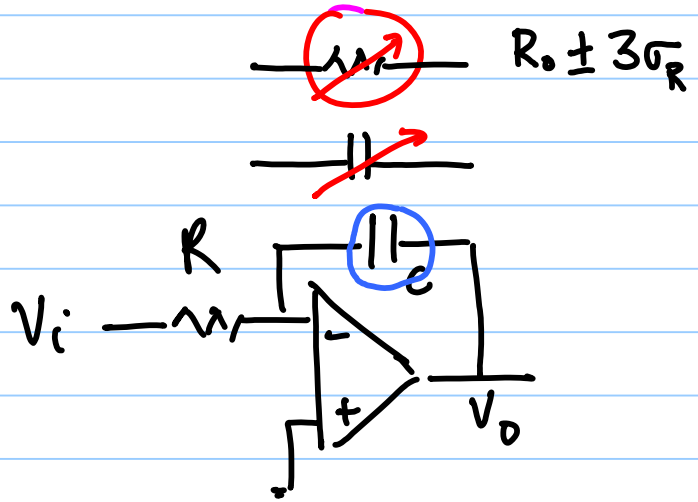
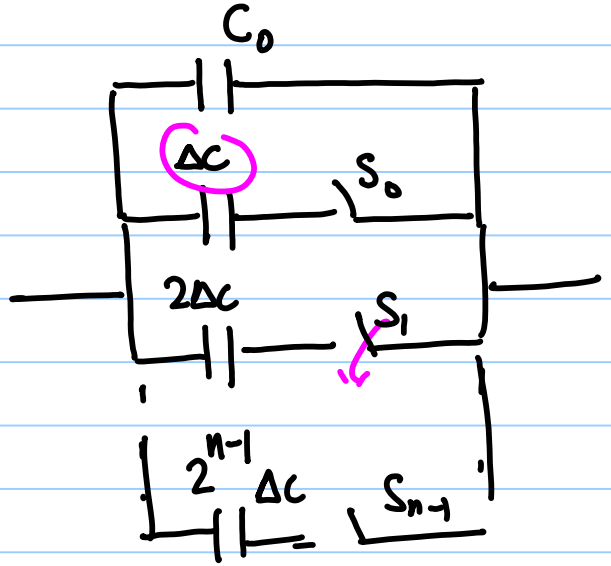
Lecture # 38

Note Title 23-04-2021

Passive RLC $\xrightarrow{-L}$ Active - RC

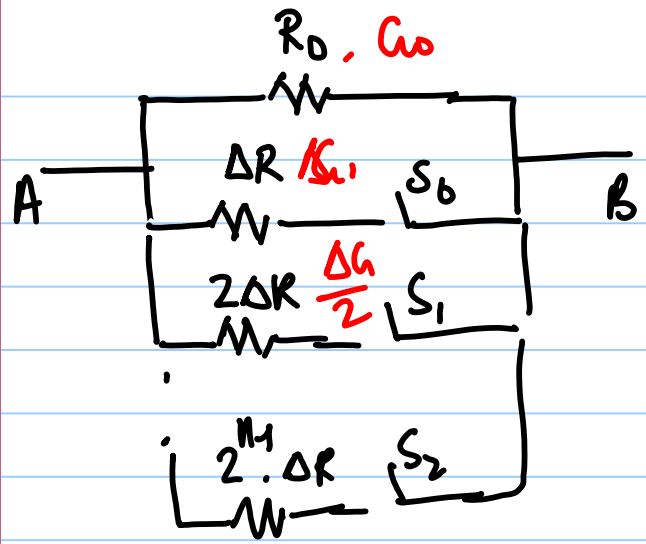




$$\frac{V_0}{V_i} = \frac{-1}{sRC_0}$$

$$= \frac{-1}{s\,(R_0 \pm \Delta R)(C_0 \pm \Delta C)}$$

$$C_{total} = C_0 + (S_0 \cdot 2^0 \cdot \Delta C + S_1 \cdot 2^1 \cdot \Delta C + S_2 \cdot \vdots + S_m \cdot 2^m \Delta C)$$



$$R_{total} = \frac{1}{\frac{1}{R_0} + \frac{S_0}{2^0.\Delta R} + \frac{S_1}{2^1.\Delta R} + \cdots + \frac{S_M}{2^M.\Delta R}}$$

