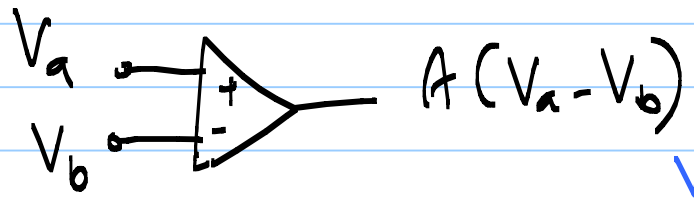
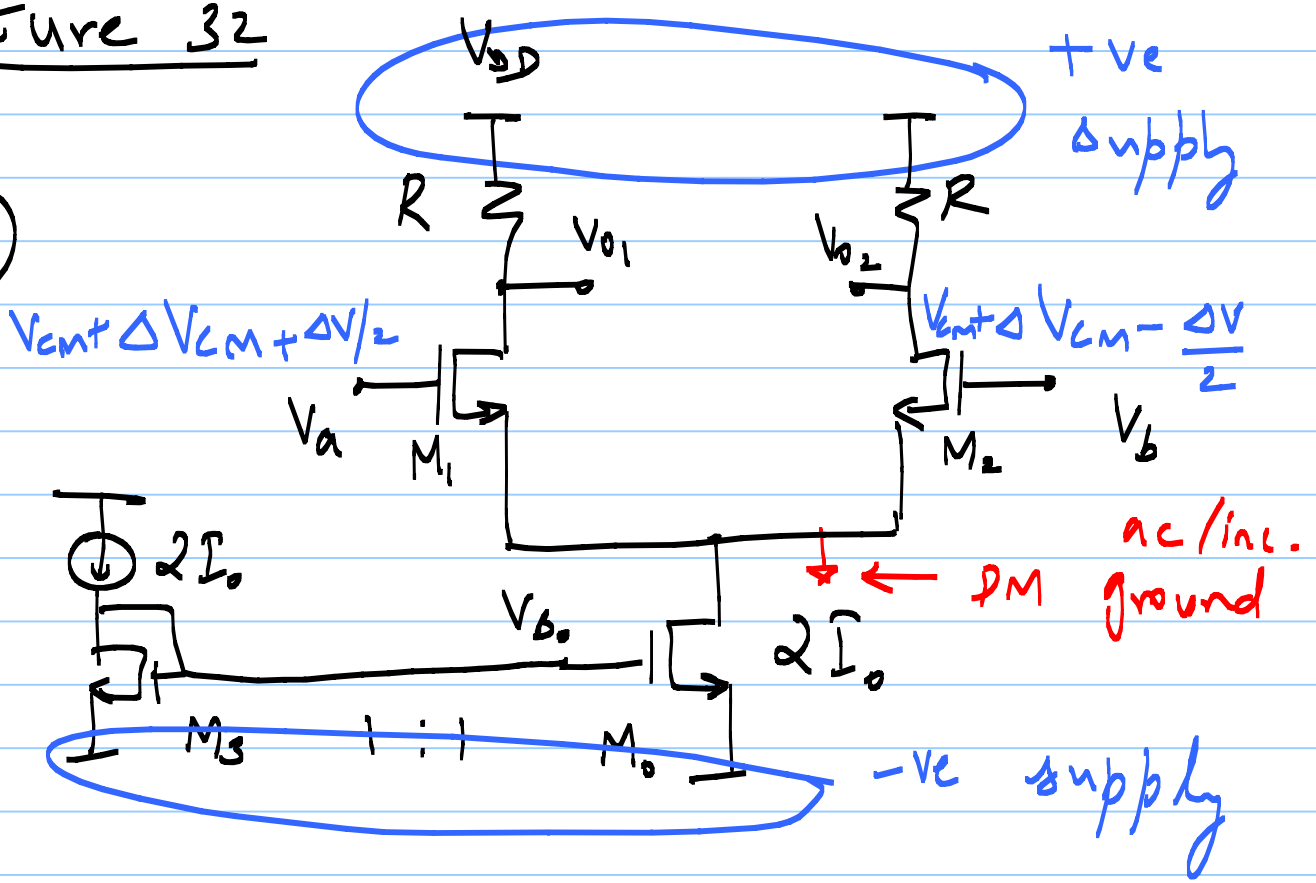
29/9/20

