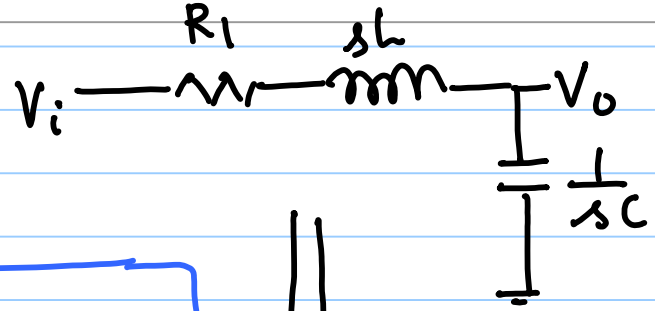
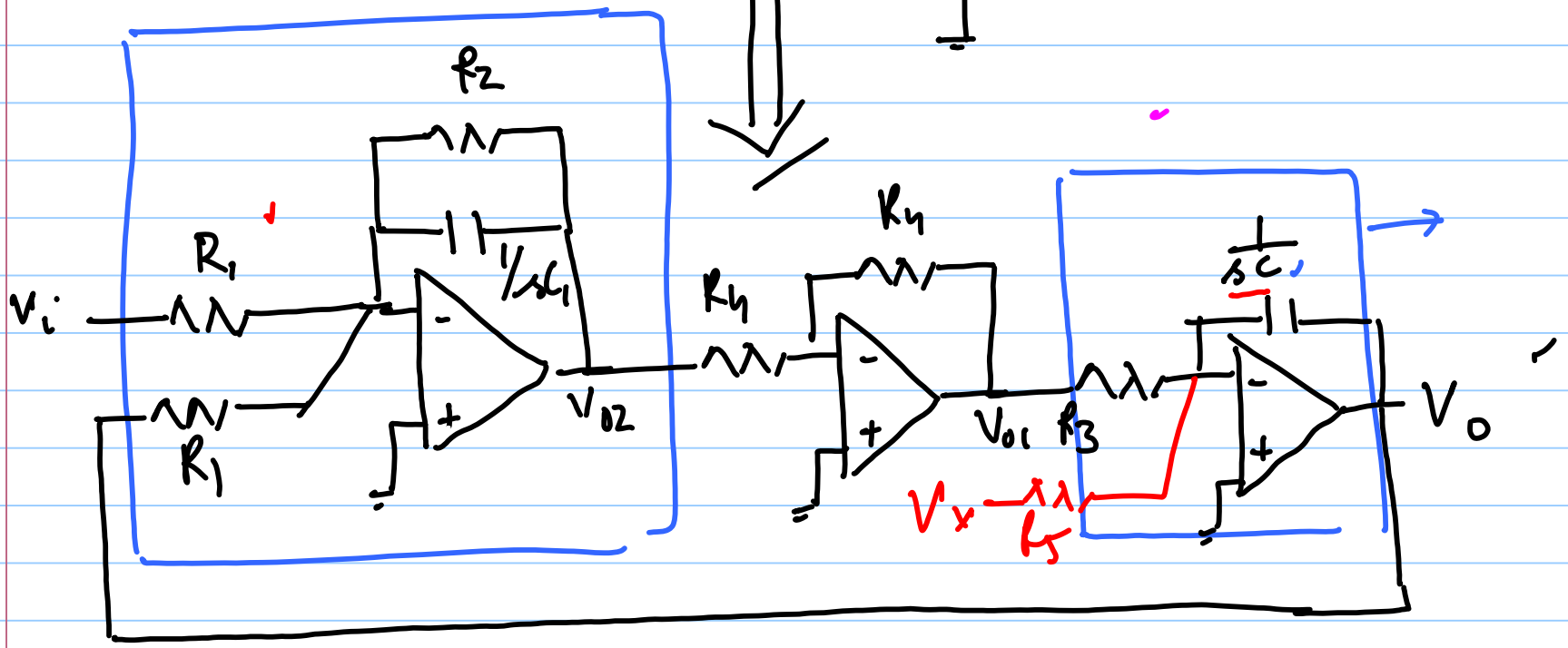
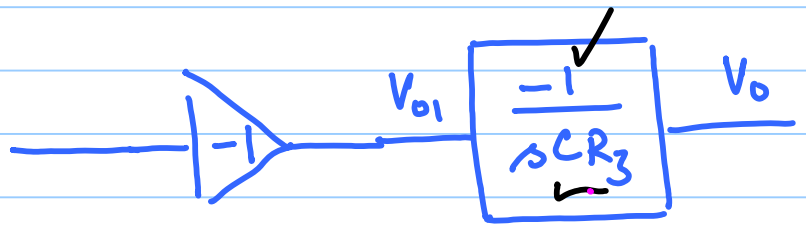
Lecture # 37