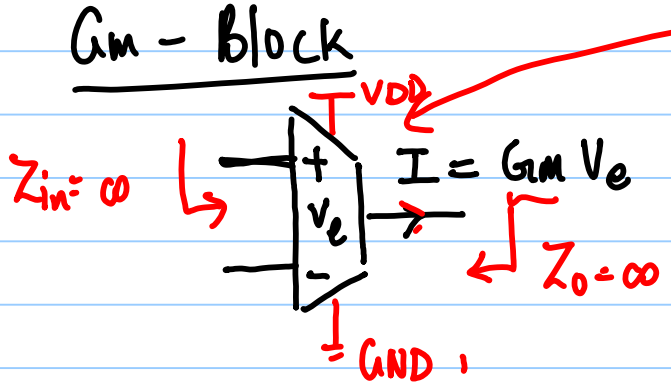
minimum change in R_{total}

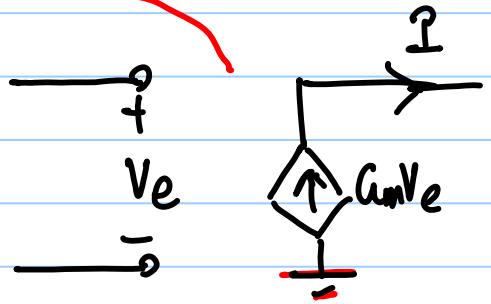
$$R_1 = \frac{1}{\frac{1}{R_0} + \frac{1}{2^M.\Delta R}} = \frac{R_0.(2^M.\Delta R)}{R_0 + 2^M.\Delta R}$$

$$R_0 - R_1 = R_0 - \frac{R_0\, 2^M.\Delta R}{2^M \Delta R + R_0} = \frac{R_0^2}{R_0 + 2^M.\Delta R}$$

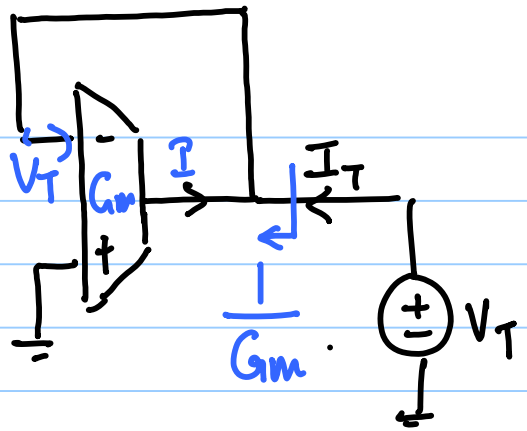
$$R_0 \,||\, R(\to\infty) = R_0 \xrightarrow{\Delta} 0$$

Gm - Block





(VCCS)

