ECE 614 Advanced Analog IC Design

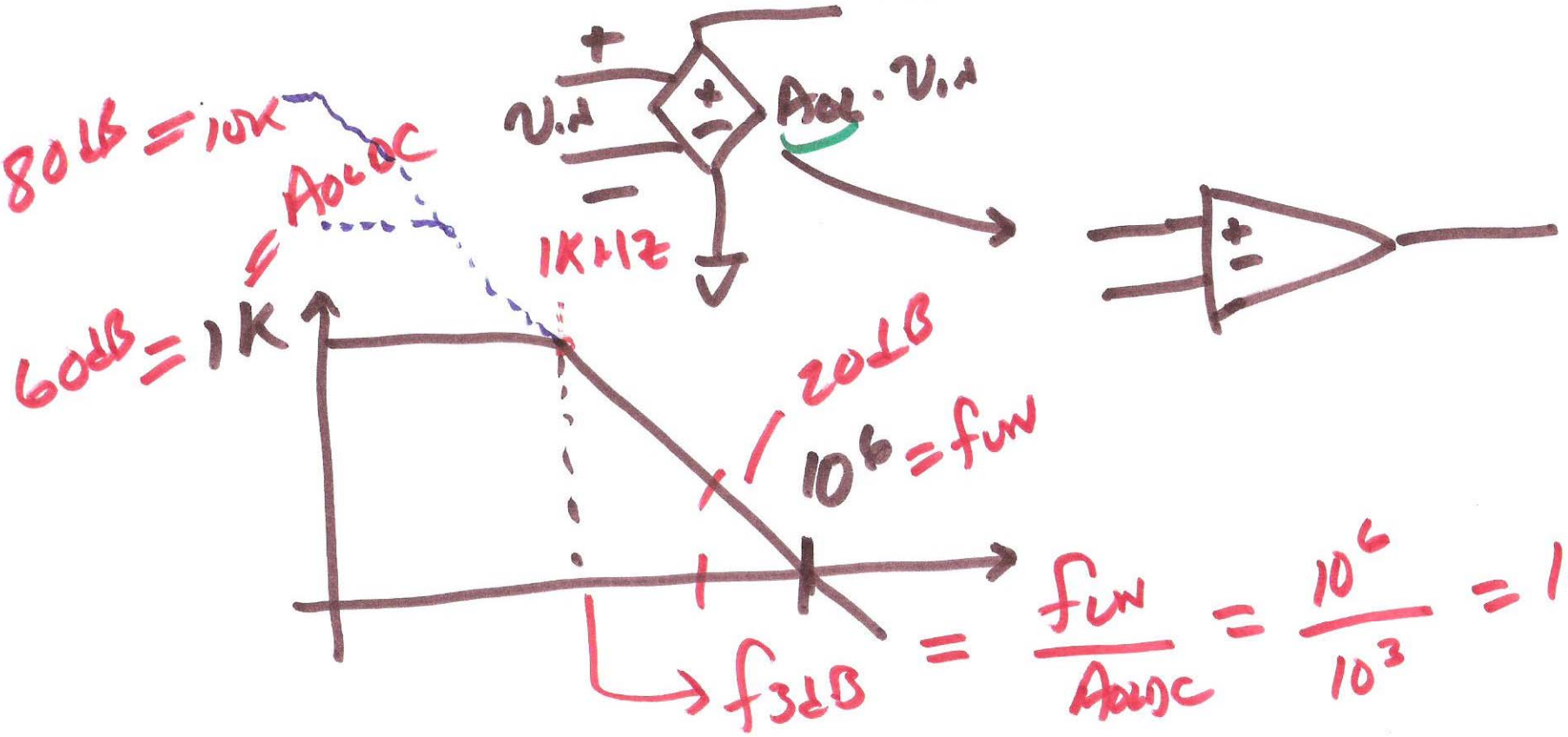
BOISE STATE UNIVERSITY

Lecture 2