Note Title 22-04-2021

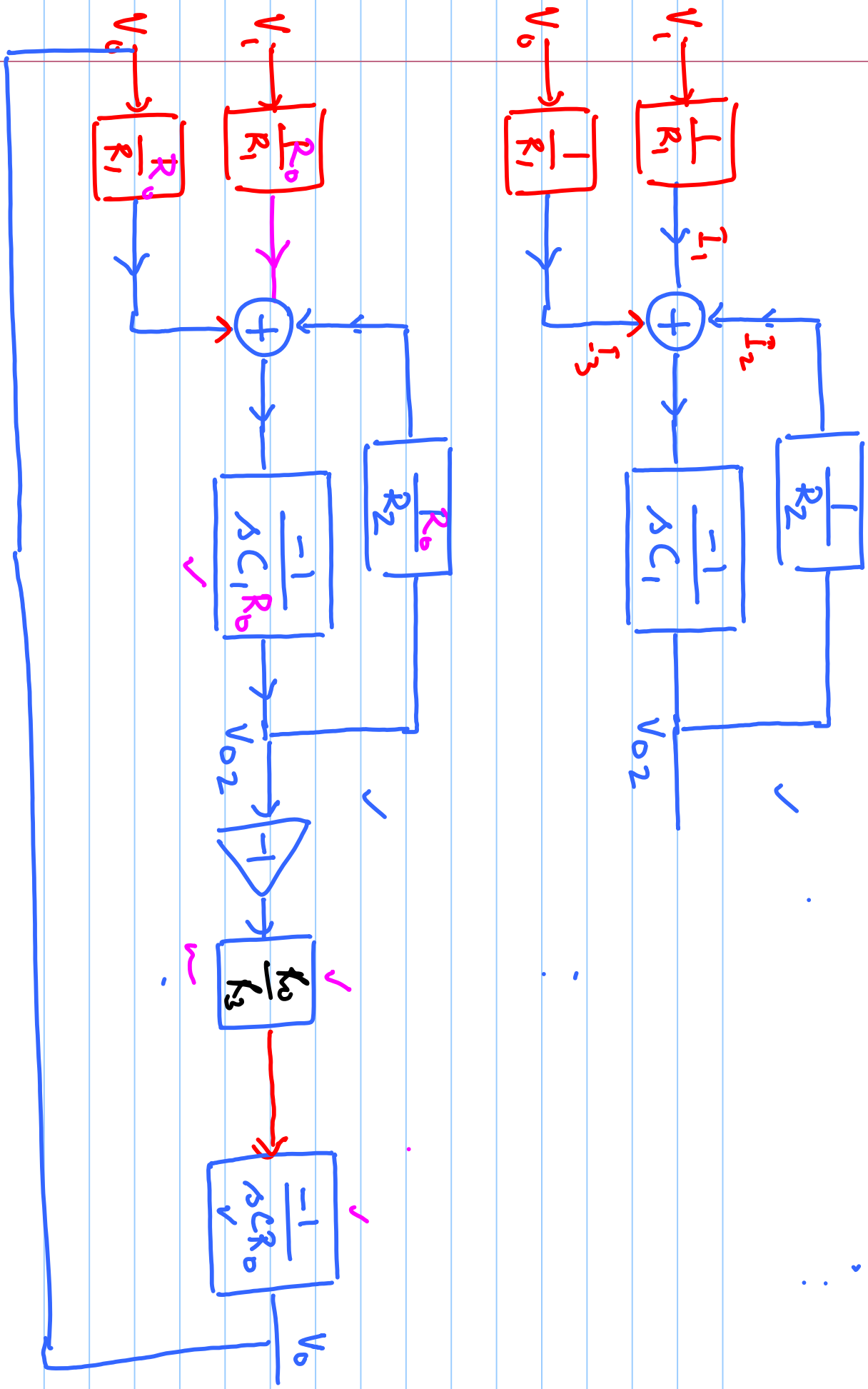
Active-RC filter

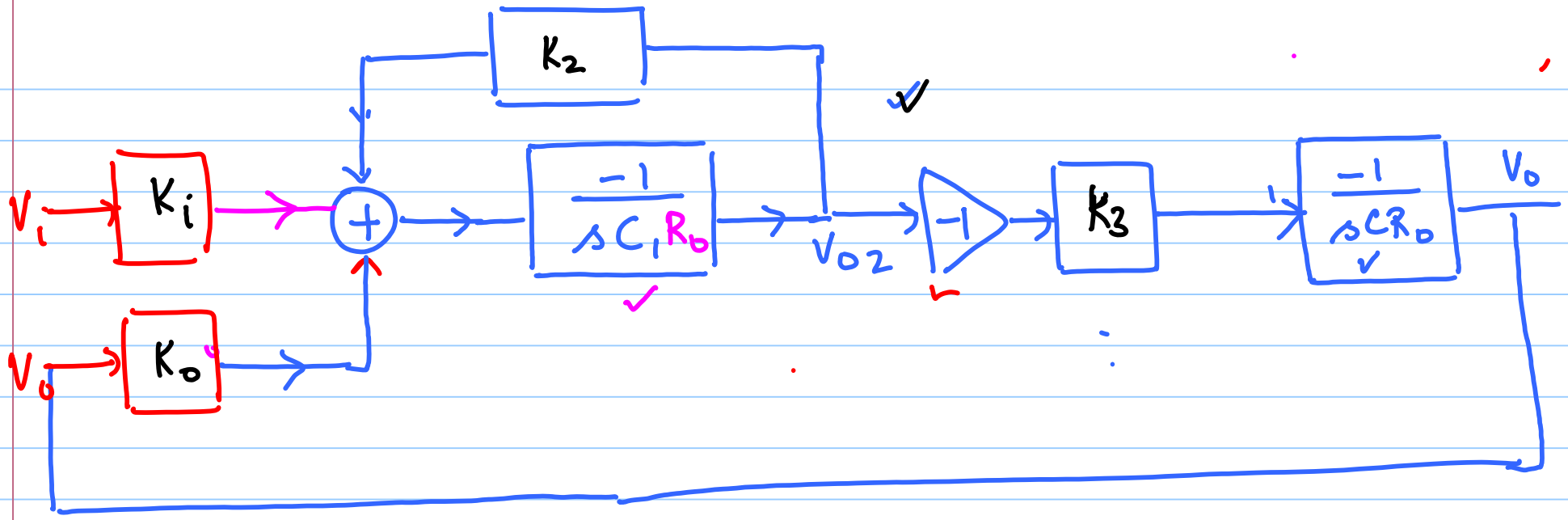


