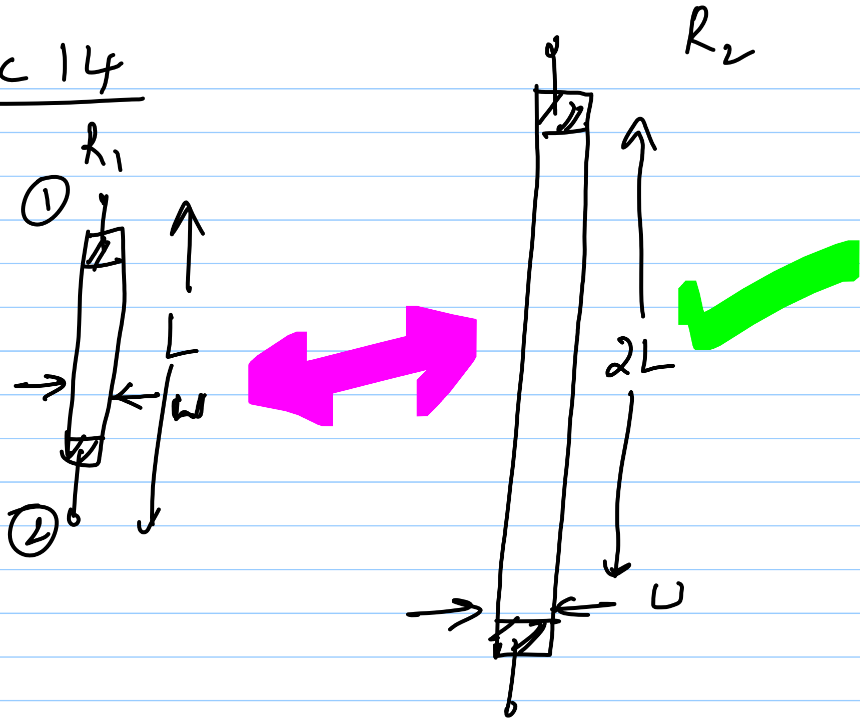
5-2-13

Lec 14

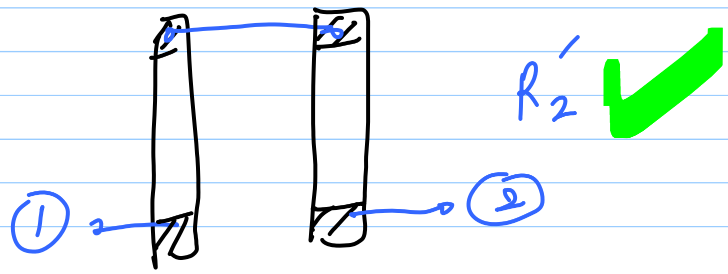
$$\frac{R_2}{R_1} = \frac{2}{1}$$

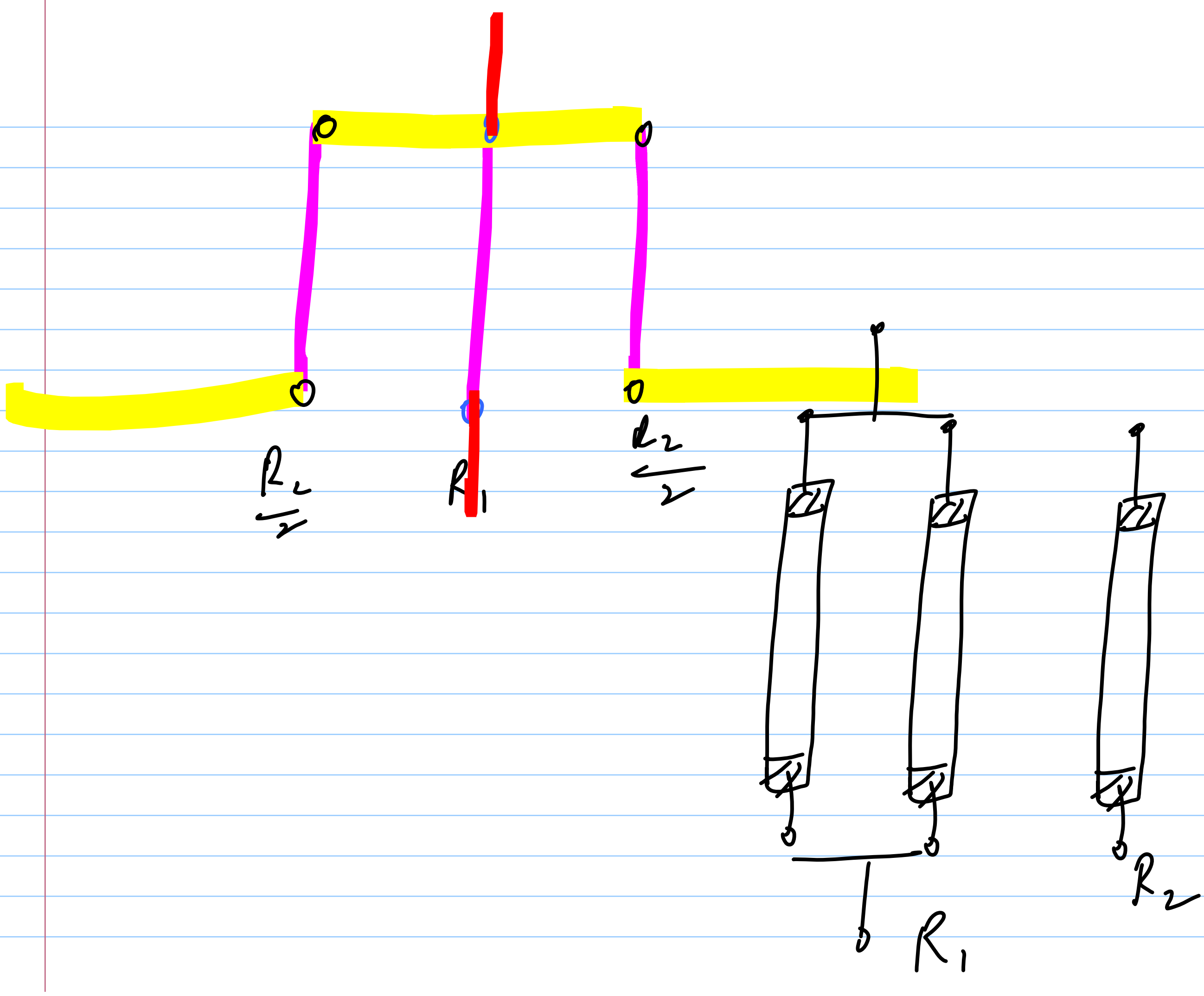


$$R_1 = R_0 + 2R_c$$

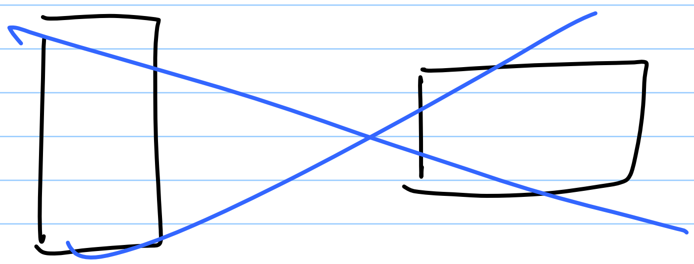
