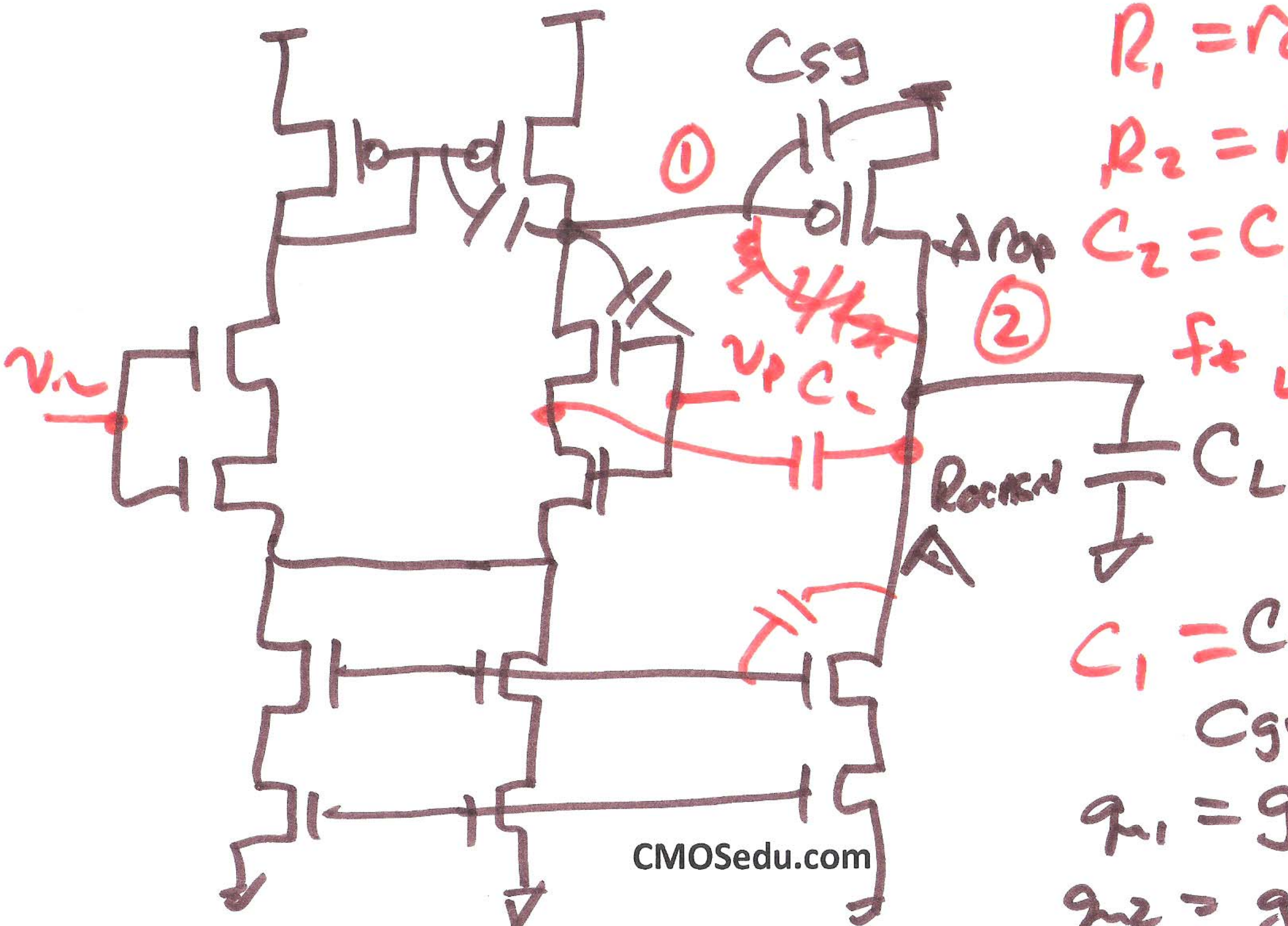
EE 422 ECG 622

May 8, 2013 Lecture 27

Review for the test



$R_1 = r_{op} \| r_{on}$

$R_2 = r_{op} \| R_{ocasN}$

$C_2 = C_L + C_{gd}$

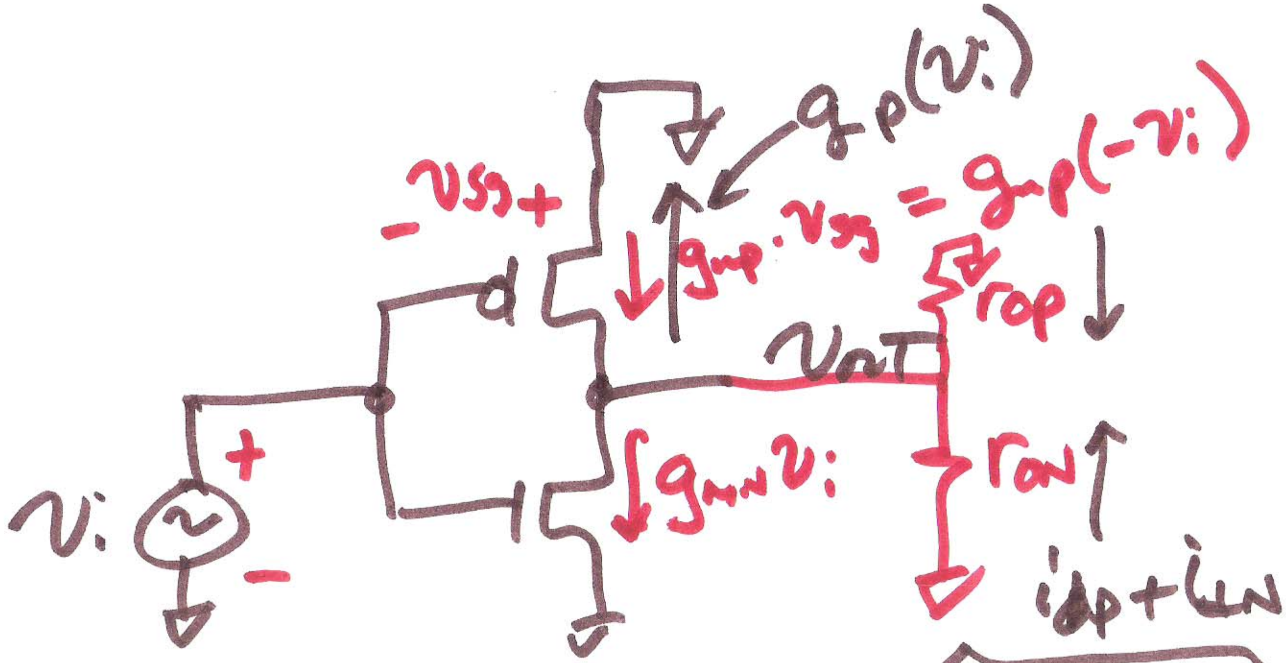
$f_{z,LHP} = \frac{g_{mn}}{2\pi C_c}$

$C_1 = C_{gdp} + C_{gdn} + C_{sg}$

$g_{m1} = g_{mn}$ (diff pair)

$g_{m2} = g_{mp}$

1)



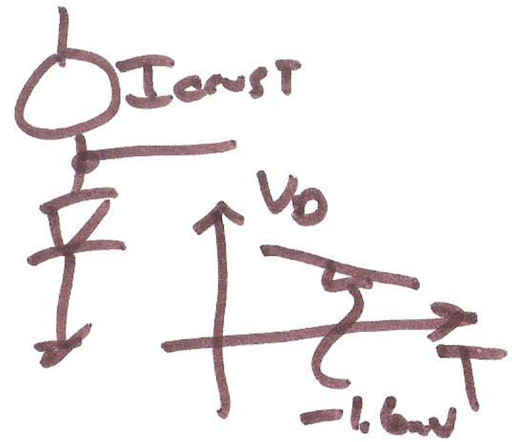
$$V_{OUT} = -v_i\underbrace{(g_{mp}+g_{mN})}_{g_{m2}}\cdot r_{oN}||r_{op}$$

Review for the test

Study quizzes
H.W.
exam
project

open book

Ch. 9, 20, 21, 22, 23, 24



Ch. 9 IV plots

MOS IV characteristics

Injecting/Removing current

Small-signal Models

g_m, r_o, Ex. 9.5

Selecting V_{ov}, f_T, g_m W/L etc.