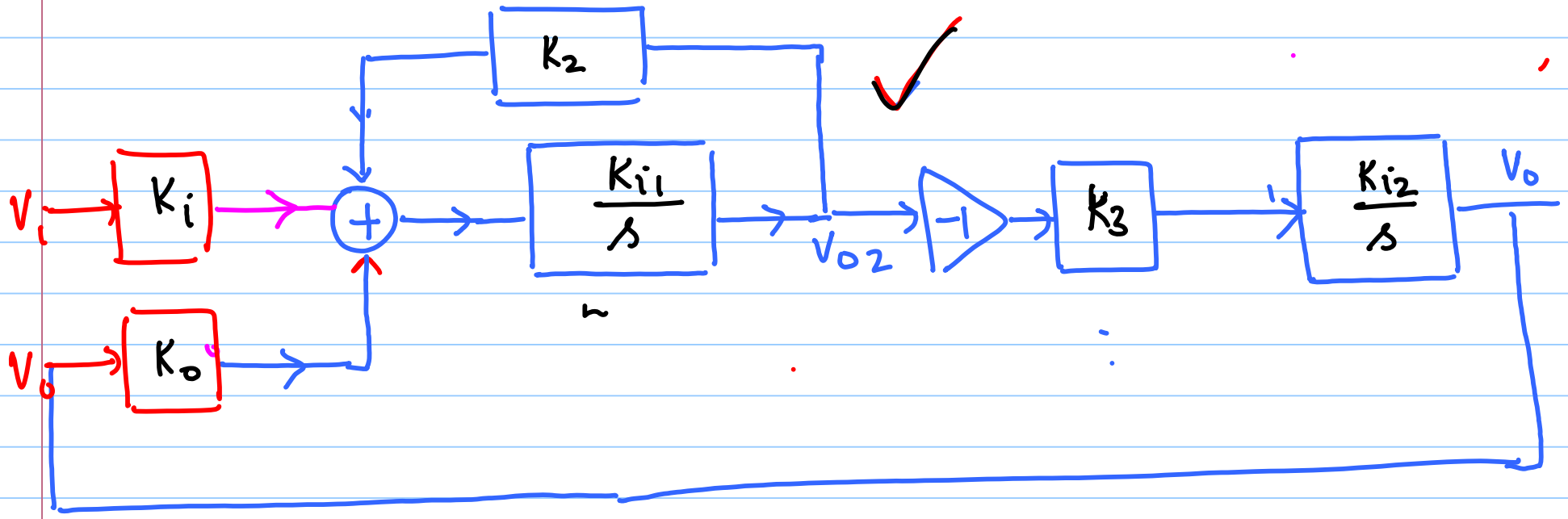


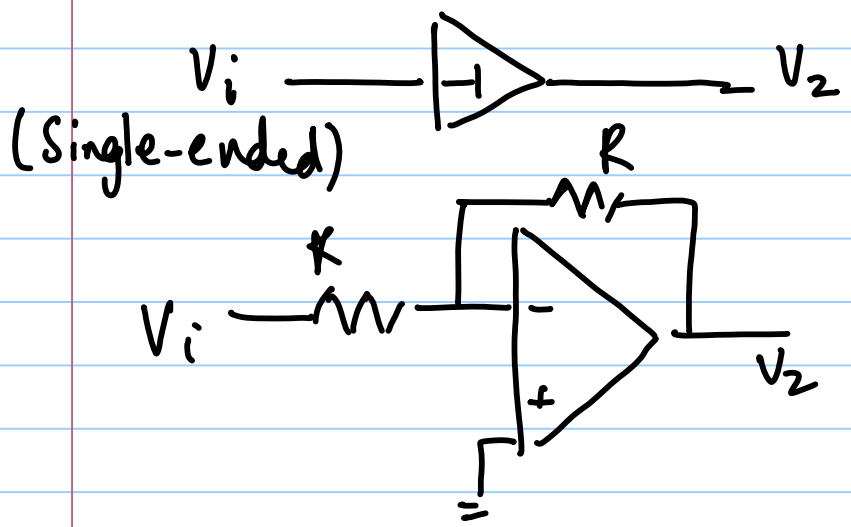


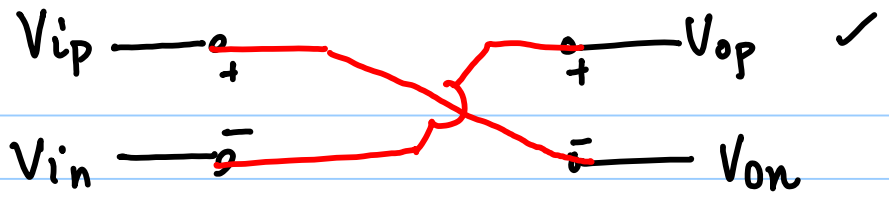
$$\frac{V_o}{V_{01}} = \frac{-1}{sCR_3} = \frac{-1}{sCR_0}\,\frac{R_0}{R_3}$$