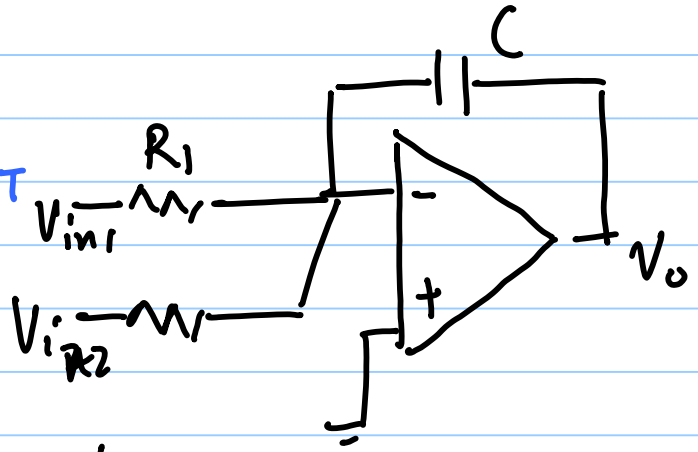


$$I = G_m(-V_T) = -I_T$$

$$\frac{V_T}{I_T} = \frac{1}{G_m} = R$$

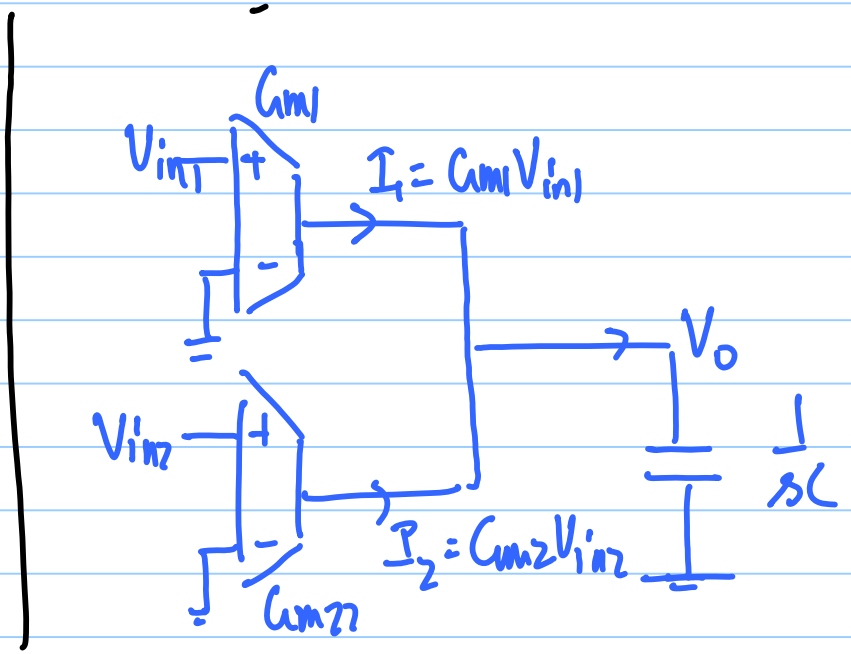
- Voltage gain
- Integrator
- RC filter

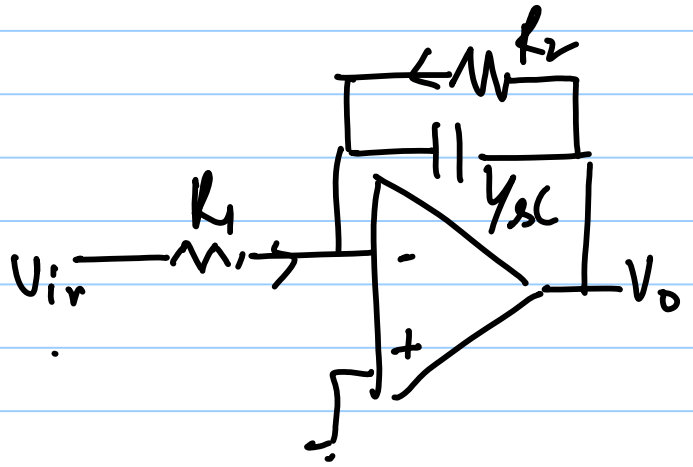
Active-RC

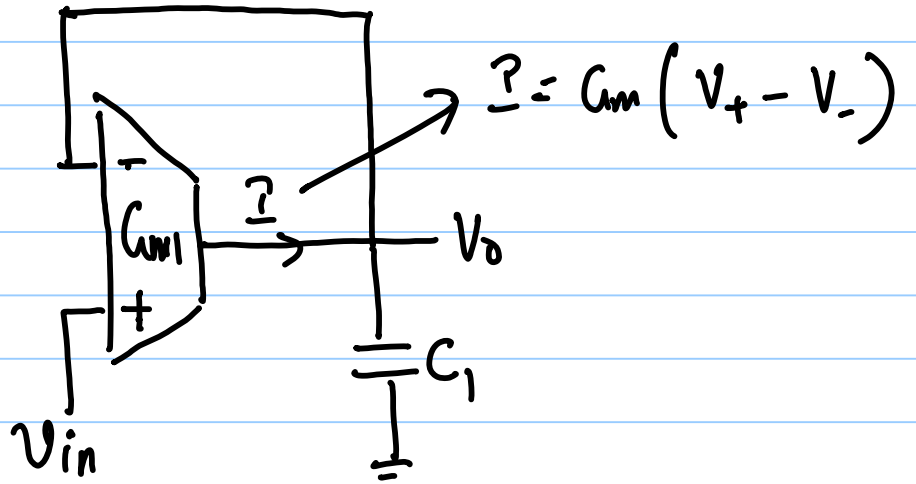


$$V_o = \left(-\frac{V_{in1}}{R_1} - \frac{V_{in2}}{R_2}\right) \times \frac{1}{sC}$$