⇙

$V_{DS,sat}$, $g_m r_o$

temp characteristics

CMOSedu.com

3)

Ch. 20 Current Mirrors

DC operations

Matching

Biasing, B-R → design equations for BMR

* Stability of the BMR *

Cascode

wide cascodes

derive MWS $\frac{1}{4}\frac{W}{L}$

Regulated cascode

Biasing CKTS.

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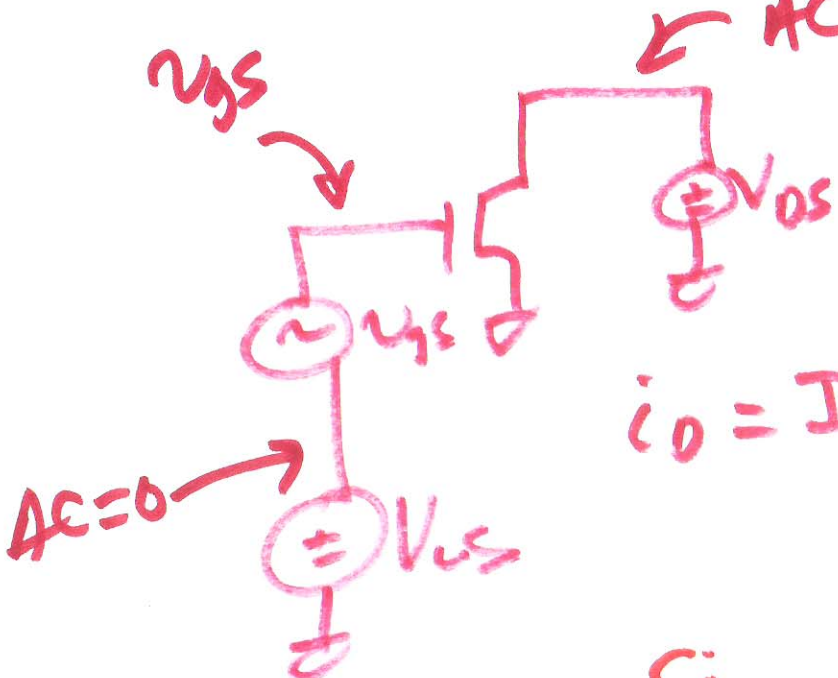
Amplifier gains