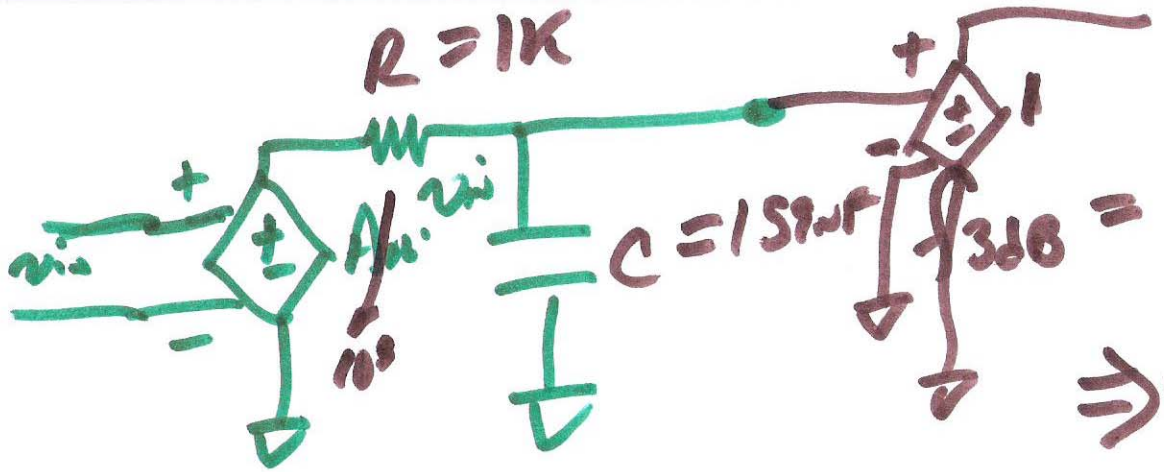
Aug. 25, 2011

Voltage-Controlled Voltage Source

VNT VCVS



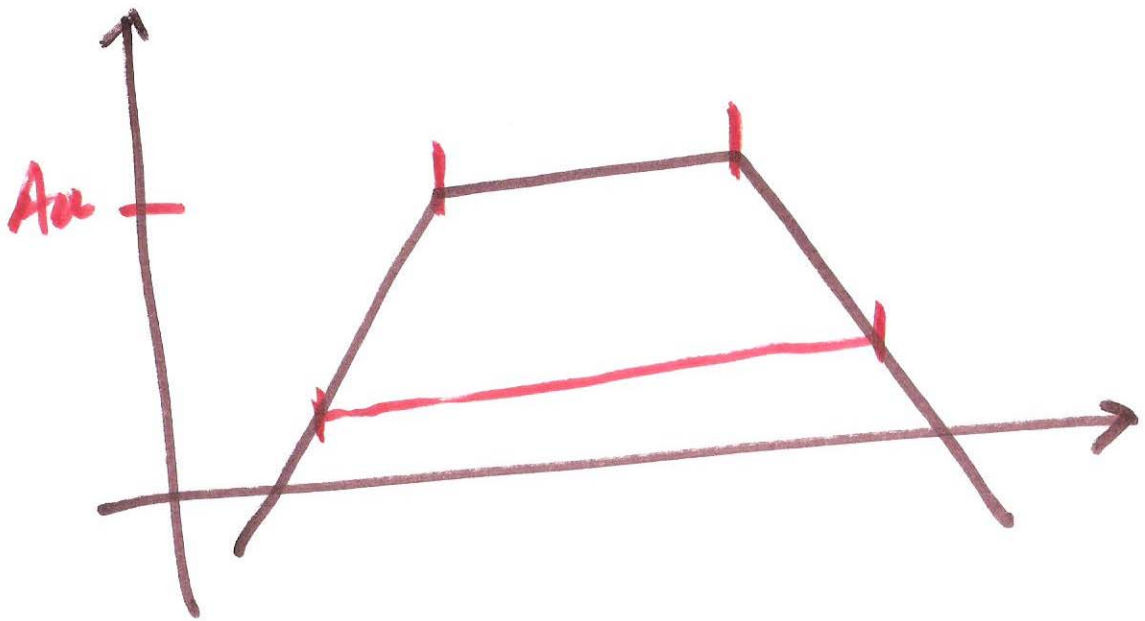
1)

