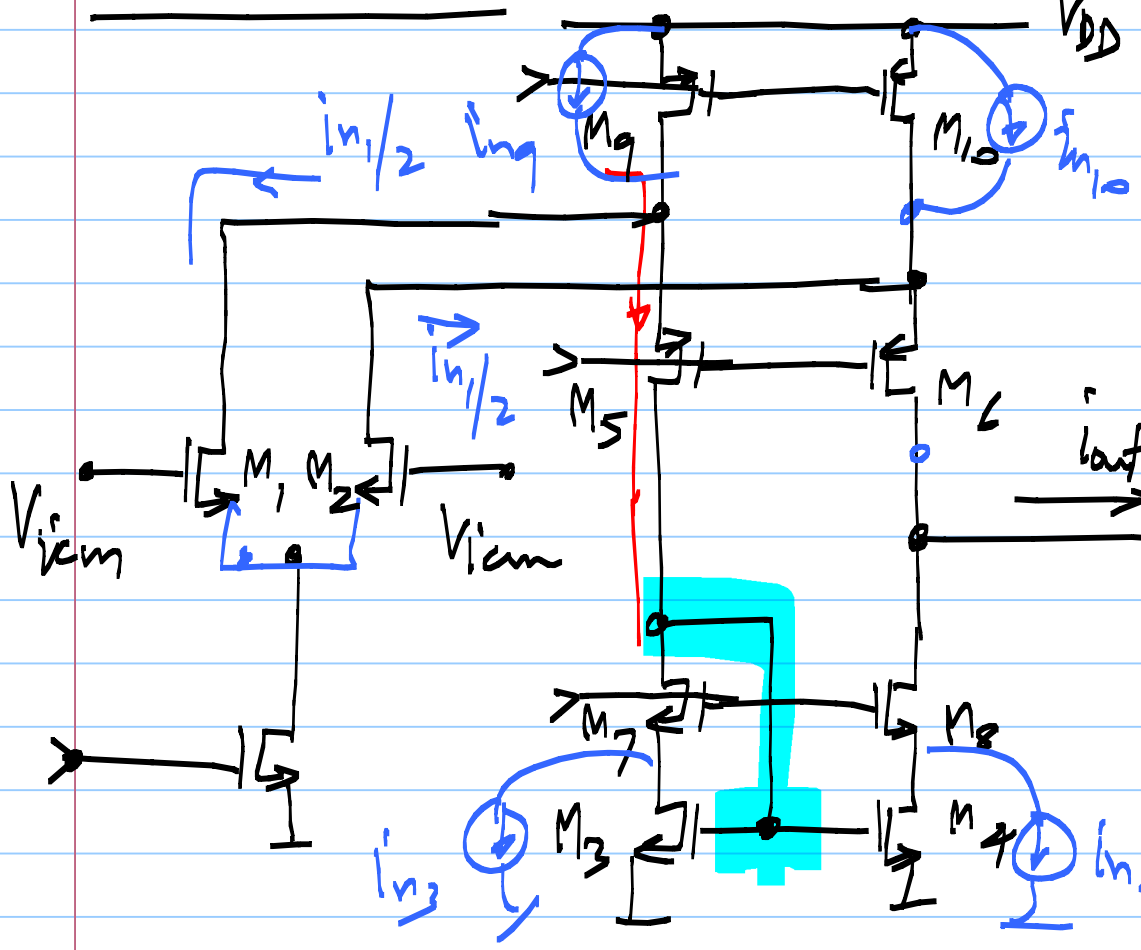
Lecture 26

10/3/2016



Cascode devices:

$M_{5,6,7,8}$: no noise

$\sim \frac{g_{ds}}{g_m + g_{ds}}$

$i_{n,1} - i_{n2}$

$+ i_{n3} - i_{n4}$

$- i_{n9} + i_{n10}$

Output noise PSD:

Folded cascode opamp: $\frac{16}{3} kT \left(g_{m1} + g_{m3} + g_{m4} \right)$

Telescopic cascode: $\frac{16}{3} kT \left(g_{m1} + g_{m3} \right)$

Simple single stage:

Input ref. noise PSD:

Folded cascode: $\frac{16}{3} \frac{kT}{g_{m1}} \left(1 + \frac{g_{m3}}{g_{m1}} + \frac{g_{m4}}{g_{m1}} \right)$

Telescopic / simple: $\frac{16}{3} \frac{kT}{g_{m1}} \left(1 + \frac{g_{m3}}{g_{m1}} \right)$

dc gain (G_m, G_-)

Swing limits

Noise

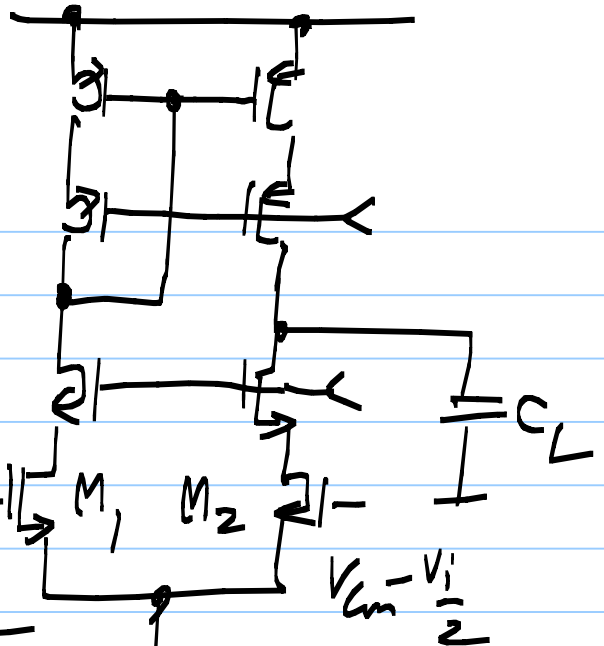
Mismatch