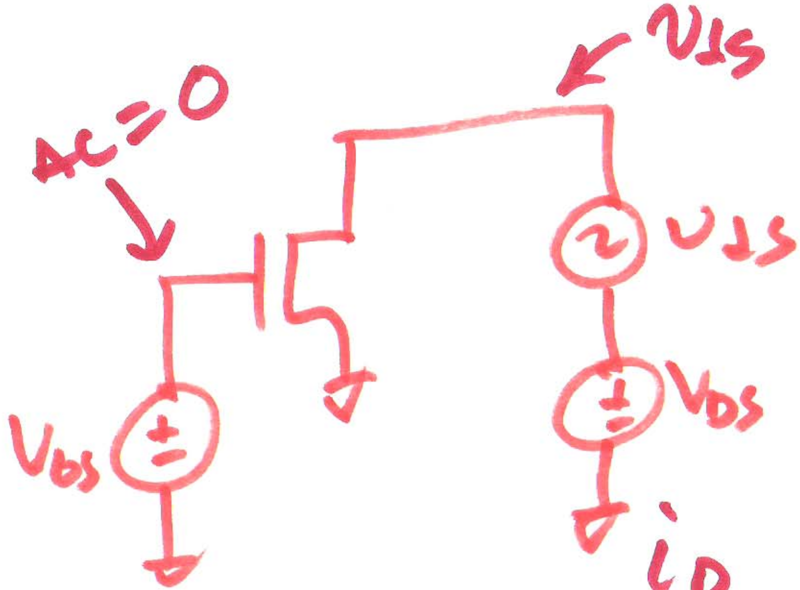
* derive g_m & r_o *

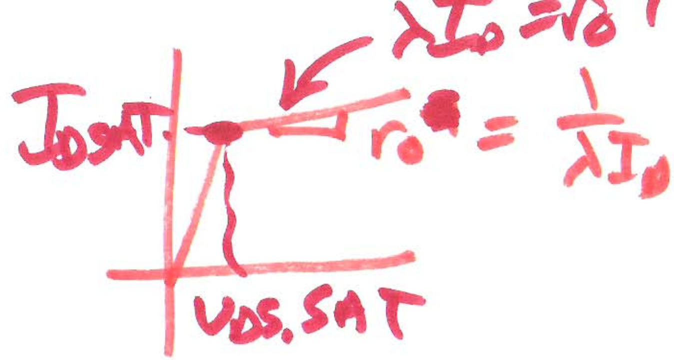


$$v_{GS} = v_{gs} + V_{GS}$$

$$i_D = I_D + i_d = \frac{KP}{2}\frac{W}{L}\left(v_{GS} - V_{THN}\right)^2$$

$$g_m = \left.\frac{\partial i_D}{\partial v_{GS}}\right|_{\substack{I_D = \text{CONST} \\ V_{DS} = \text{CONST}}} = KP \cdot \frac{W}{L}\left(V_{GS} - V_{THN}\right)$$





$$v_{DS} = v_{ds} + V_{DS}$$

$$\overbrace{i_d + I_D}^{i_D} = \frac{KP}{2}\frac{W}{L}\left(V_{GS} - V_{THN}\right)^2\left(1 + \lambda v_{DS}\right)$$

$$r_o^{-1} = \frac{\partial i_D}{\partial v_{DS}} = \underbrace{\frac{KP}{2}\frac{W}{L}\left(V_{GS} - V_{THN}\right)^2}_{I_{D,SAT}} \cdot \lambda \cdot \cancel{\frac{\partial v_{DS}}{\partial v_{DS}}}^{\,1}$$

