Lecture 8, May 7

EE 420

ECG 620

Study past H.W., Quizzes, midterm

project question.

open-book, closed notes

Ch. 9 IV plots

intuitive questions

MOSFET IV curves

body effect

derive g_m & r_o

KNW Ex. 9.5
and pmos Flavor

trade-offs
device sizes
V_{OV}, f_T, g_m, W, L
G_{FT}, $g_m r_o$

Temp. effects
$\frac{\delta K_P}{dT}$, $\frac{\delta V_{THN}}{dT}$

V_{THN}
V_T
B.G.

diode voltage drop V_{OV} $T\uparrow$

Ch. 20

Current Mirror Topologies

DC biasing

Wide swing current mirrors

MAtching

Calculations Using Square-law Equations

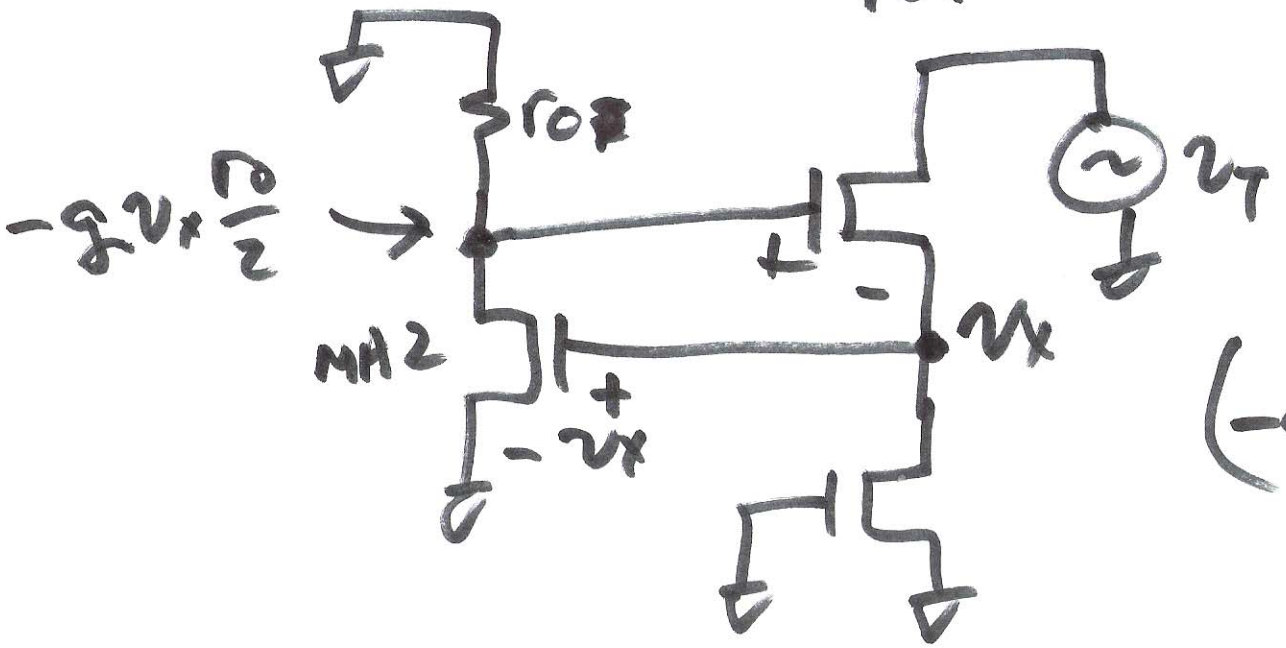
BMR – operation
stability

Temp.

