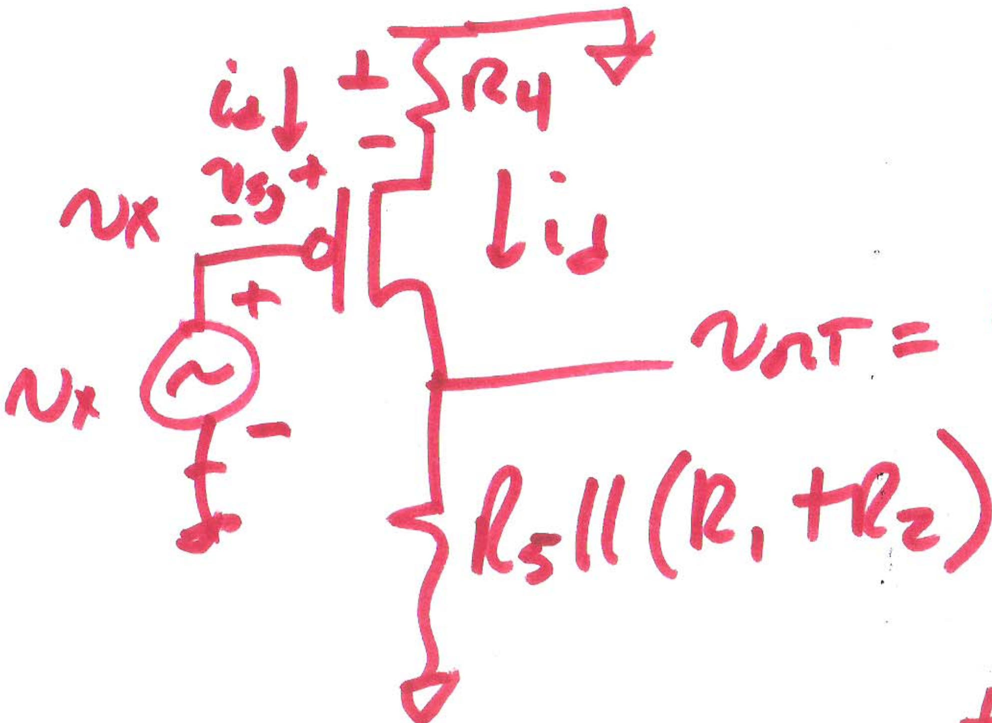

$v_{out} = i_d \cdot R_5 \| (R_1 + R_2)$

$$i_d \cdot R_4 + v_{sg2} + v_x = 0$$

$$i_d \left(R_4 + \frac{1}{g_{m2}}\right) = -v_x$$

$$\frac{v_{out}}{v_x} = -\frac{R_5 \| (R_1 + R_2)}{R_4 + 1/g_{m2}}$$

5)

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$$A_{OL}^{*} = \frac{v_o}{v_i} = \frac{R_3 \cdot \left(R_5 \| (R_1 + R_2)\right)}{\left(\frac{1}{g_{m1}} + R_1 \| R_2\right)\left(R_4 + \frac{1}{g_{m2}}\right)}$$

)