V_o
V_-
R_1
R_o
$\frac{-1}{sC_1R_o}$
$\frac{R_o}{R_2}$
V_{o2}
-1
$\frac{1}{s^3}$
$\frac{-1}{sCR_o}$
V_o
I_1
I_2
$\frac{-1}{sC_1}$
$\frac{1}{R_2}$


K_2
V_i
K_i
$\frac{-1}{sC_1R_0}$
V_{02}
-1
K_3
$\frac{-1}{sCR_0}$
V_0
V_0
K_0


K_2
V_i
K_i
$\frac{K_{i1}}{s}$
V_{02}
-1
K_3
$\frac{K_{i2}}{s}$
V_0
V_0
K_0





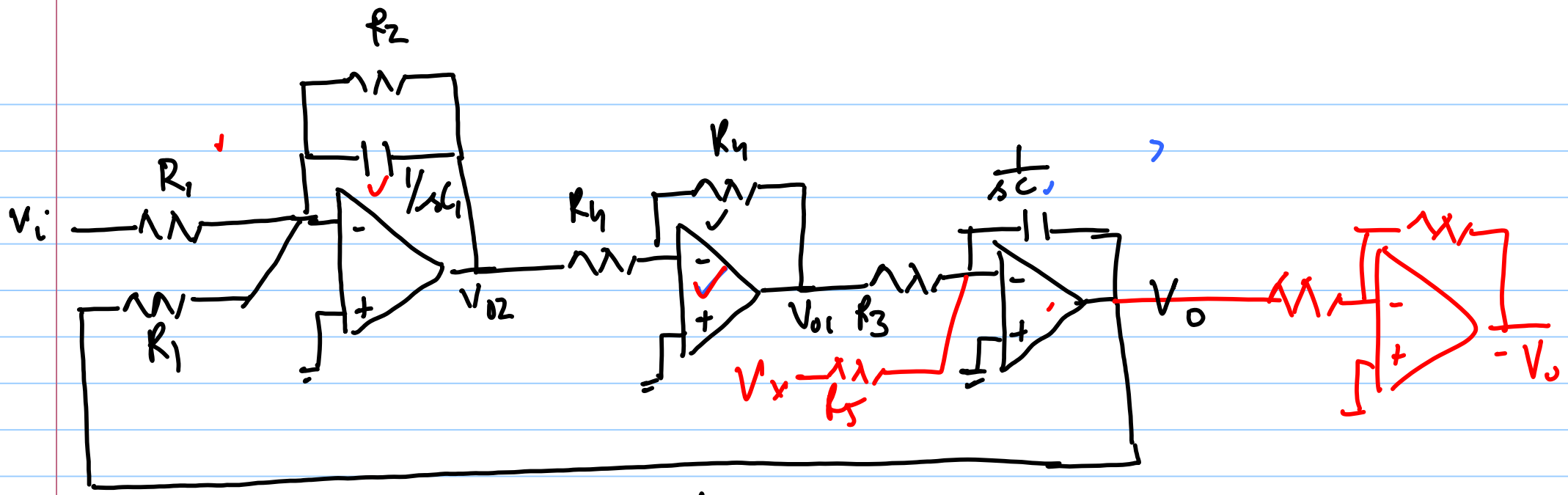
$V_i = V_{ip} - V_{in} = v_{diff}$ (Differential)

$V_{ip} = -V_{in} = \frac{v_{diff}}{2}$

$V_{out} = V_{op} - V_{on}$

$= -(V_{ip} - V_{in})$

$= -v_{diff}$



$$\left\{\left(\frac{V_i+V_o}{R_1}\right)\frac{-R_2}{1+sC_1R_2}\times\frac{-1}{v}\right\}\times\frac{1}{\frac{-1}{sCR_3}}=V_o$$

$$(V_i+V_o) = -V_o\,sCR_3(1+sCR_2)\frac{R_1}{R_2}$$

$$V_i = -V_o\left(1+sCR_3\frac{R_1}{R_2}(1+sCR_2)\right)$$

$$\frac{V_o}{V_i} = -\frac{1}{\qquad\qquad}$$

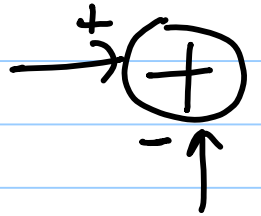
$$H(s) = \frac{1}{1 + \frac{s}{\omega_0 Q} + \frac{s^2}{\omega_0^2}} = \frac{V_o}{V_i} \qquad H(s) = \frac{1 + s^2/\omega_0^2}{1 + \frac{s}{\omega_0 Q_p} + \frac{s^2}{\omega_0^2}}$$