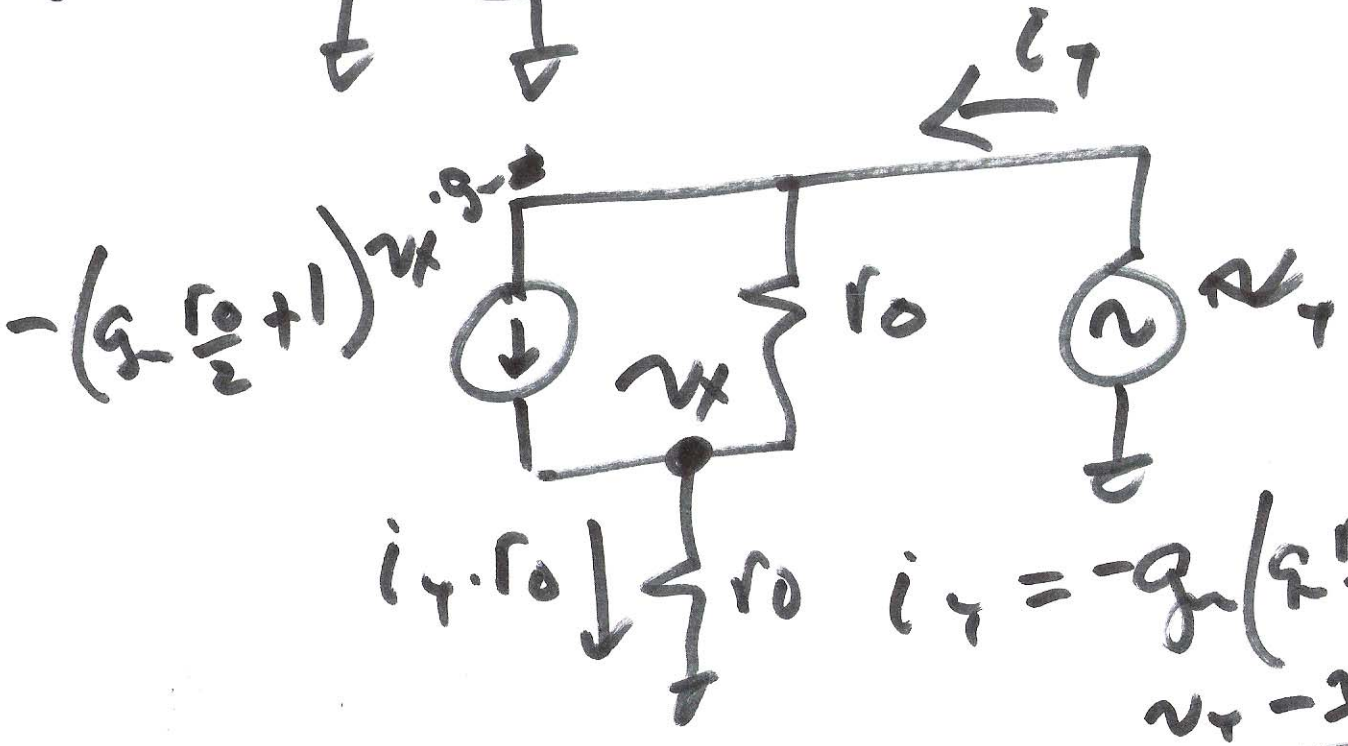
Cascoding

KNOW how to derive output resistance in Fig. 20.42 !

$r_{op} = r_{on} = r_o$



$\left(-g_m v_x \frac{r_o}{2} - v_x\right)$



$$i_T = -g_m\left(g_m \frac{r_o}{2}+1\right)v_x$$

$$\frac{v_T - v_x - i_T \cdot r_o}{r_o}$$

$$i_T = -g_m r_o \left(g_m \frac{r_o}{2} + 1 \right) i_T + \frac{v_T}{r_o} - i_T \frac{r_o}{r_o}$$

$$i_T \left(1 + g_m r_o \left(g_m \frac{r_o}{2} + 1 \right) + 1 \right) = \frac{v_T}{r_o}$$