Lecture 32

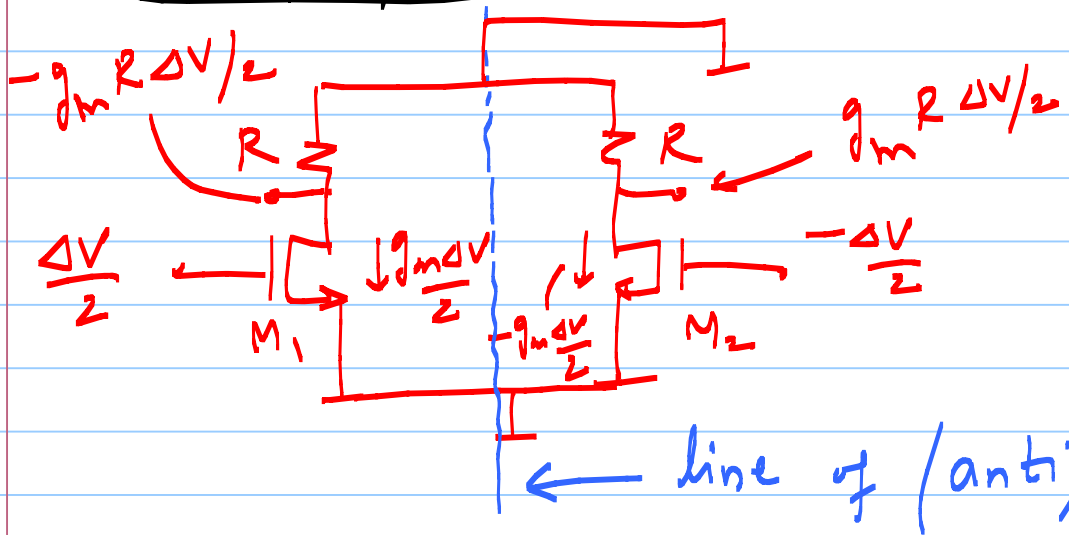


$$V_{CM} = \frac{V_a + V_b}{2}$$

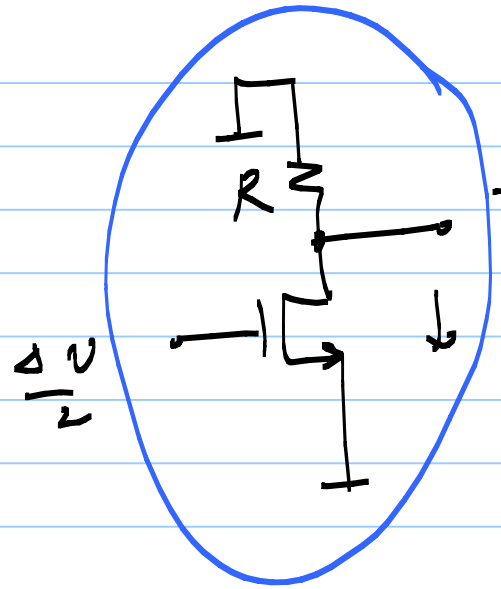
