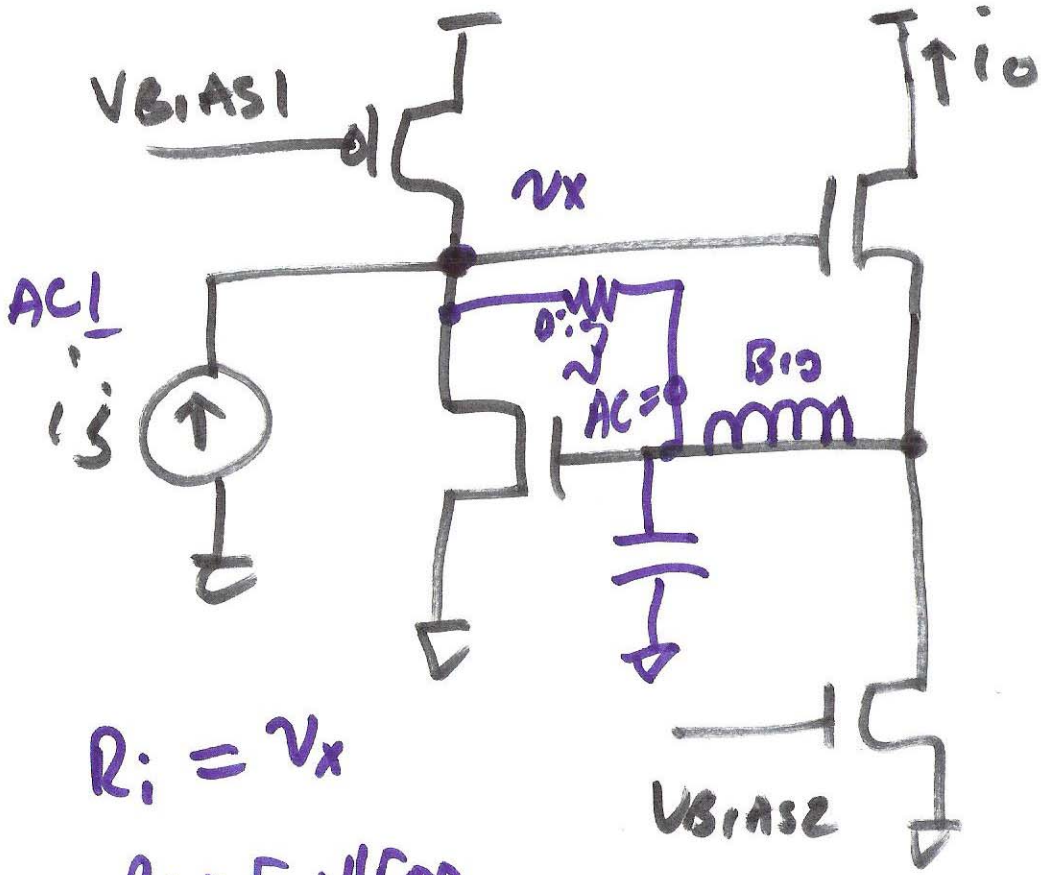
ECE 614 Advanced Analog IC Design

BOISE STATE UNIVERSITY

Lecture 7 Sept. 13, 2011



$R_i = \frac{v_x}{i_x}$

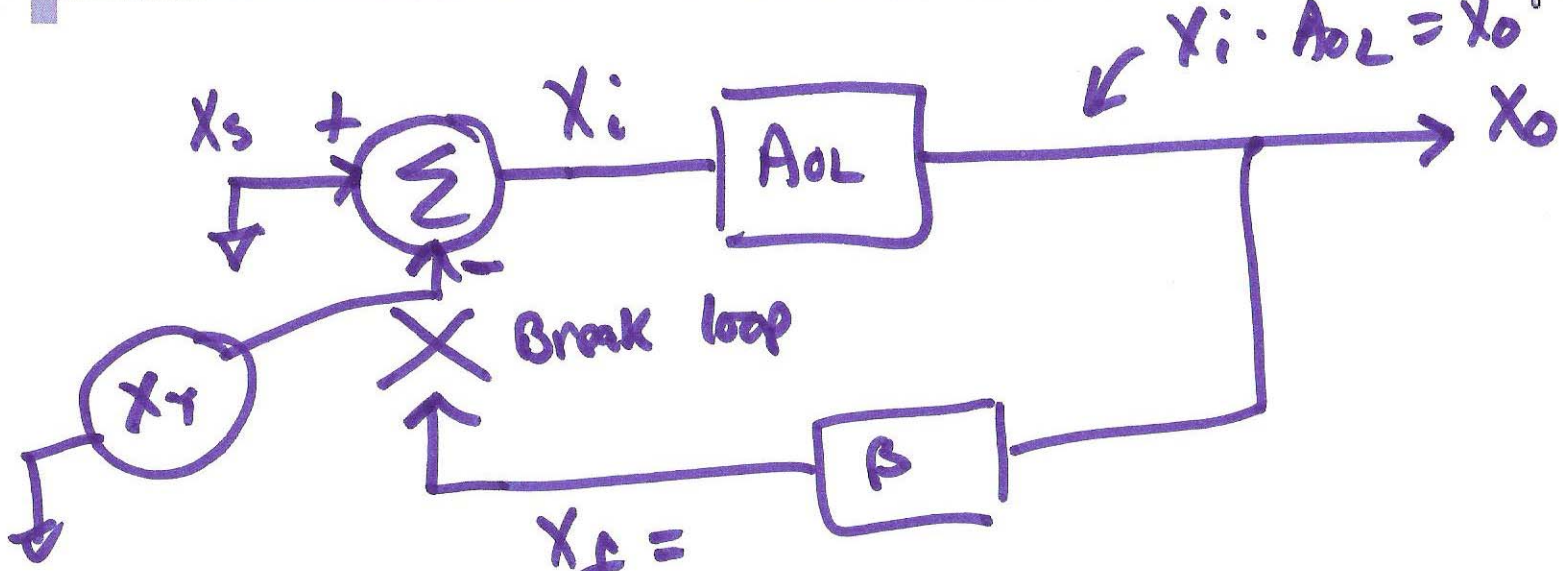
$R_i = r_{on} \| r_{op}$

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

βA_{OL} = loop gain

$\beta A_{OL} = -1 \rightarrow |A_{CL}|$ UNstable f.b. system!

plotting loop gain can tell you how stable your system is.