$$R_2 = 2R_0 + 2R_c$$

$$R_2' = 2R_0 + 4R_c$$

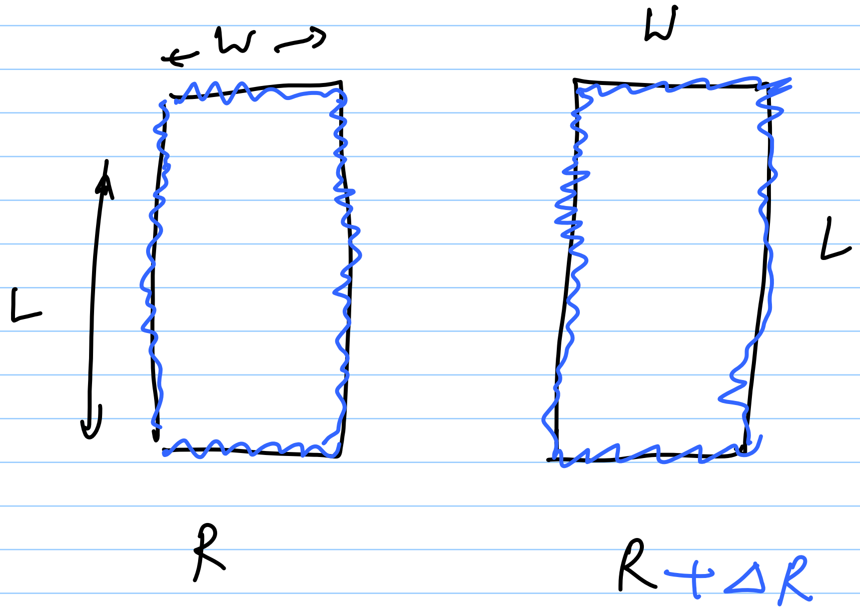




* Use identical units (can use different numbers to get multiples of R, C etc.)
* Use arrays & dummy devices to create identical surroundings
* Same orientation



