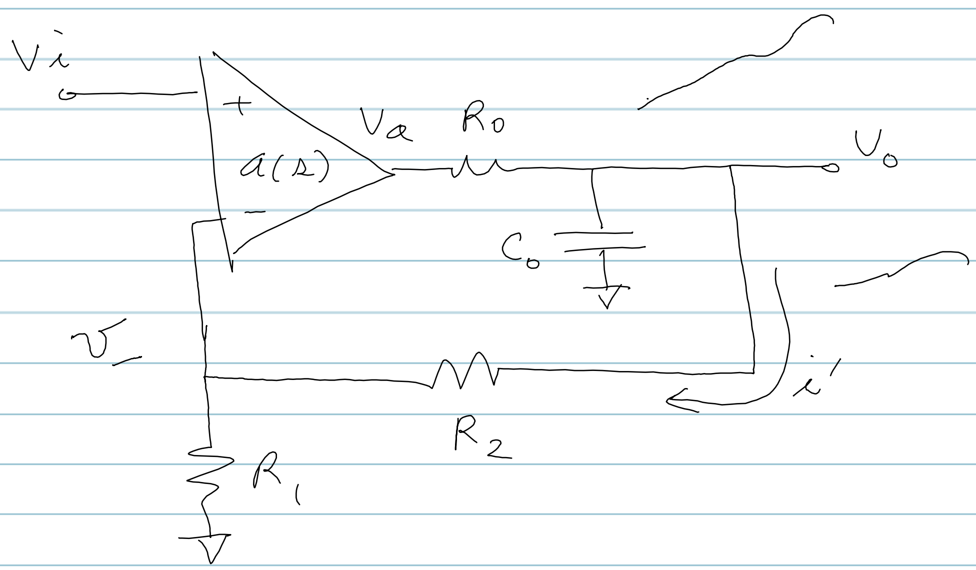
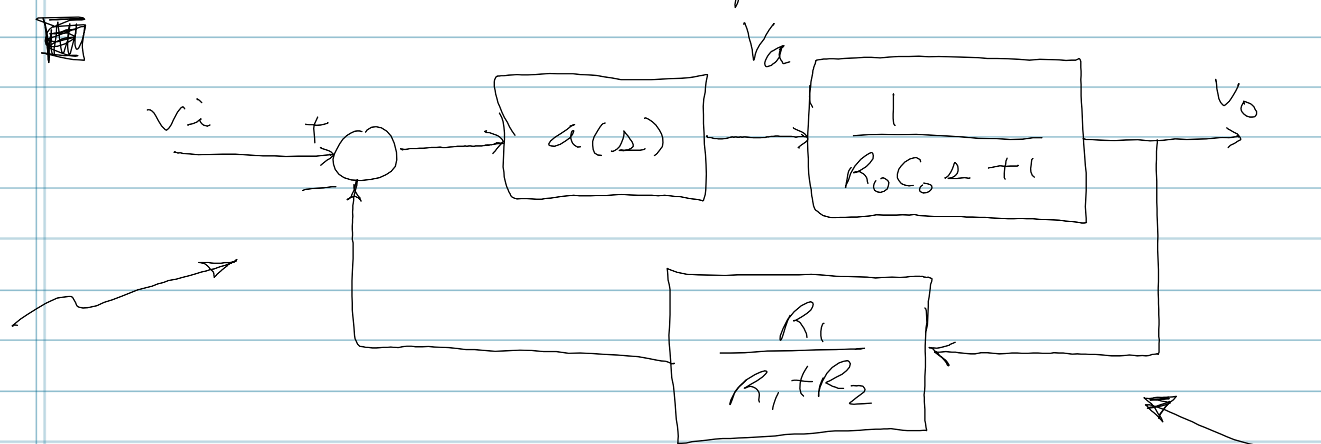
Lab 3 Circuit Analysis



Key assumption: $i' \approx 0$ if $R_2 >> R_0$

Under this assumption:

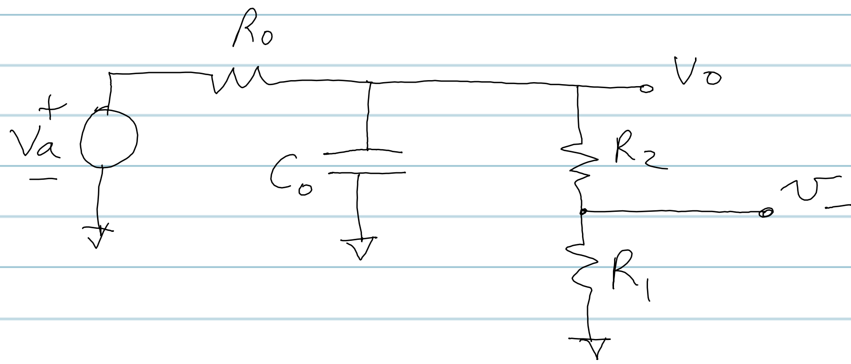


Here in Lab 3, $R_2 = 100\,\Omega$

$R_0 = 10\,\Omega$

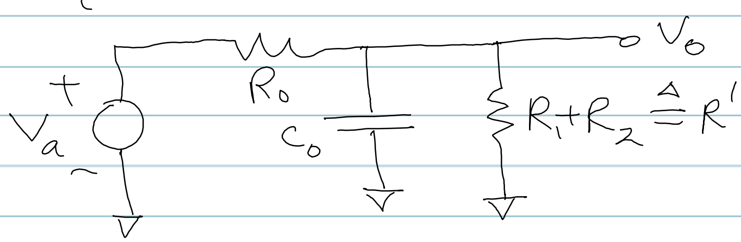
which is OK to allow decoupling divider from RC circuit.

Exact Analysis



If we know V_o, then $v_- = V_o \dfrac{R_1}{R_1+R_2}$

So: find V_o

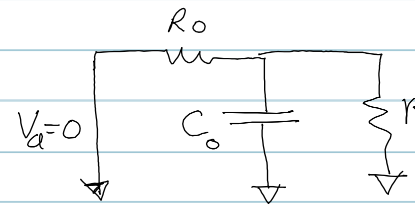


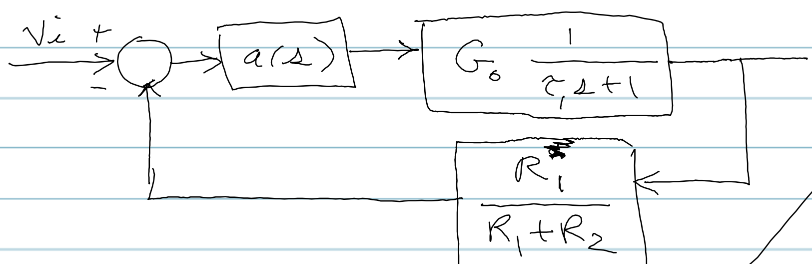
$$\frac{V_o}{V_a}(s) = G_o \frac{1}{\tau_1 s + 1}$$

DC gain: $\left.\dfrac{V_o}{V_a}\right|_{DC} = \dfrac{R_1+R_2}{R_o+R_1+R_2} = \dfrac{R'}{R_o+R'} \triangleq G_o$

Time constant:

$\tau_1 = (R_o \| R') C_o$





If $R' \gg R_o$: $G_o \simeq 1$

$\tau_1 \simeq R_o C_o$

Let $R_2 = 100k$

$R_1 = 10k$

$R_o = 10k$

$C_o = C_o$

$R' = 110k$

$G_o = \dfrac{110}{10+110} = 0.917$

$\simeq 1$

$\tau_1 = 0.917 R_o C_o$

$\simeq R_o C_o = \tau$

2.14 / 2.140 Analysis and Design of Feedback Control Systems
Spring 2014