$$= -(G_{m1}V_{in1} + G_{m2}V_{in2}) \times \frac{1}{sC}$$

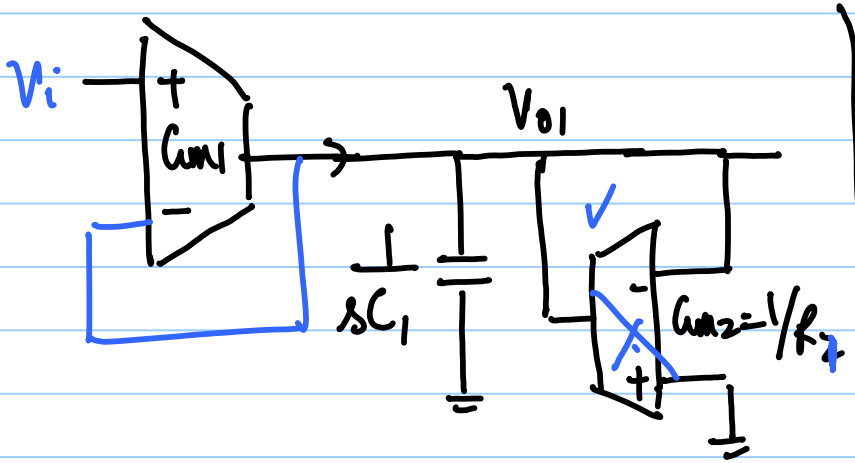






$$\left(\frac{V_{in}}{R_1} + \frac{V_o}{R_2}\right) \times \frac{1}{sC_1} = -V_o$$

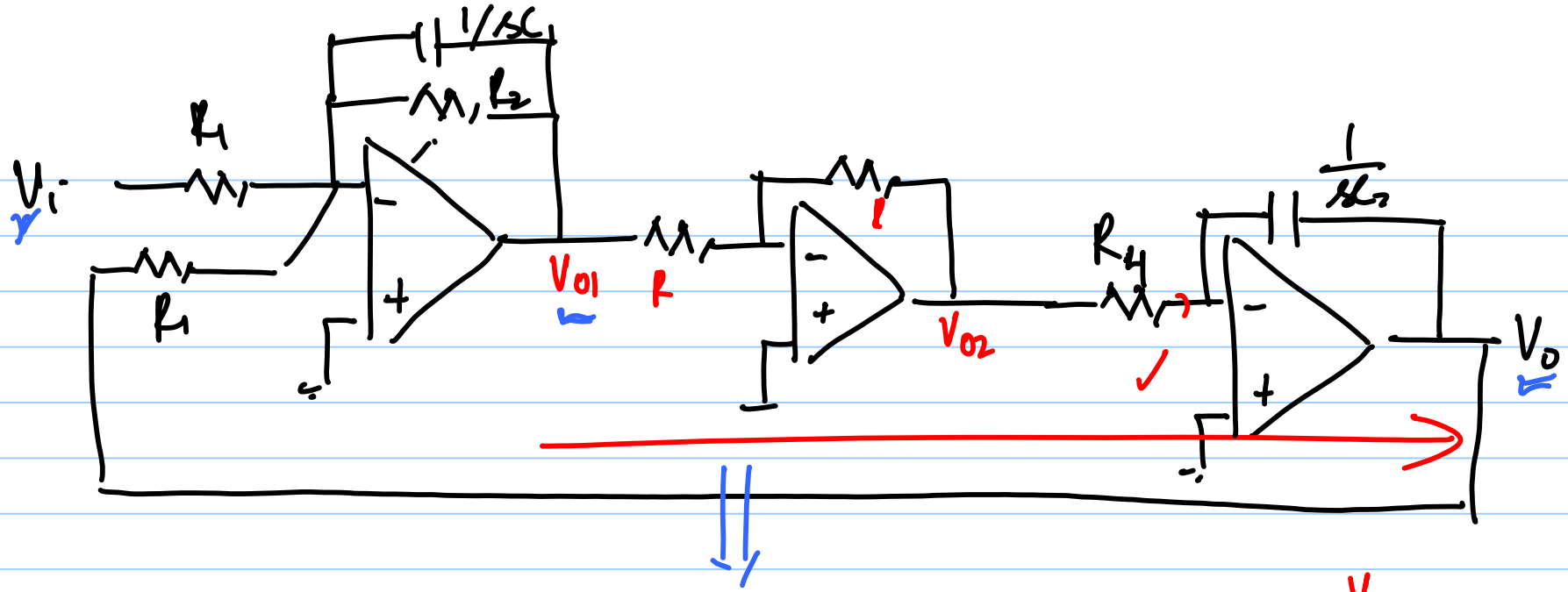
$$G_{m1}(V_{in} - V_o) \times \frac{1}{sC_1} = V_o$$