Random Mismatch



Observations

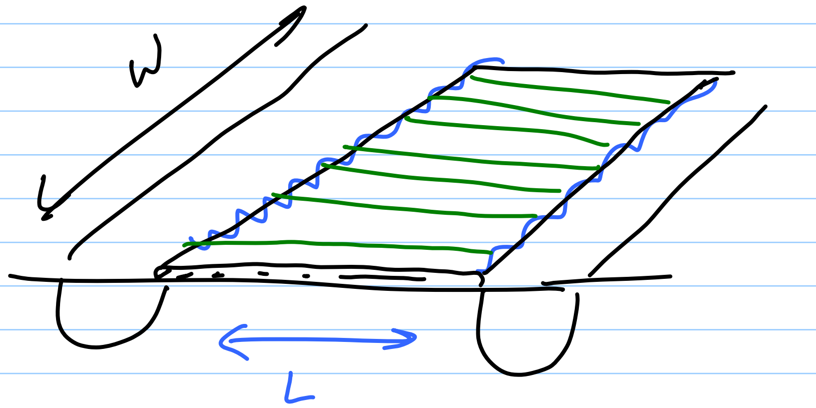
* As $W \uparrow$ & $L \uparrow$ $\Rightarrow$ $\frac{\Delta W}{W}$ & $\frac{\Delta L}{L} \downarrow$

$\Rightarrow$ larger devices exhibit smaller mismatches

* As $(W \cdot L) \uparrow$,

$\frac{\Delta W}{W}$ & $\frac{\Delta L}{L} \downarrow$

due to "averaging" effect



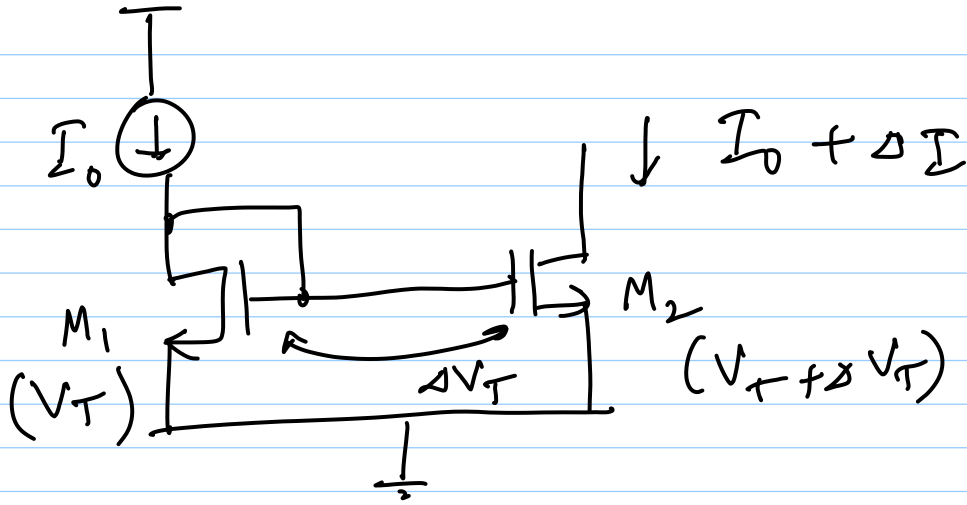
$$\sigma_{V_T} = \frac{A_{V_T}}{\sqrt{W \cdot L}}$$ e.g. $A_{V_T} = 5 mV \cdot \mu m$

$$\sigma_{\beta} = \frac{A_{\beta}}{\sqrt{W \cdot L}}$$ $\beta = \mu C_{ox}$

$$\sigma_{\frac{\Delta R}{R}} = \frac{A_R}{\sqrt{WL}}$$

$$\sigma_{\frac{\Delta C}{C}} = \frac{A_C}{\sqrt{WL}}$$

$\% \cdot \mu m$ units



$$\Delta I = -g_m \Delta V_T$$

$$\sigma^2(\Delta I) = g_m^2 \, \sigma_{V_T}^2$$

$$\sigma^2\left(\frac{\Delta I}{I_0}\right) = \frac{g_m^2}{I_0^2} \cdot \sigma_{V_T}^2 = \frac{4\sigma_{V_T}^2}{(V_{GS}-V_T)^2}$$

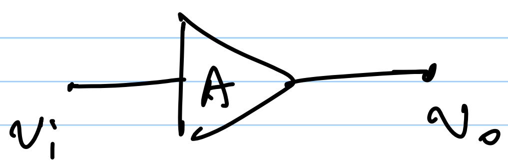
Mismatch Effects

* DC mismatches (e.g. Current mirror)

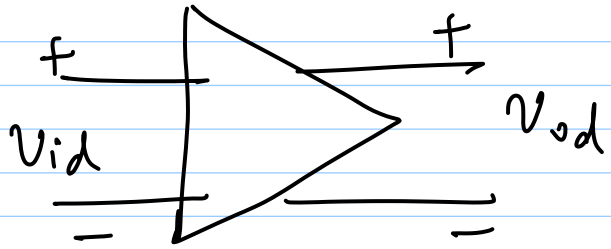
* e.g. Diff. amp.

↳ Common mode gain gets worse

↳ Even order distortion



$$V_o = A_0 + A_1 V_i + A_2 V_i^2 + A_3 V_i^3 + \dots$$



$$V_{od} = f(V_{id})$$

no A_0 term ✗

A_1 term ✓

$A_2, A_4 \ldots$ ✗

* If 2 sides are not identical

⇒ imperfect cancellation of even order terms