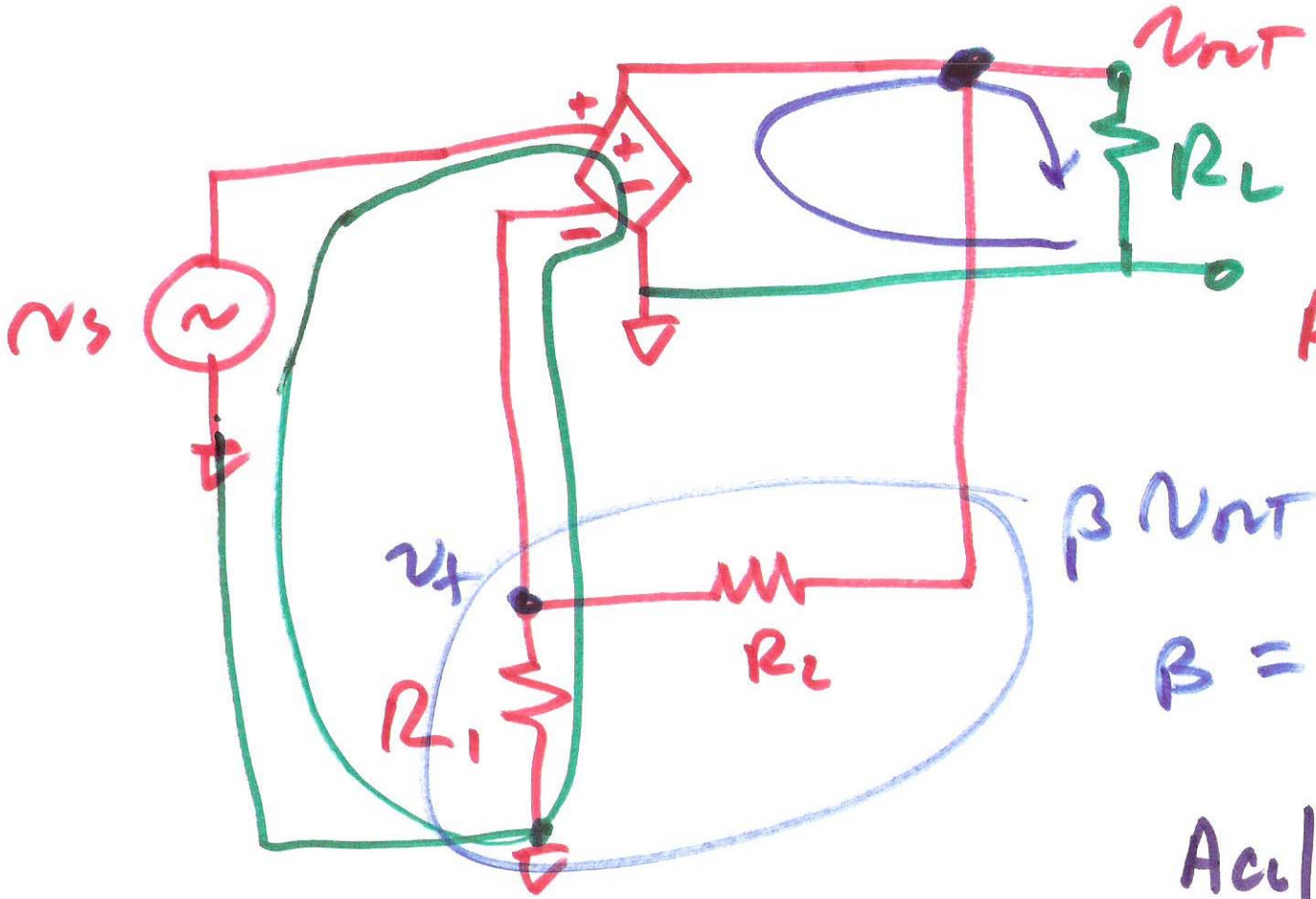


$$\Rightarrow C = \frac{1}{2\pi \cdot 10^{3}}$$

$$= .159 \cdot 10^{-6}$$

$$= \underline{159\ nF}$$





$$A_{CL} = \frac{A_{OL}}{1 + A_{OL} \cdot \beta}$$

$$\beta v_{out} = v_f$$

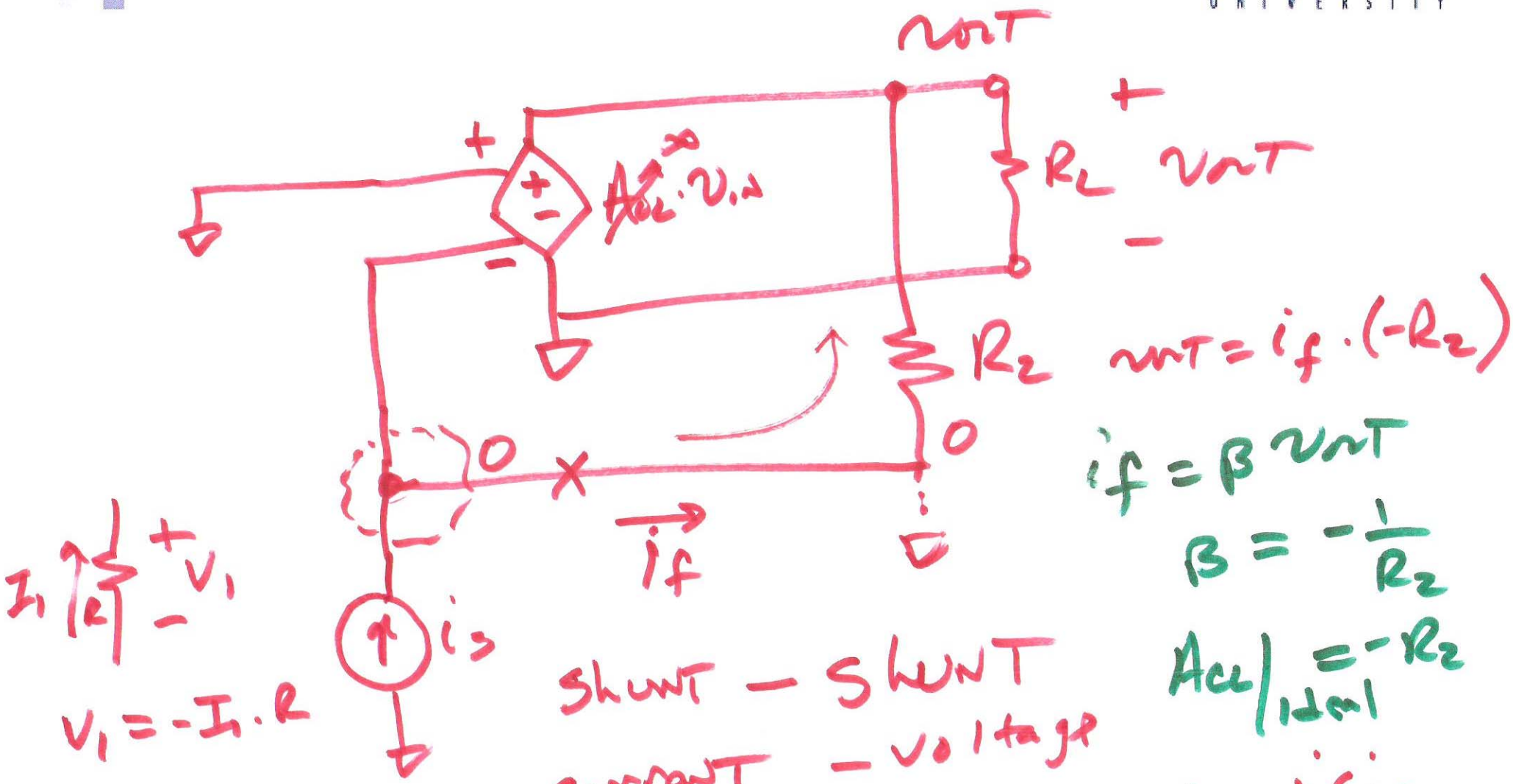
$$\beta = \frac{R_1}{R_1 + R_2}$$

$$A_{CL}\Big|_{ideal} \simeq \frac{1}{\beta}$$