$$\Delta V = V_a - V_b$$



DM eq. circuit

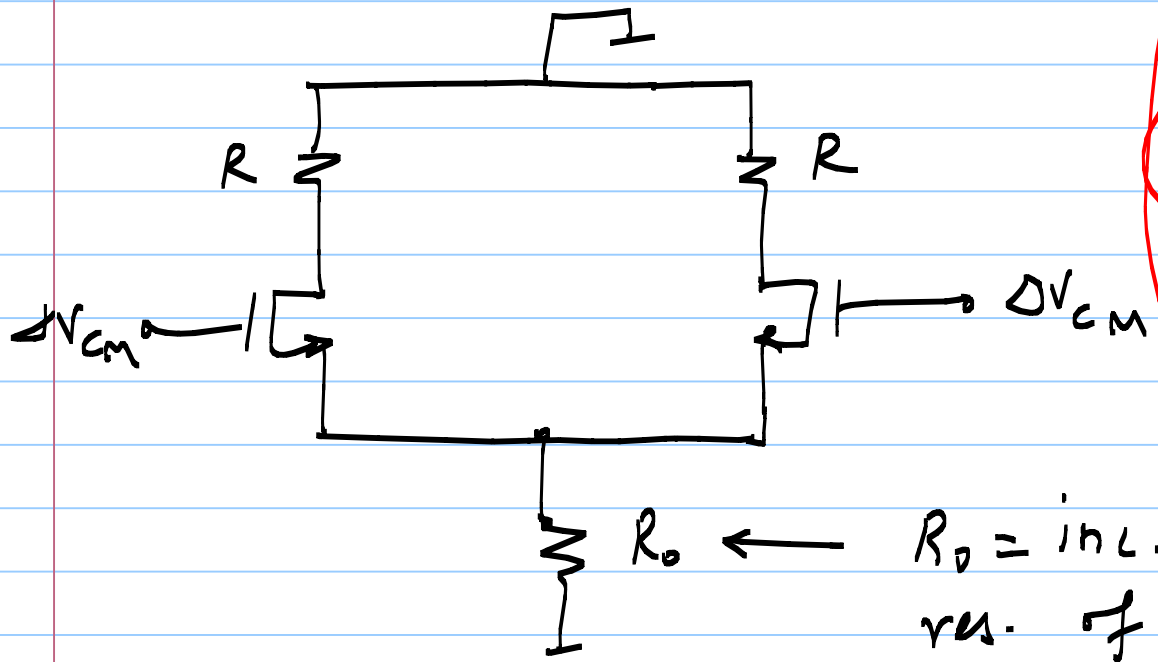


"v's and i's on each "half-circuit" have equal magnitude & opposite phase