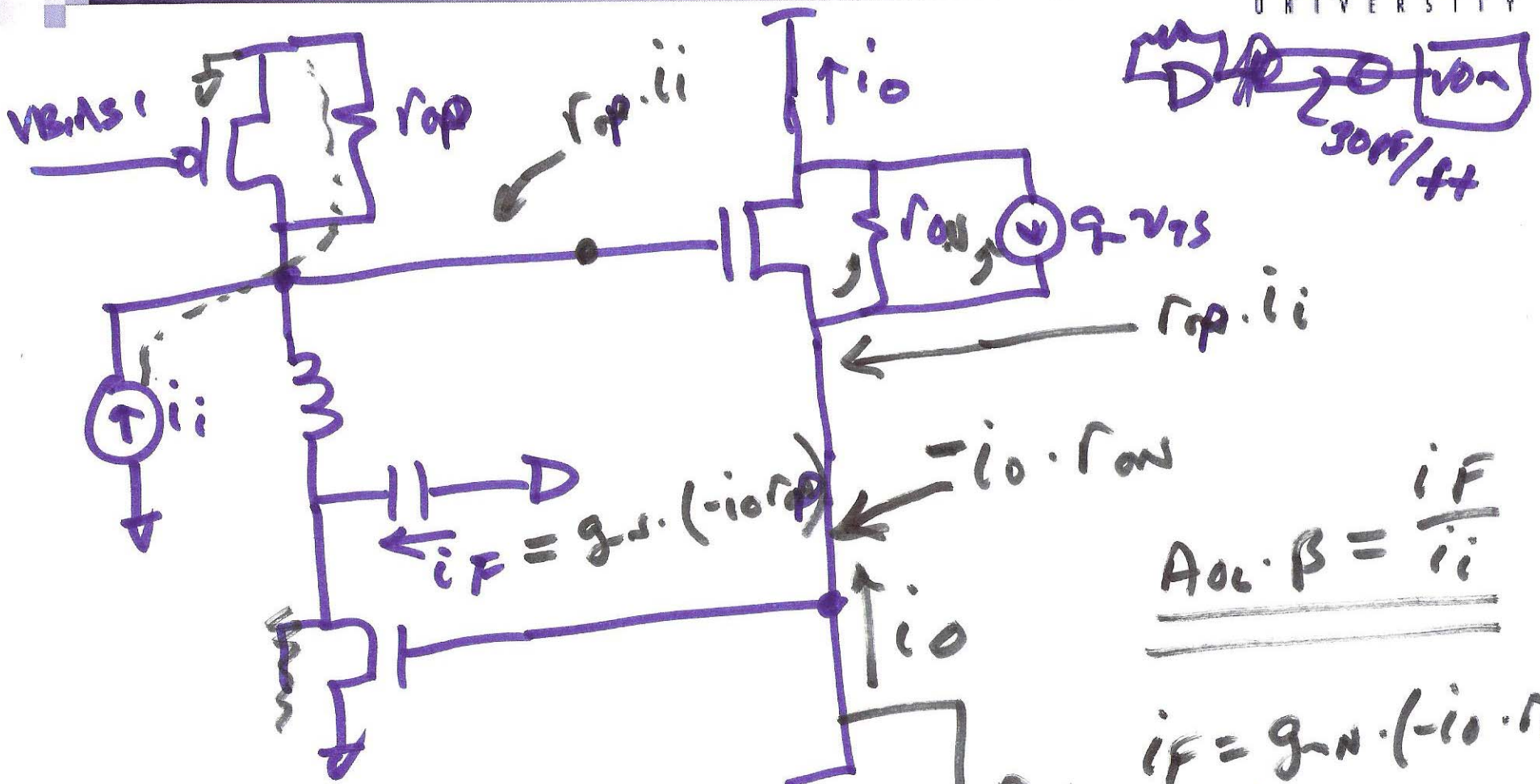
$X_f = X_o \cdot \beta$

$X_f = X_i \cdot A_{OL} \cdot \beta \rightarrow \frac{X_f}{X_i} = A_{OL} \cdot \beta$

$X_f = -X_f \cdot A_{OL} \cdot \beta$

$\frac{X_f}{X_i} = A_{OL} \cdot \beta$ $\quad$ $\frac{X_f}{X_f} = -\underbrace{A_{OL} \cdot \beta}_{\text{loop gain}}$

2)