Series – Shunt

voltage – voltage

3)



$v_{out} = i_f \cdot (-R_2)$

$i_f = \beta \, v_{out}$

$\beta = -\frac{1}{R_2}$

$A_{cl}|_{ideal} = -R_2$

$V_1 = -I_1 \cdot R$

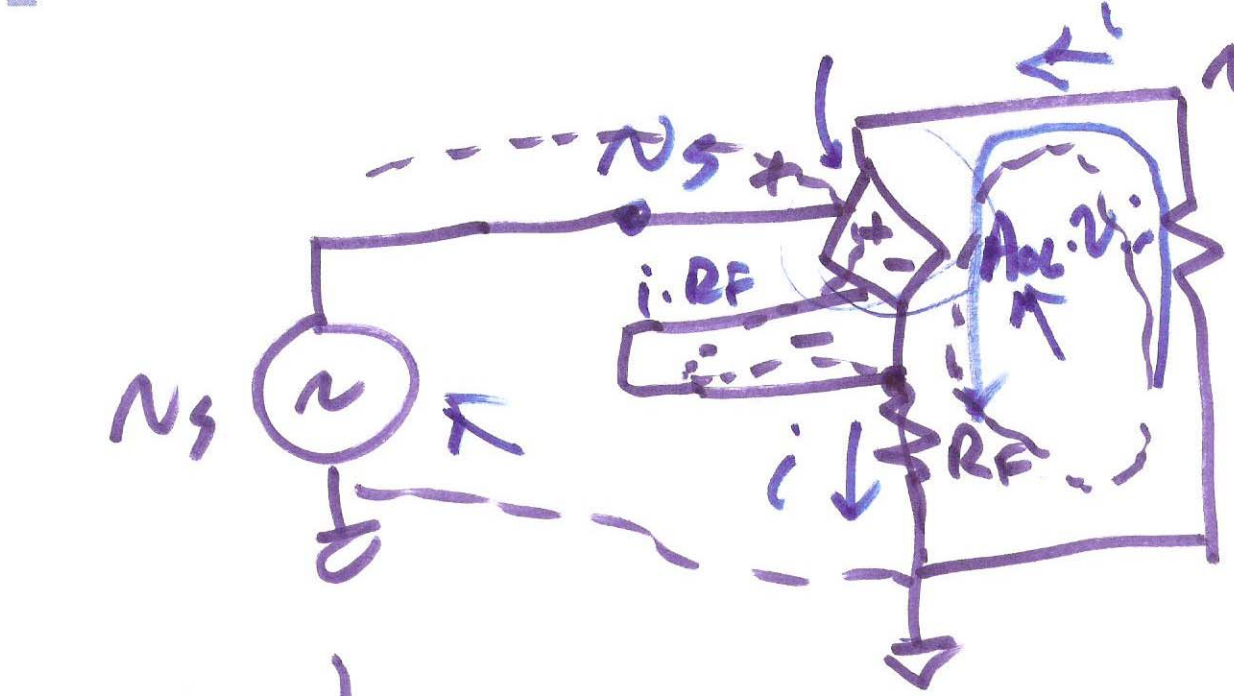
Shunt − Shunt

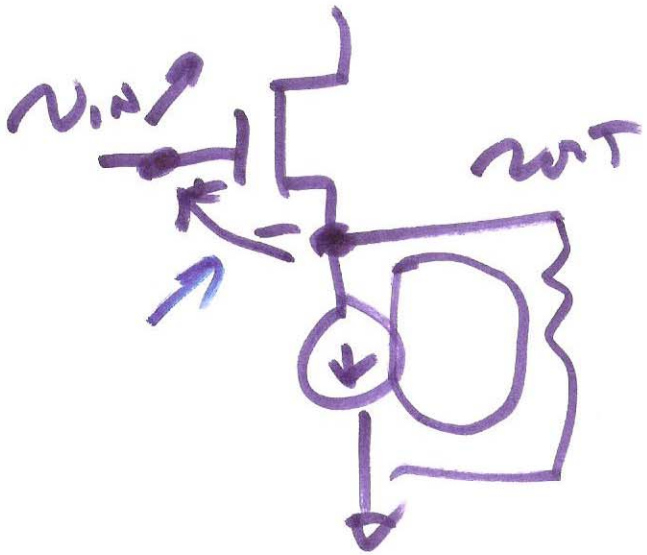
current − voltage

TRANSimpedance Amplifier

TIA

4)