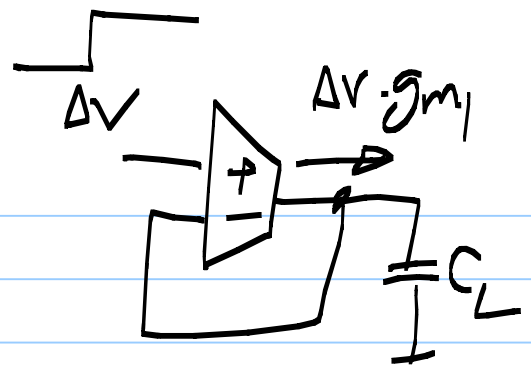
SR_+: I_0/C_L

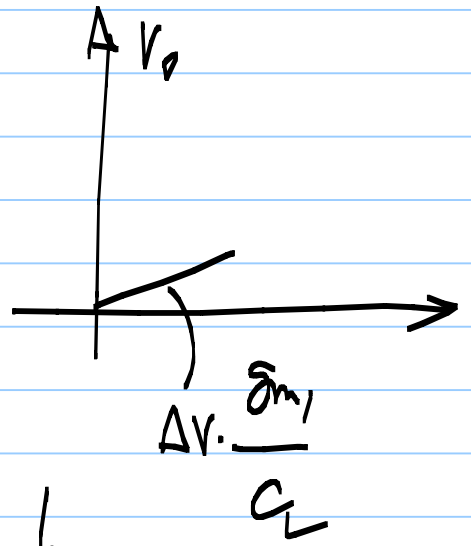
SR_-: I_0/C_L

Telescopic

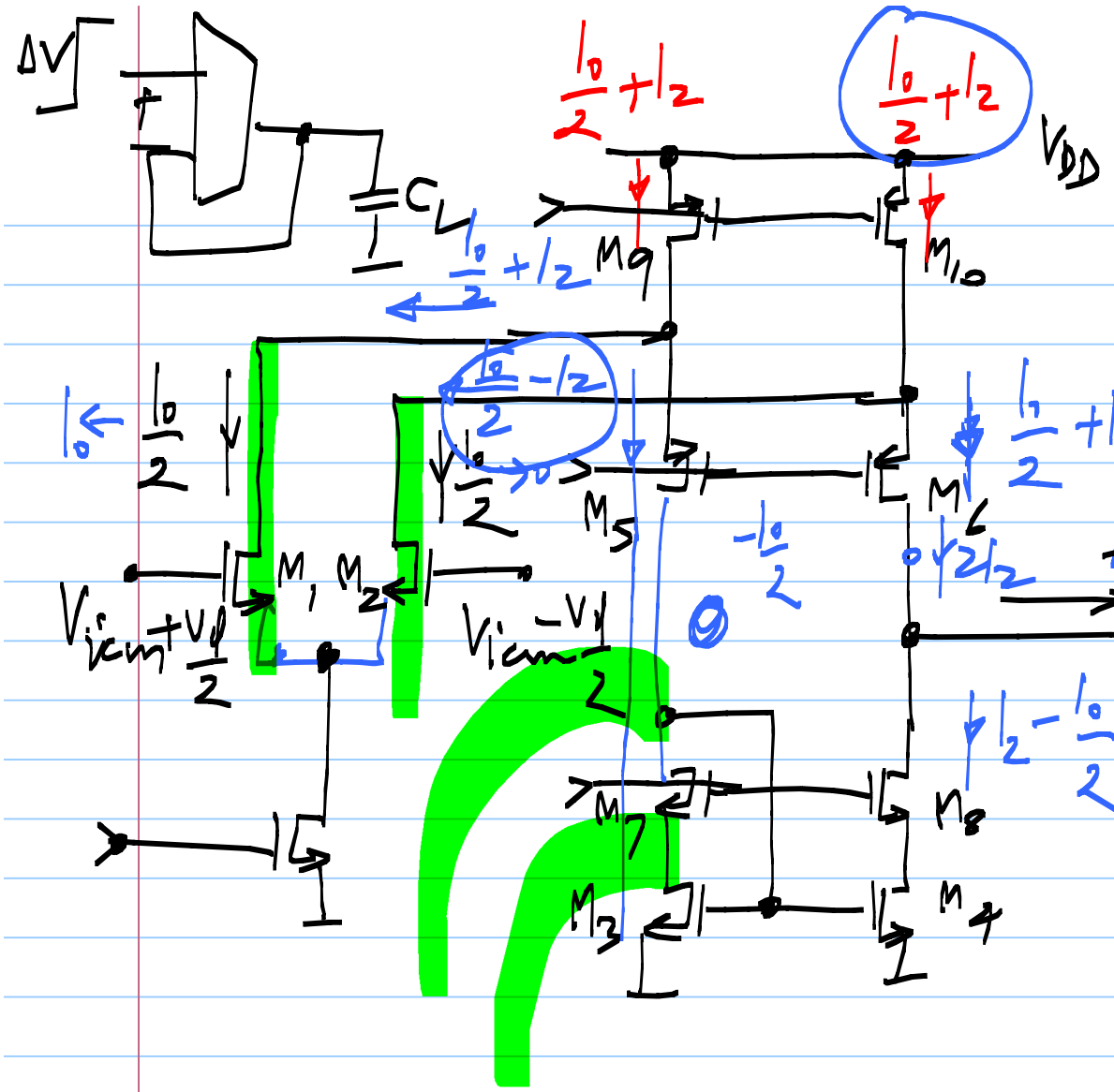
Cascode







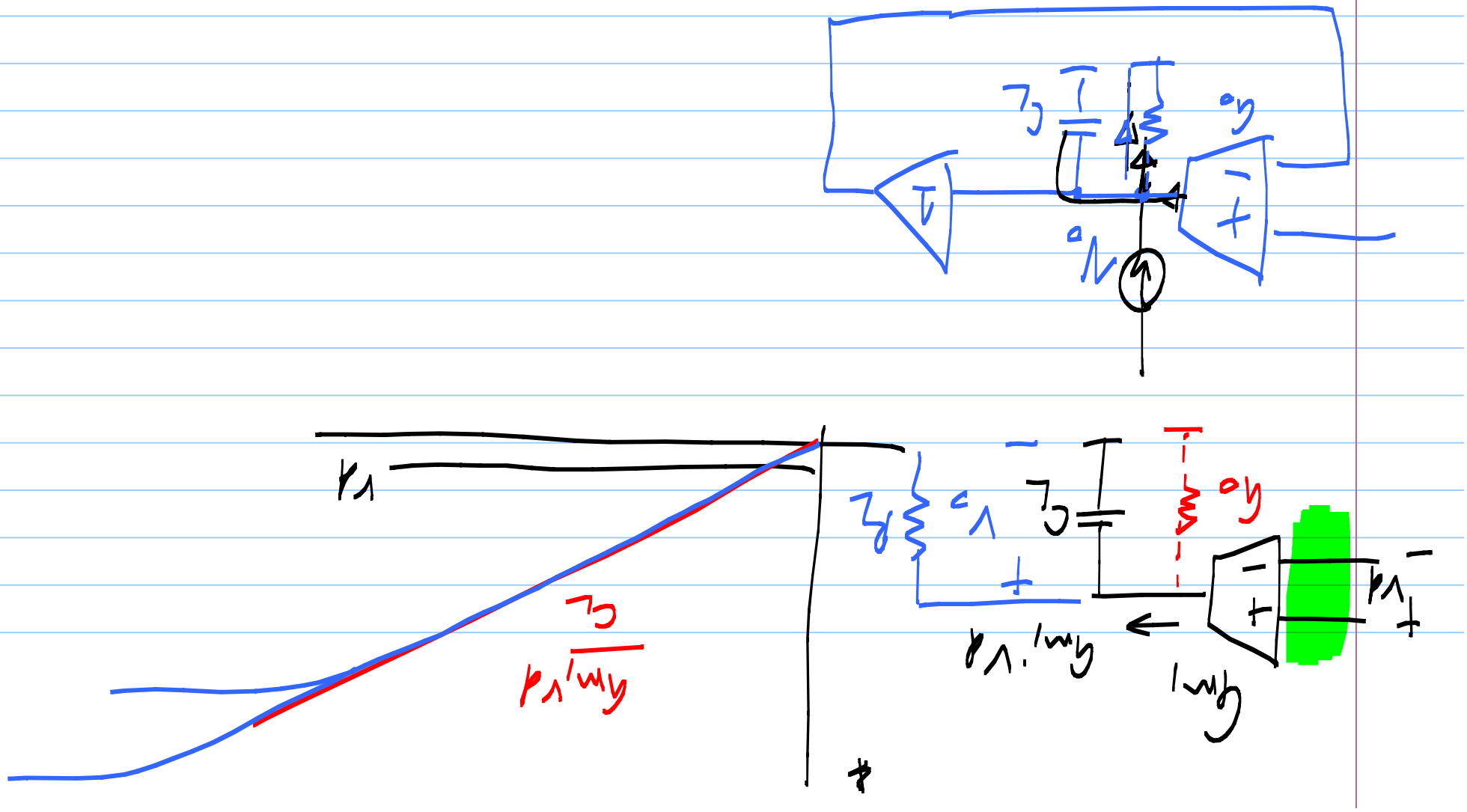
$$\text{Slope} < \frac{I_0}{C_L}$$



$\frac{I_0}{C_L}$ only if $I_2 > \frac{I_0}{2}$

$\frac{2I_2}{C_L}$ if $I_2 < I_0/2$??

$$\min\left(\frac{I_0}{C_L}, \frac{2I_2}{C_L}\right)$$



Any transimpedance amp.
Better to use
a
$I - V$
$V \rightarrow I$
V_d
$G_{m1} V_d$
into C_L
G_{m1}
$G_{m1} V_d$
Z_S
Z_S
$V_o = I_x \cdot Z_m$
V_o
I_x
$I_x \cdot Z_m$
Z_m
I_x
V_o

g_{m1}
C_L
v_o
g_{m1}
C_L
v_o
g_{m1}
C_L
v_o
g_{m1}
C_L
C_x
g_{m2}
C_L
$\frac{g_{m1}}{2C_L} \cdot v_A$