$A_{OL} \cdot \beta = \frac{i_F}{i_i}$

$i_F = g_{mN} \cdot (-i_o \cdot r_{ON})$

$v = j\omega L \cdot i$

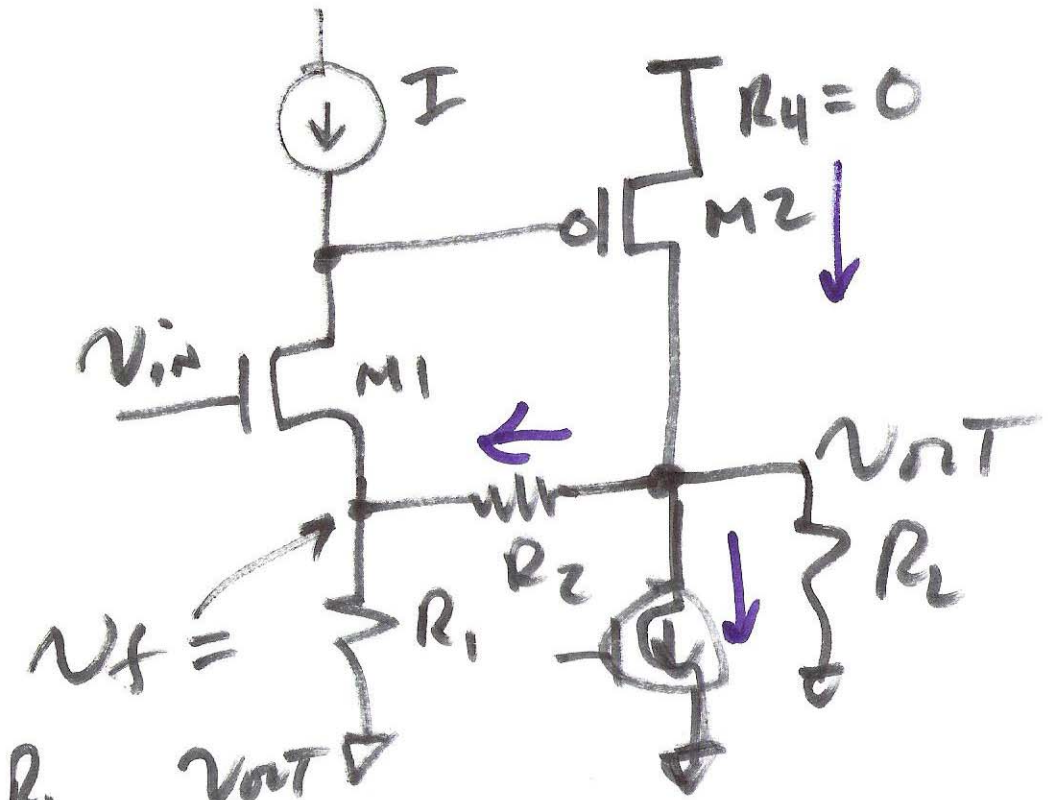
$i_F = g_{mN} \cdot r_{op} \cdot i_i$

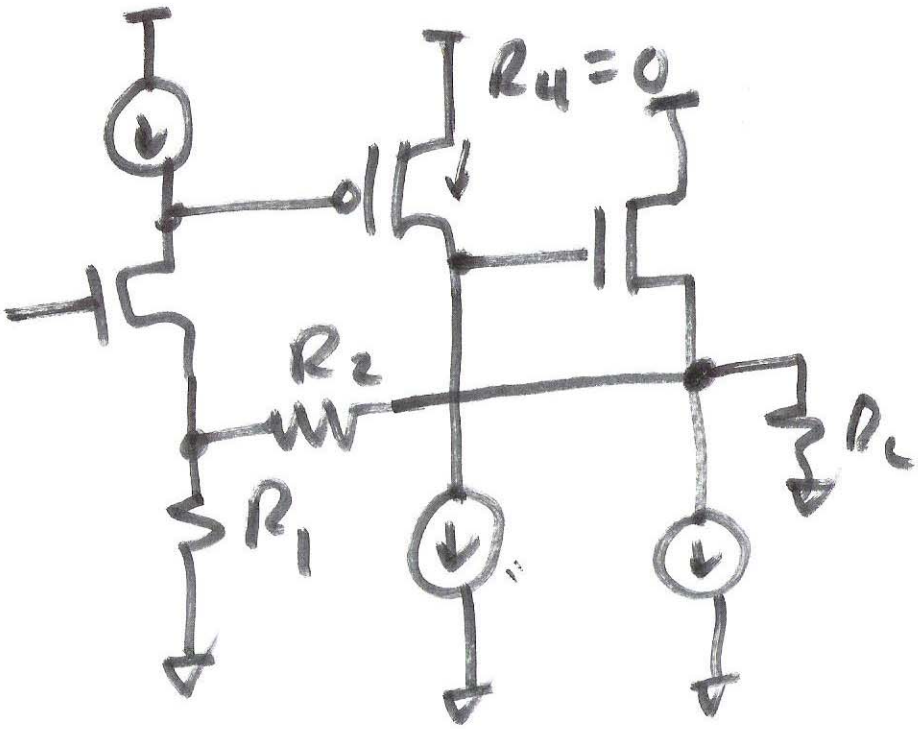
$\frac{i_F}{i_i} = g_{mN} \cdot r_{op}$

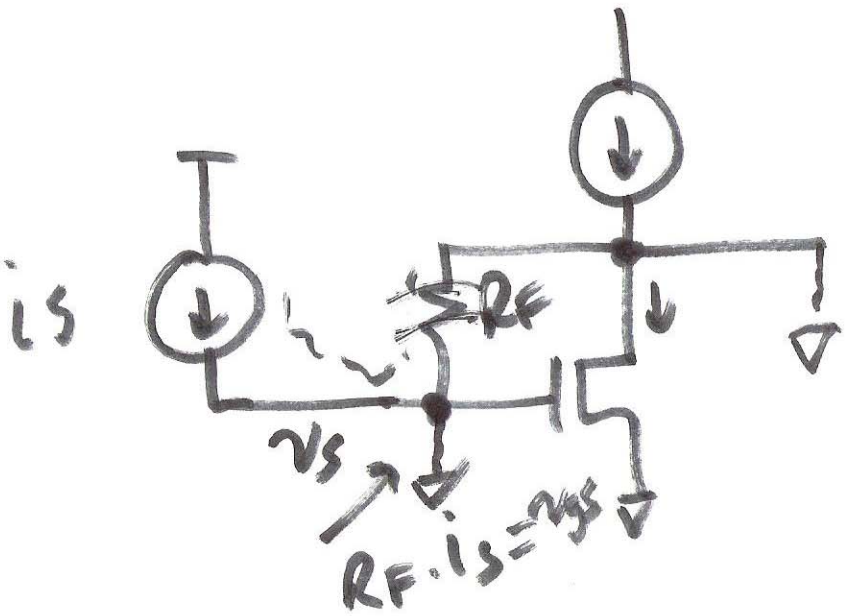
$= 25 \rightarrow \underline{28dB}$

$i = -\frac{v}{j\omega L}$

3)


I
$R_4 = 0$
M2
V_{in}
M1
V_{OUT}
R_2
R_2
R_1
$V_f =$
$\frac{R_1}{R_1 + R_2}$
V_{OUT}
β


$R_4 = 0$
R_2
R_1
R_L
SHRPS - SHUNT!
Added SF!



$v_{out} = -g_m R_F \cdot R_F \cdot i_s$

$\frac{v_{out}}{i_s} = -g_m R_F^2$

$\frac{v_{out}}{v_s} = -g_m R_F$

Shunt - Shunt

I V

TRANSimpedance Amp

We will return to this in Ch. 8.

5)