$v_{out} = -i \cdot R_L$

$v_{out} = A_{CL} \cdot v_i + i R_F$

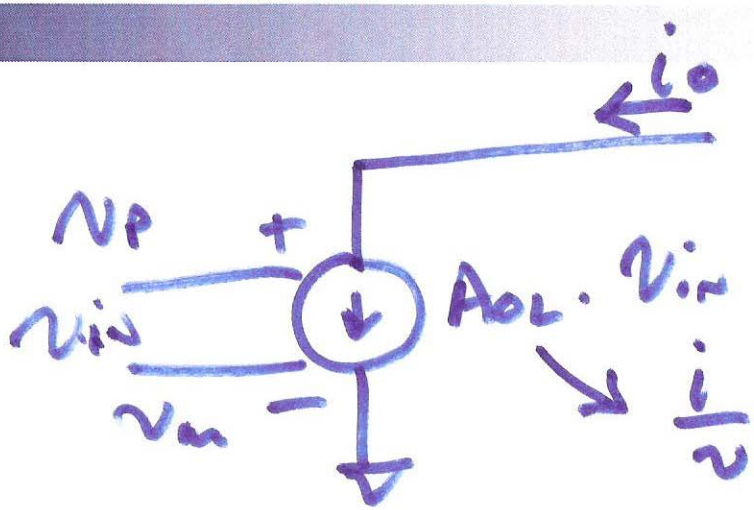
$v_{in} = v_s - i R_F$

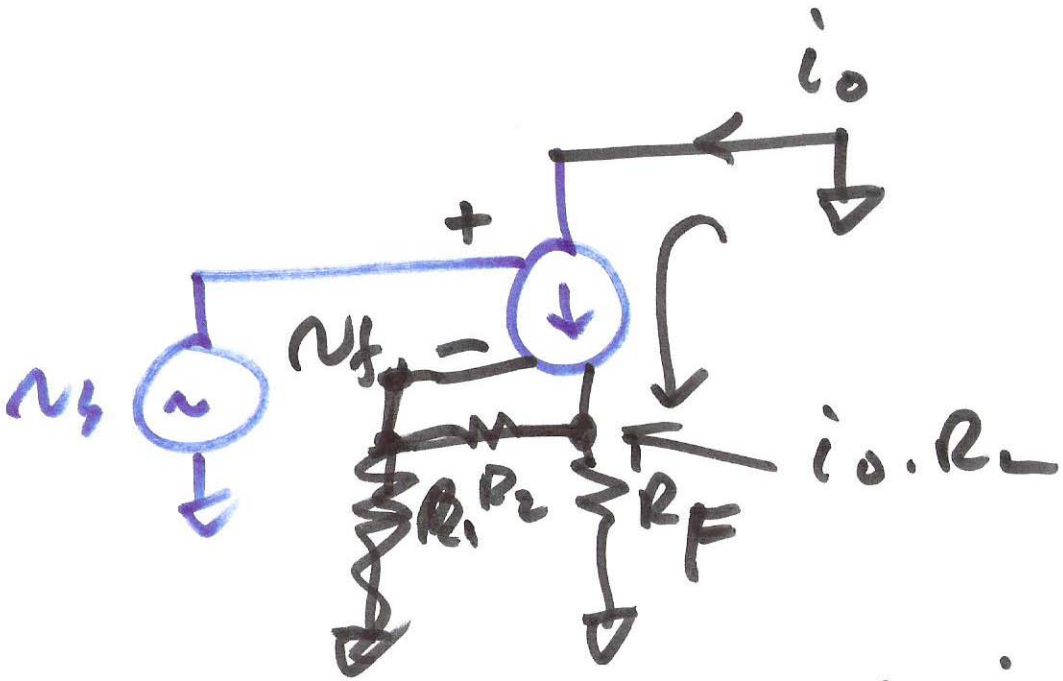
Series - Series

Voltage - Current

$$A_{CL} = \frac{i}{v}$$

5)





All input is f.b.