$$\frac{v_T}{i_T} = r_o + g_m r_o^2 \left(g_m \frac{r_o}{2} + 1 \right) + r_o$$

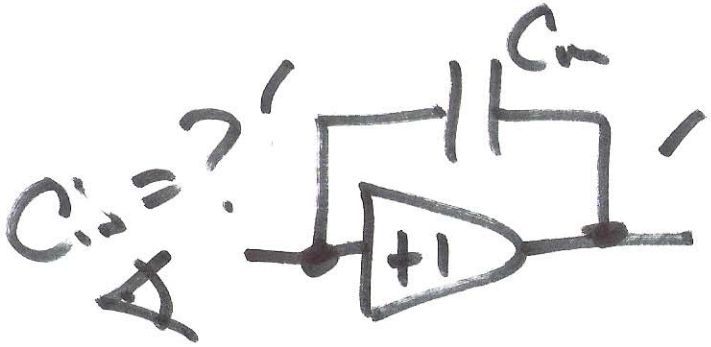
$$\simeq g_m^2 \frac{r_o^3}{2}$$

Ch. 21

freq. resp

gains

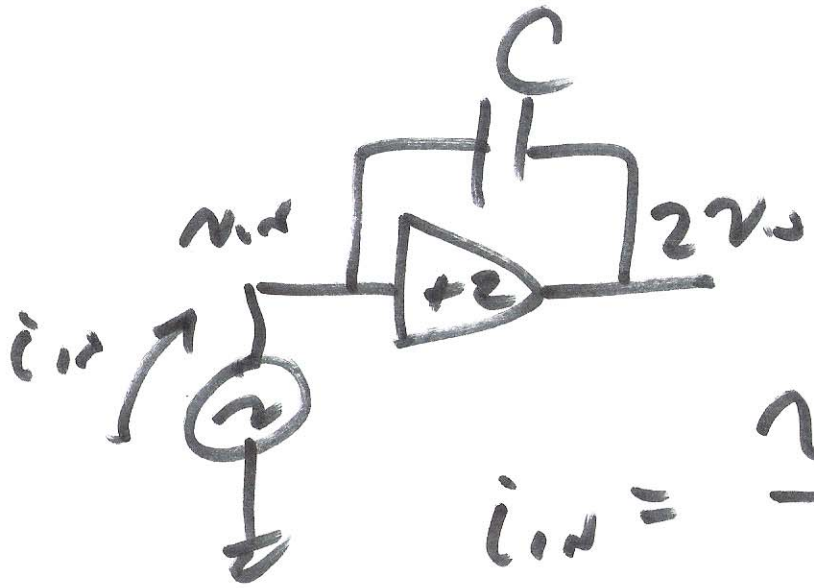
Millers theorem



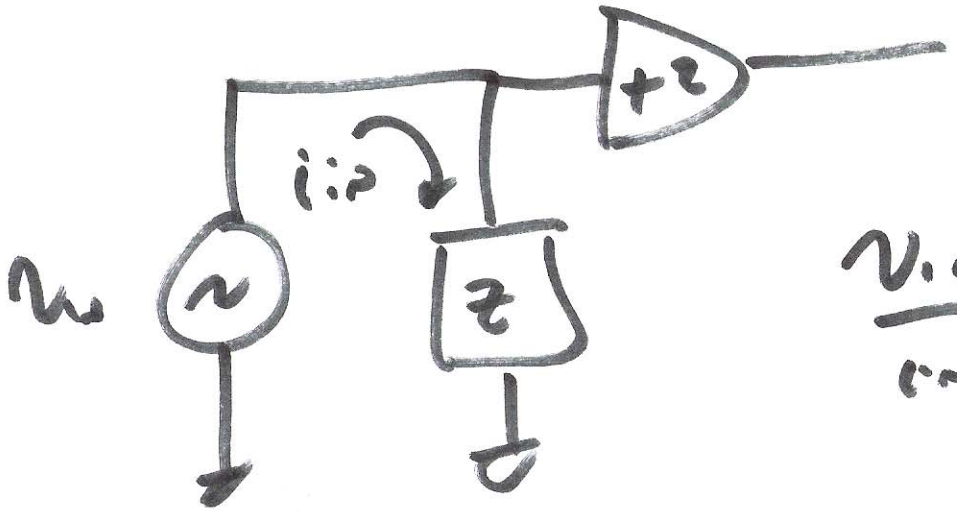
$$i_{in} = \frac{v_{in} - v_{out}}{1/j\omega C_M}$$

$v_{in} = v_{out}$ $i_{in} = 0$

$$Z_{in} = \frac{v_{in}}{i_{in}} = \infty$$



$$i_{in} = \frac{v_{in} - 2v_{in}}{1/j\omega C}$$



$$\frac{v_{in}}{i_{in}} = -\frac{1}{j\omega C} \cdot \frac{j}{j} = j \cdot \frac{1}{\omega C}$$

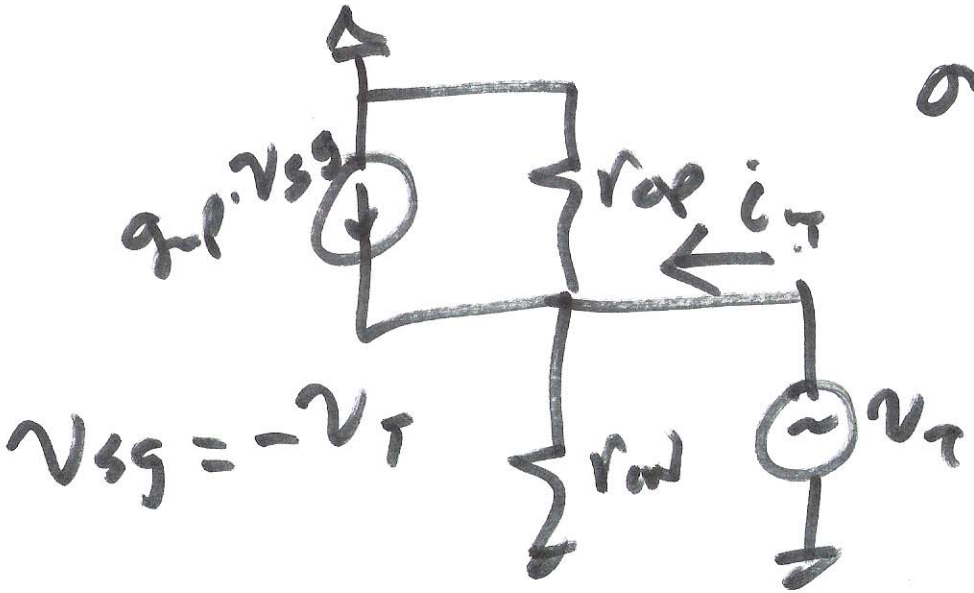
$$\text{let } L = \frac{1}{\omega C}$$

$$\frac{v_{in}}{i_{in}} = j \cdot \omega \cdot L$$

Ch. 21

gains
- C.S.
- C.G.
- C.D. (S.F.)

output resistance



21.2

$$-g_{mp} \cdot v_{sg} = i_T$$

$$i_T = g_{mp} \cdot v_T$$

$$\frac{v_T}{i_T} = \frac{1}{g_{mp}} \| r_{on} \| r_{on}$$

frequency response

Ch. 22 diff amps
- CMR
- gain etc

Study quiz & H.W
Ch. 23 & 24

Indirect compensation

OTAs