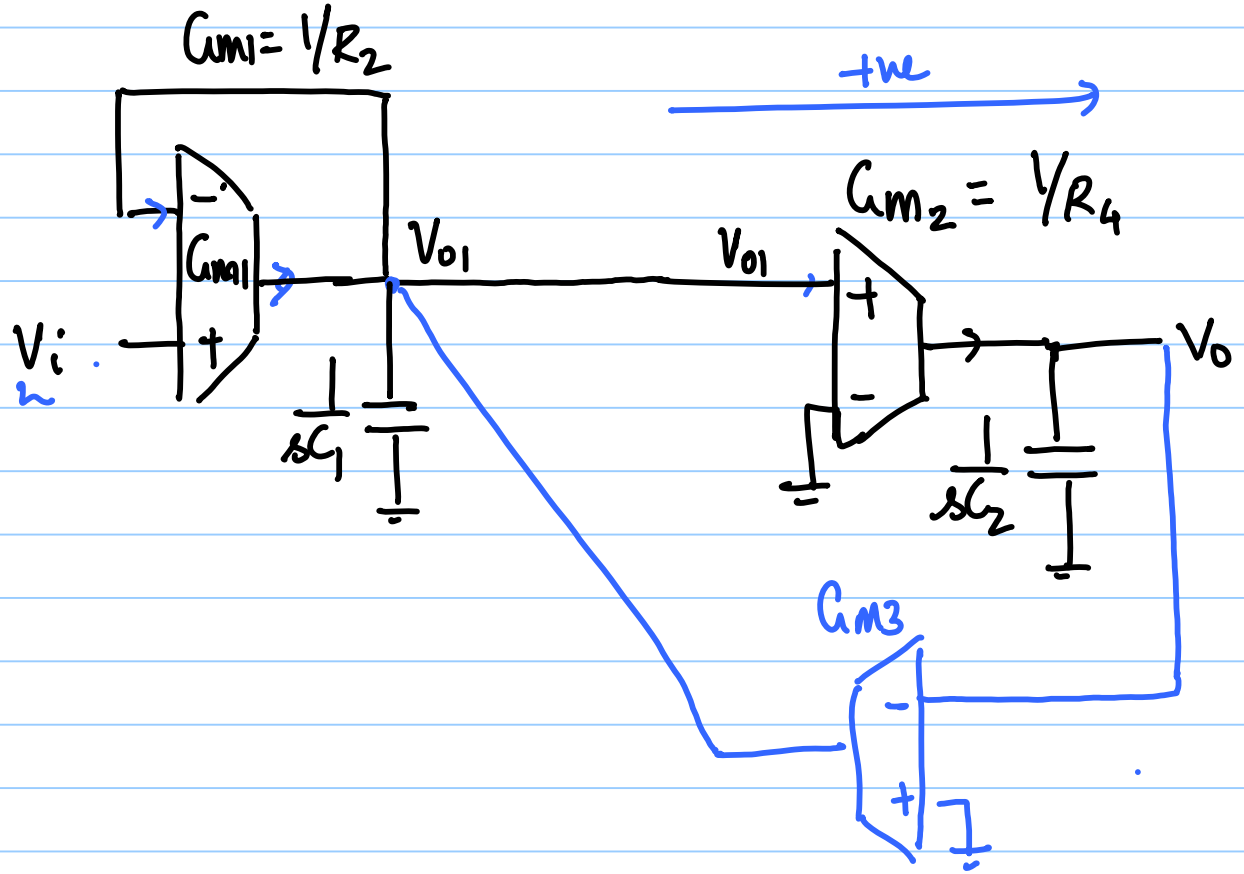
$$V_{in} = V_o\left(1 + \frac{sC_1}{G_{m1}}\right)$$