$$i_o \cdot \underbrace{R_F}_{B} = V_f$$

$$i_o \cdot \underbrace{R_F \cdot \frac{R_1}{R_1+R_2}}_{B} = V_f$$

$B \Rightarrow \Omega$

$A_{CL}\big|_{ideal} = \frac{1}{B}\ V$

Series – Series

voltage current

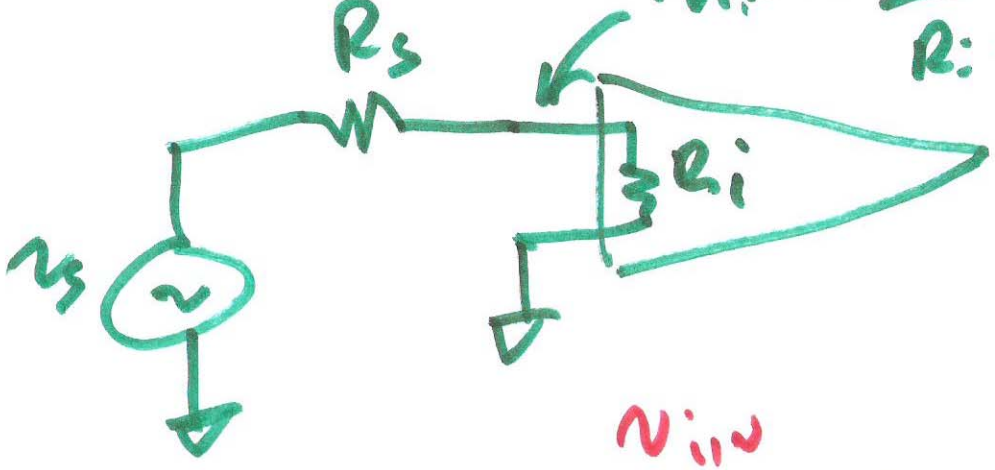
6)