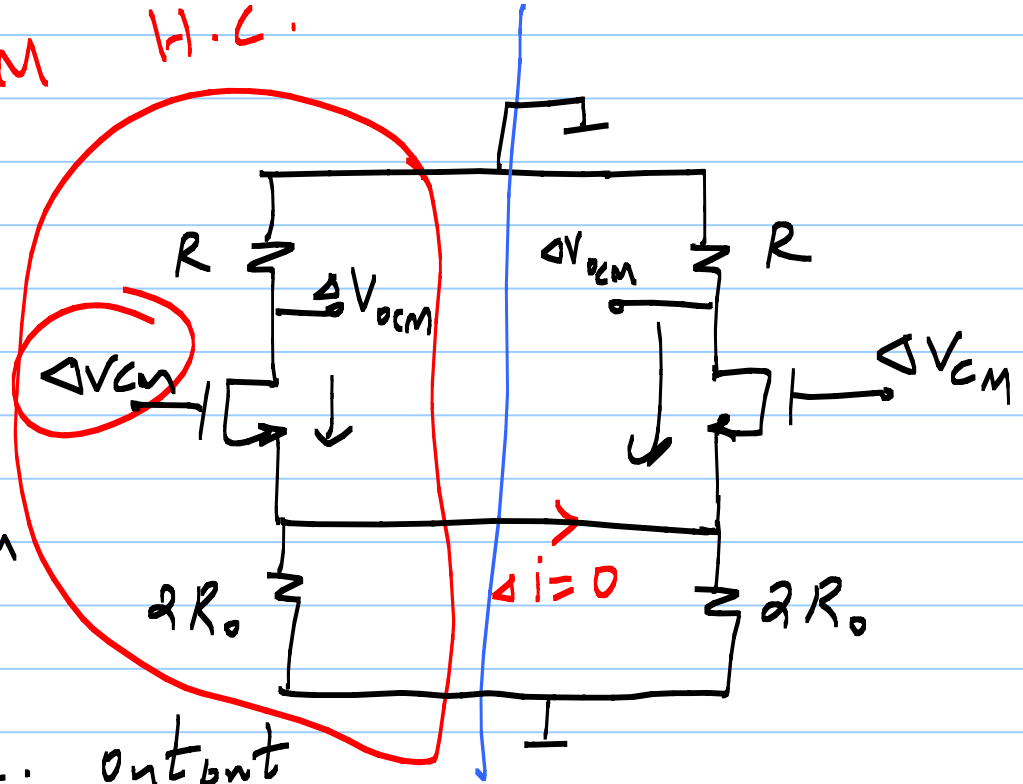


→ DM half circuit

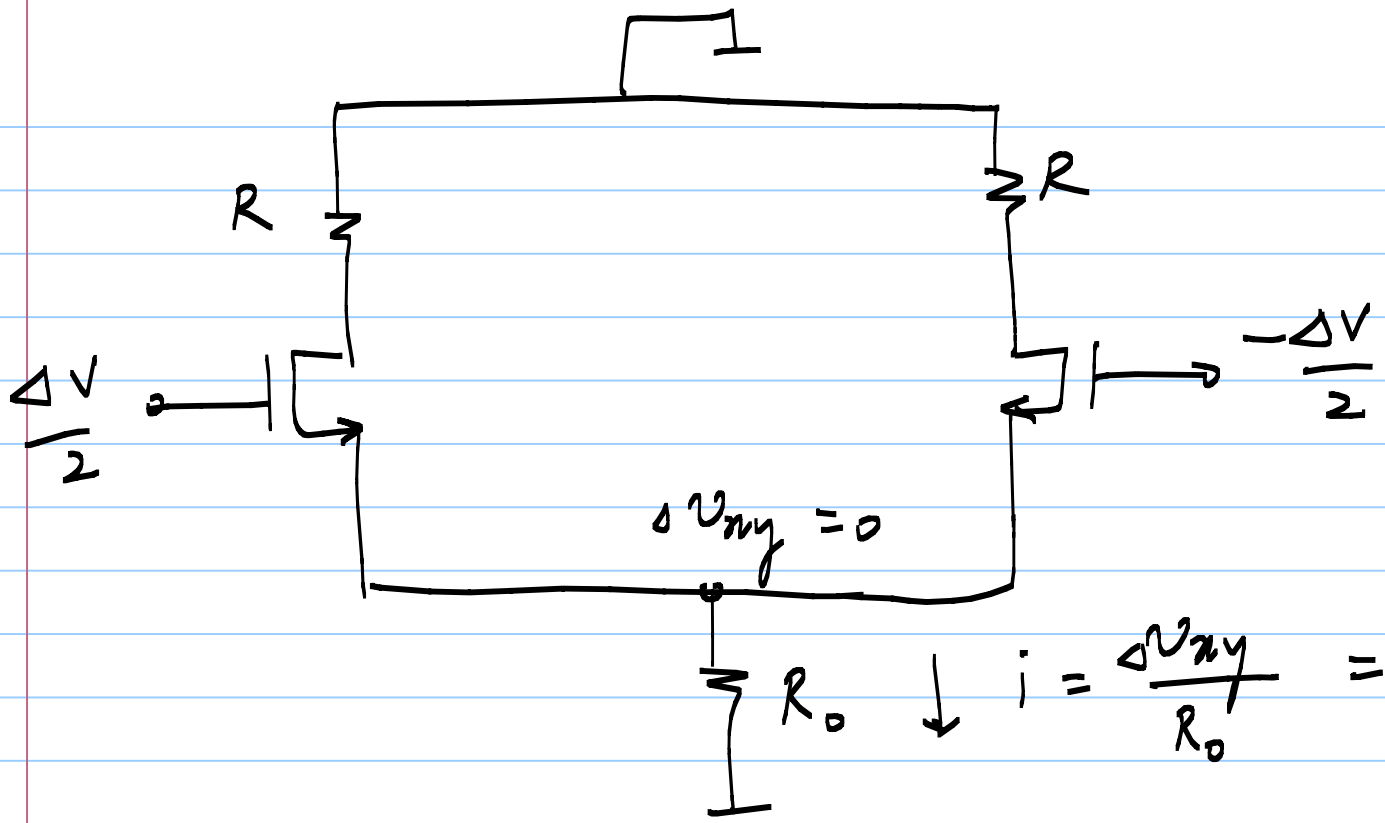
CM eq. cir.