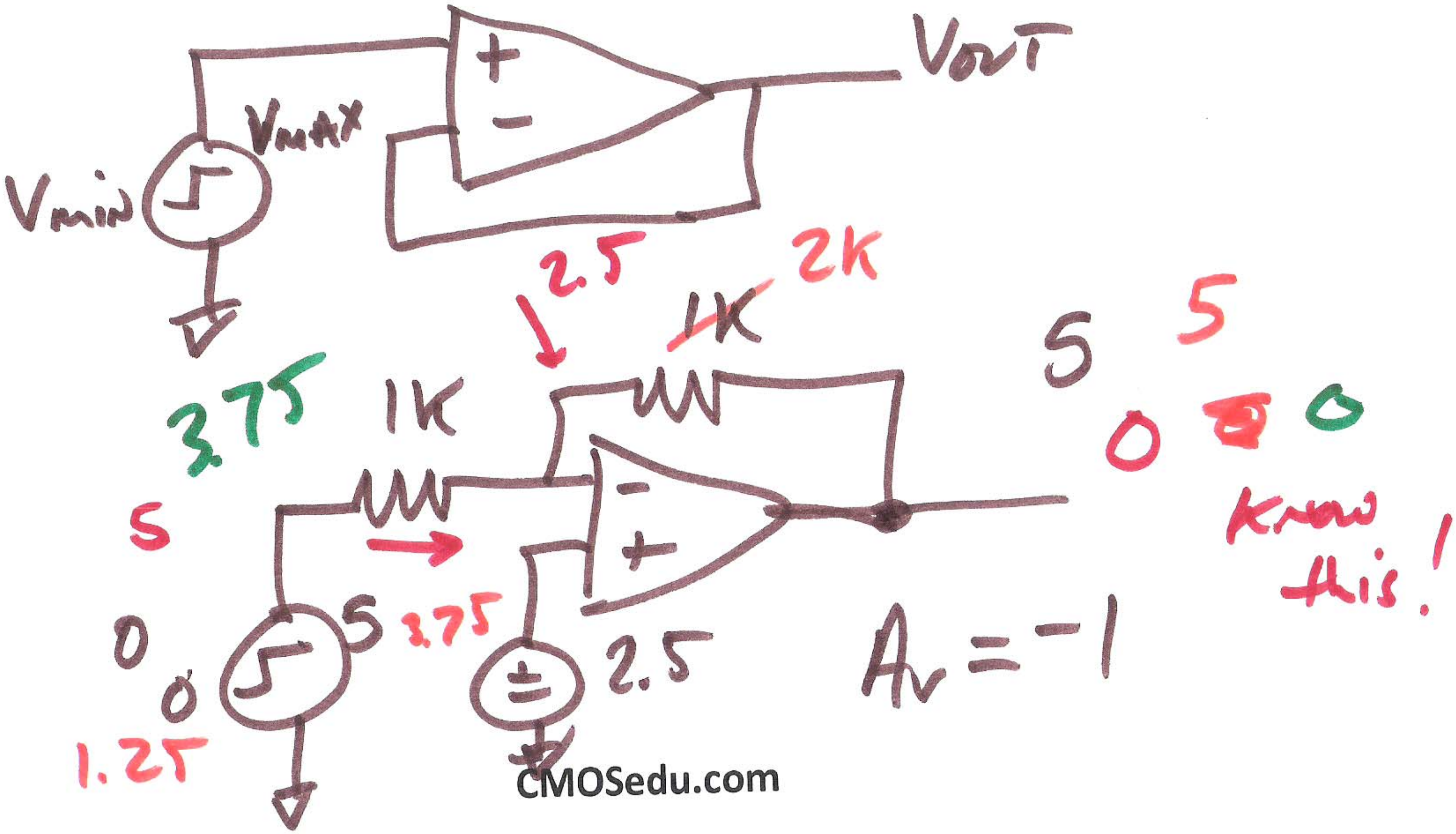
$$r_o = \frac{1}{\lambda I_{D,SAT}}$$

transistor gains

diff-Amp

SR, CMRR, AC gain

→ INPUT CMR ←



op-amp design

Why $|A_{OL}| = 0\text{dB}$

$\angle A_{OL} = 180°$?

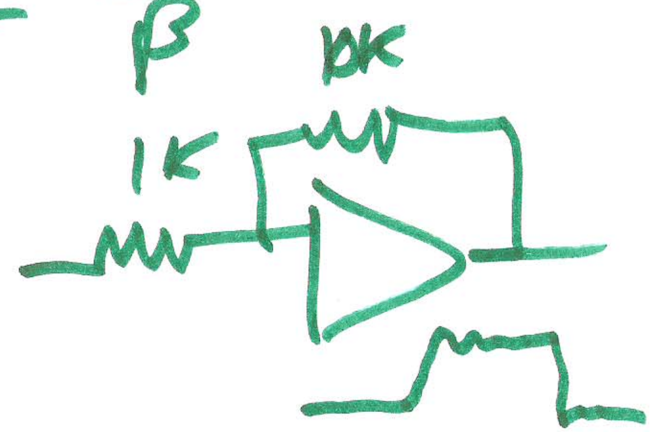
$A_{OL} = 1$

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

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

($\frac{1}{A_{OL}} \to 0$)

$A_{OL} \to \infty$.



push-pull amplifier

output, 24.29

for example