Voltage Amp

$R_{in} = \infty$

$v_{in} = \frac{R_i}{R_i + R_s} \cdot v_s$

Fig. 3.11



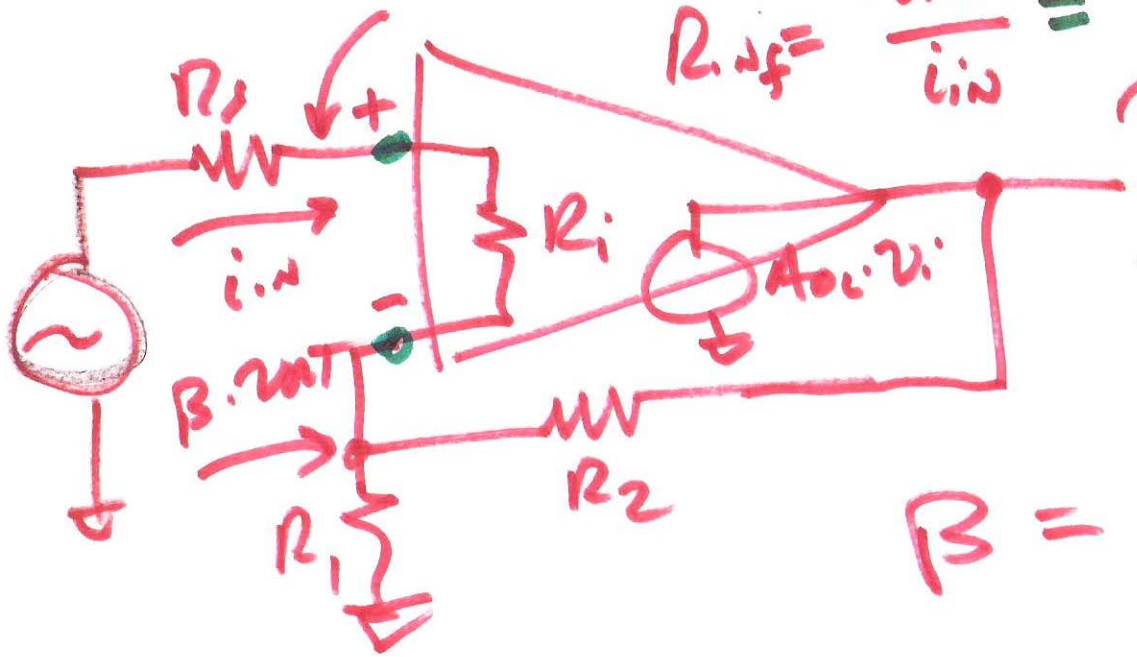
$R_o = \infty$

$i_{IN} = \frac{v_{IN} - \beta \cdot v_{OUT}}{R_i}$

$R_{inf} = \frac{v_{in}}{i_{in}} =$

$v_{OUT} = A_{OL}(v_{IN} - \beta \cdot v_{OUT})$

$\frac{v_{OUT}}{v_{IN}} = \frac{A_{OL}}{1 + \beta A_{OL}}$



$\beta = \frac{R_1}{R_1 + R_2}$

$$R_{inf} = \frac{v_{in}}{i_{in}}$$

$$V_{OUT} = V_{IN} \cdot \frac{A_{OL}}{1 + \beta A_{OL}}$$

$$V_{IN} = V_{OUT} \frac{(1 + \beta A_{OL})}{A_{OL}}$$

$$i_{IN} = \frac{V_{IN} - \beta V_{OUT}}{R_i}$$

$$\frac{1 + \beta A_{OL} - A_{OL}\beta}{1 + \beta A_{OL}}$$

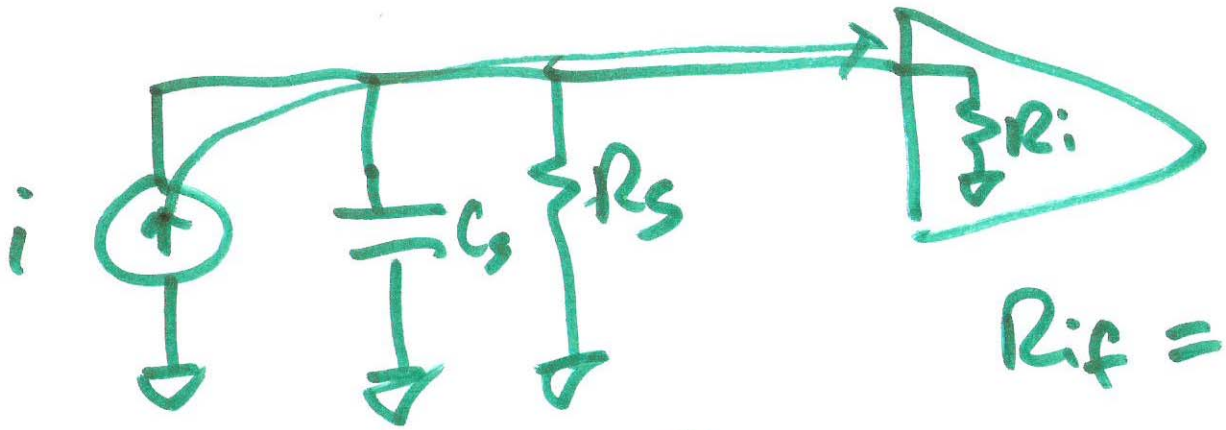
$$i_{IN} = \frac{V_{IN}}{R_i}\left(1 - \frac{A_{OL}}{1 + \beta A_{OL}}\right)$$

$$\frac{v_{in}}{i_{in}} = R_{inf} = R_i \cdot (1 + \beta A_{OL})$$

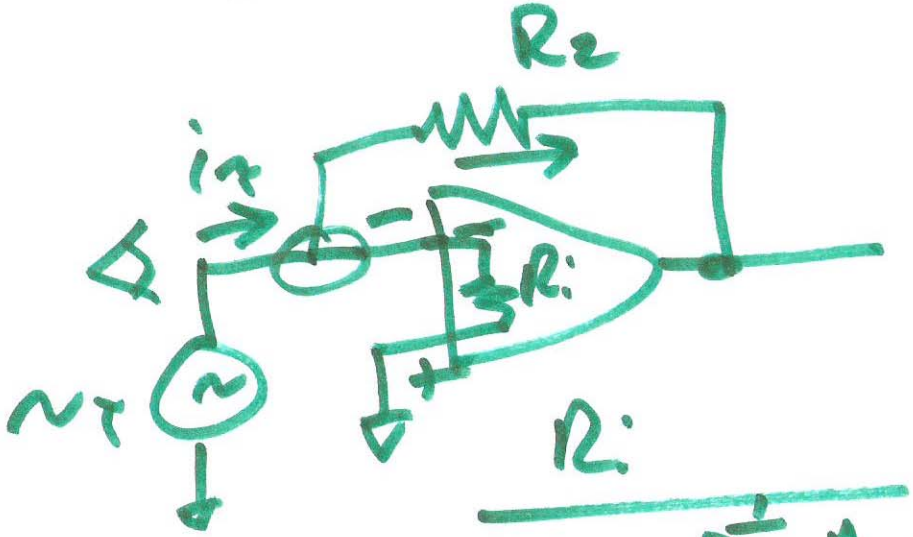
8)