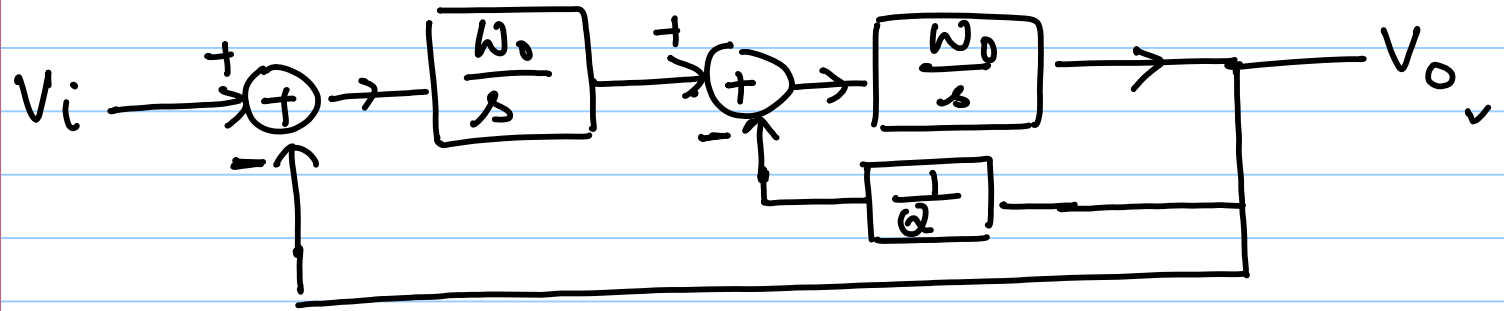
$$V_o \left(1 + \frac{s}{\omega_0 Q} + \frac{s^2}{\omega_0^2} \right) = V_i$$

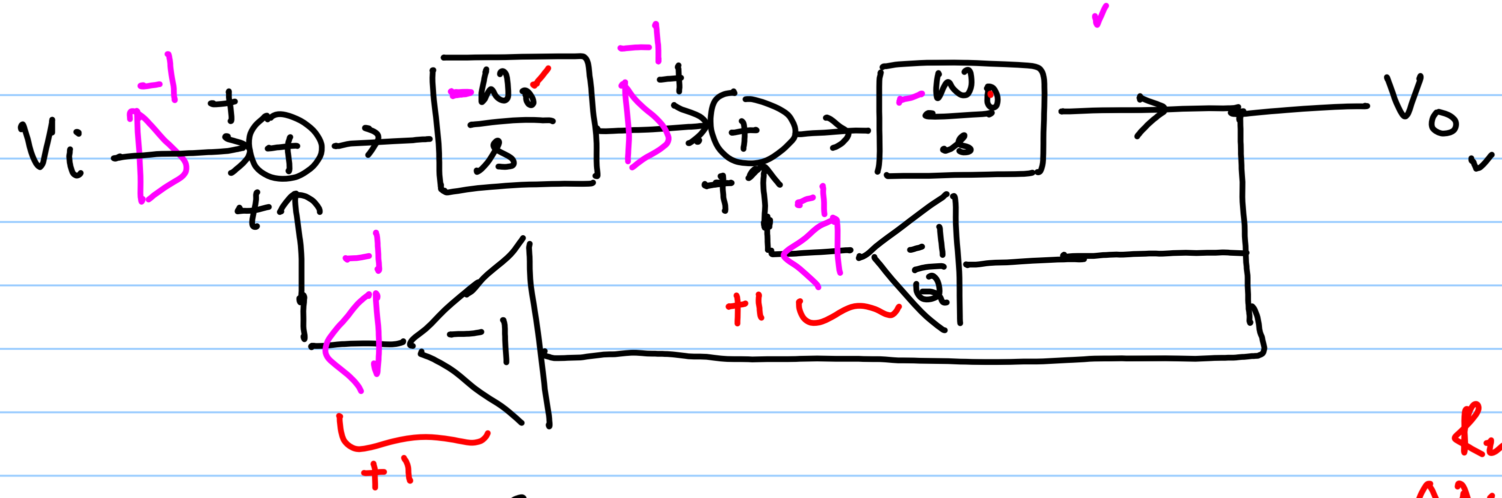
$$V_o \left(\frac{\omega_0^2}{s^2} + \frac{\omega_0}{s} \frac{1}{Q} + 1 \right) = V_i \frac{\omega_0^2}{s^2}$$