CM H.C.

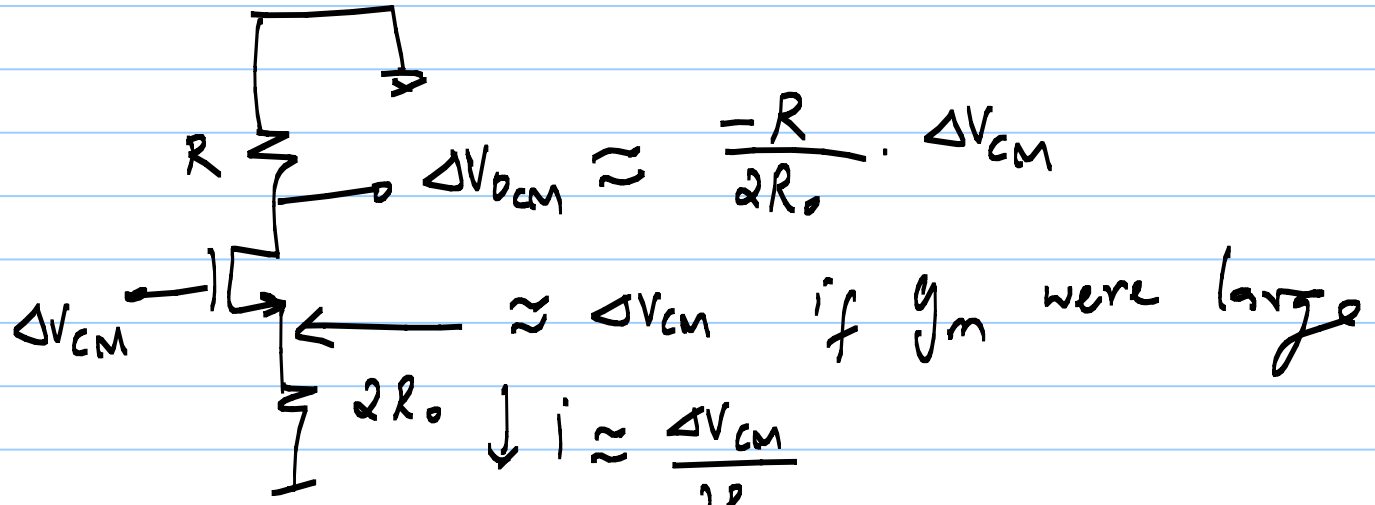


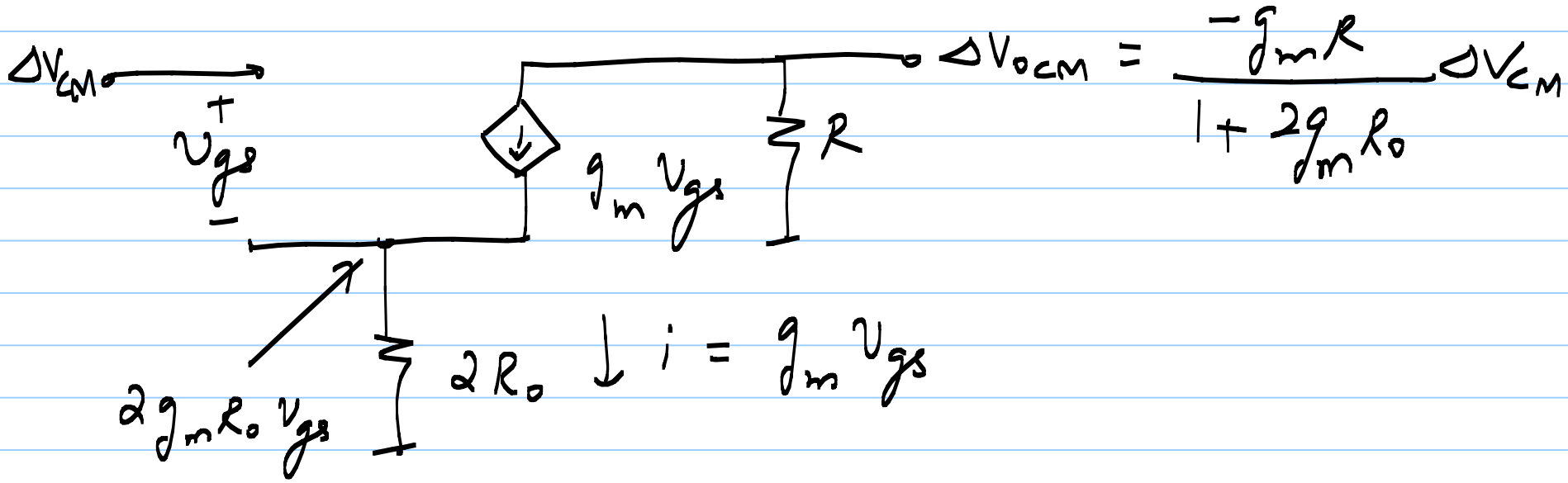
R_o ← R_o = inc. output res. of $2I_o$ current source



$\downarrow \; i = \frac{\Delta v_{xy}}{R_0} = 0$ is the only possible state of the DM cir.

$\Delta V_{OCM} = ?$





$$A_{DM} = -g_m R$$

$$A_{CM} = \frac{-g_m R}{1 + 2g_m R_o}$$

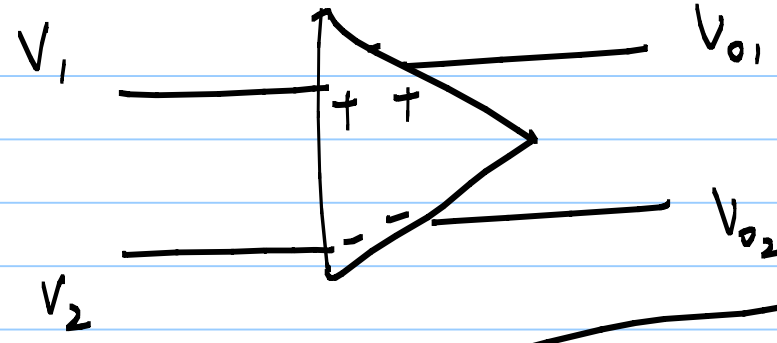
$$CMRR = \left| \frac{A_{DM}}{A_{CM}} \right|$$

Common Mode Rejection Ratio

$$CMRR_{dB} = 20 \log \left| \frac{A_{DM}}{A_{CM}} \right|$$

large CMRR = "good" differential amplifier

Diff. Amp.



DC @ ⊕ input

Ac @ + input

e.g. $V_1 = 1V + 2mV \sin\omega t + 5mV\ (DC)$

$V_2 = 1.01V + 1mV \sin\omega t + 5mV\ (DC)$

$1.01V$

$V_{ICM} = \frac{V_1 + V_2}{2} = 1.005V + 1.5mV \sin\omega t + 1\mu V \cos\omega_2 t$

$V_{iDM} = \frac{V_1 - V_2}{2} = -0.005V + 0.5mV \sin\omega t + 2\mu V \cos\omega_2 t$

$V_1 = V_{ICM} + V_{iDM}$; $V_2 = V_{ICM} - V_{iDM}$

$V_{iDC} = V_{CM} = 1.005V \rightarrow 1.01V$

$$v_{CM} = 1.5\,mV \sin \omega t$$

$$\Delta V_{iDM} = -0.005$$

$$v_{DM} = 0.5\,mV \sin \omega t$$