$$\frac{V_o}{V_{in}} = \frac{1}{1 + sC_1/G_{m1}}$$

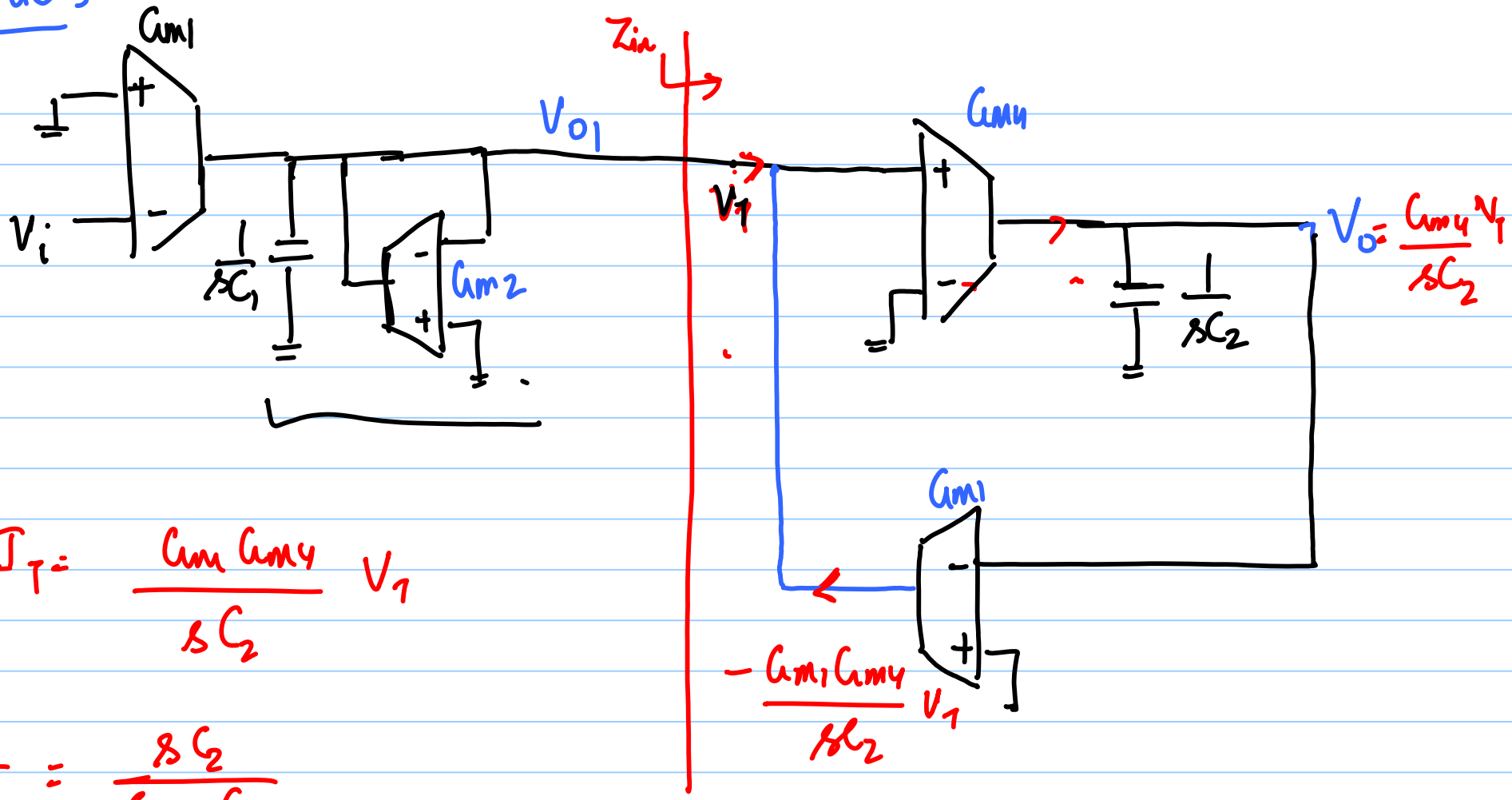
$$V_{o1} = \frac{+G_{m1} V_i}{sC_1 + G_{m1}}$$


1/sC1
R2
R1
Vi
R1
Vo1
R
Vo2
R4
1/sC2
Vo

$\frac{V_o}{V_{o1}} =$


Gm1 = 1/R2
+ve
Gm2 = 1/R4
Vo1
Vo1
Vo
Vi
Gm1
1/sC1
1/sC2
Gm3

"Gm-C filters"



$$I_T = \frac{G_{m1} G_{m4}}{sC_2} V_1$$

$$\frac{V_1}{I_T} = \frac{sC_2}{G_{m2} G_{m4}}$$