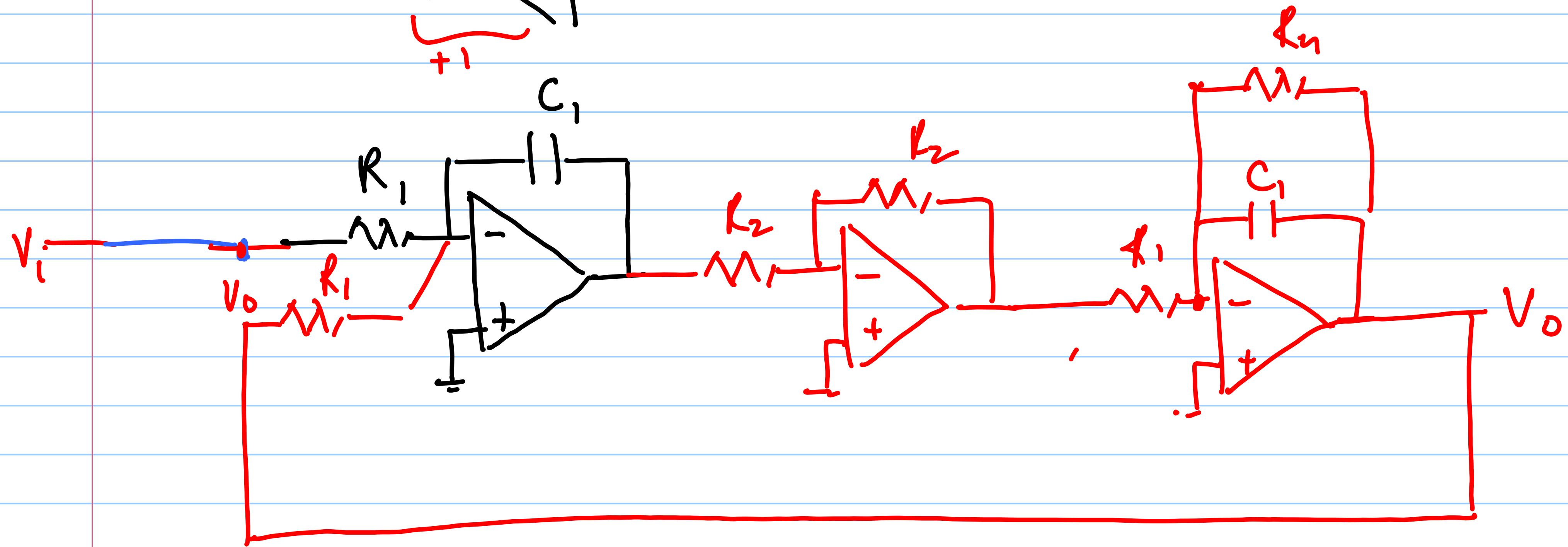
$$V_o = V_i \cdot \frac{\omega_0^2}{s^2} - V_o \left(\frac{\omega_0^2}{s^2} + \frac{\omega_0}{s} \frac{1}{Q} \right)$$

$$V_o = \left[(V_i - V_o) \frac{\omega_0}{s} - \frac{1}{Q} V_o \right] \frac{\omega_0}{s}$$









$$\frac{V_o}{V_i} = \frac{-1}{1 + \frac{s}{\omega_p Q_p} + \frac{s^2}{\omega_p^2}}$$