Current input

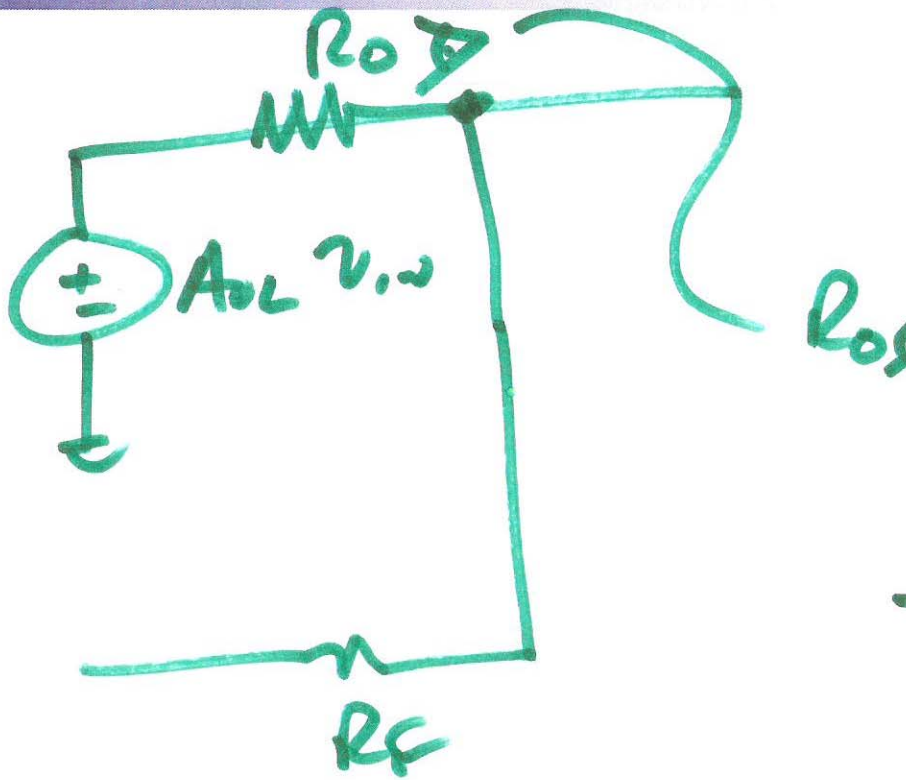
Shunt



$$R_{if} = \frac{R_i}{1 + \beta A_{OL}}$$

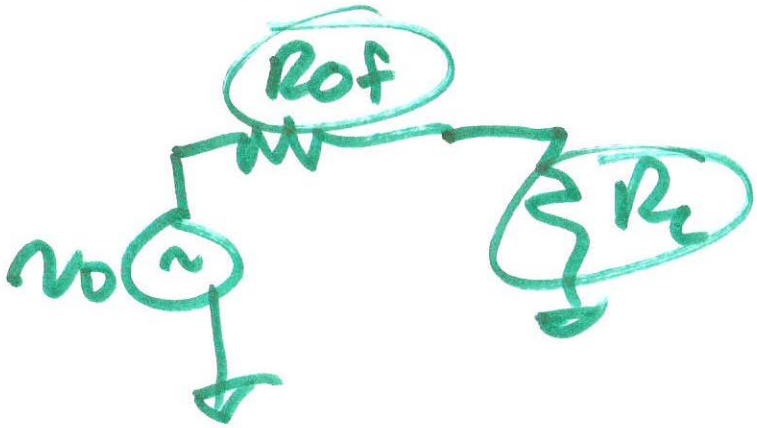


$$\frac{R_i}{1 + \frac{1}{R_2} A_{OL}}$$



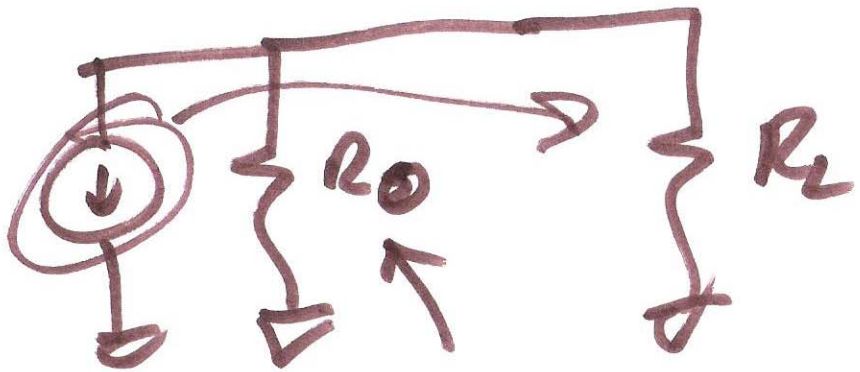
$$R_{of} = \frac{R_o}{1 + \beta A_{OL}}$$

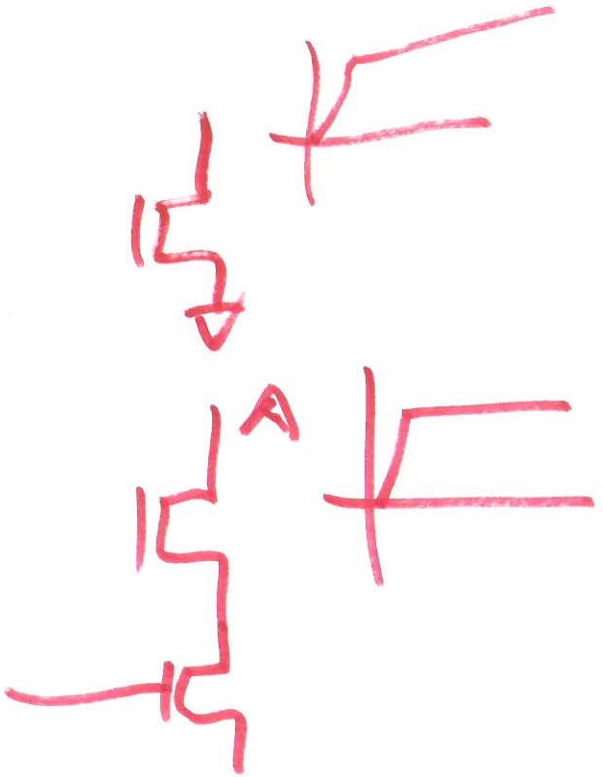
- Shunt voltage



CURRENT

- series f.b





$$R_O|_{ideal} = \infty$$

$$R_{of} = R_O \cdot (1 + \beta A_{OL})$$

11)