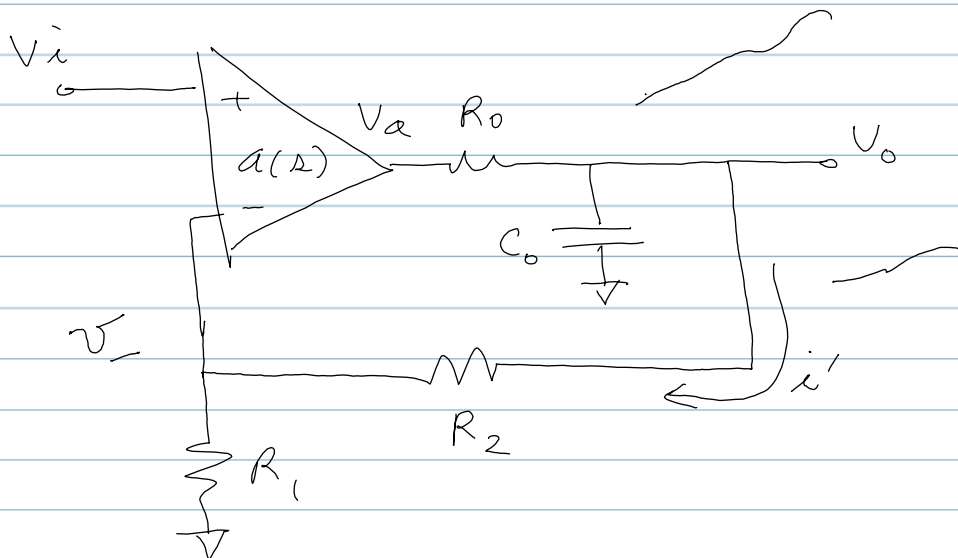


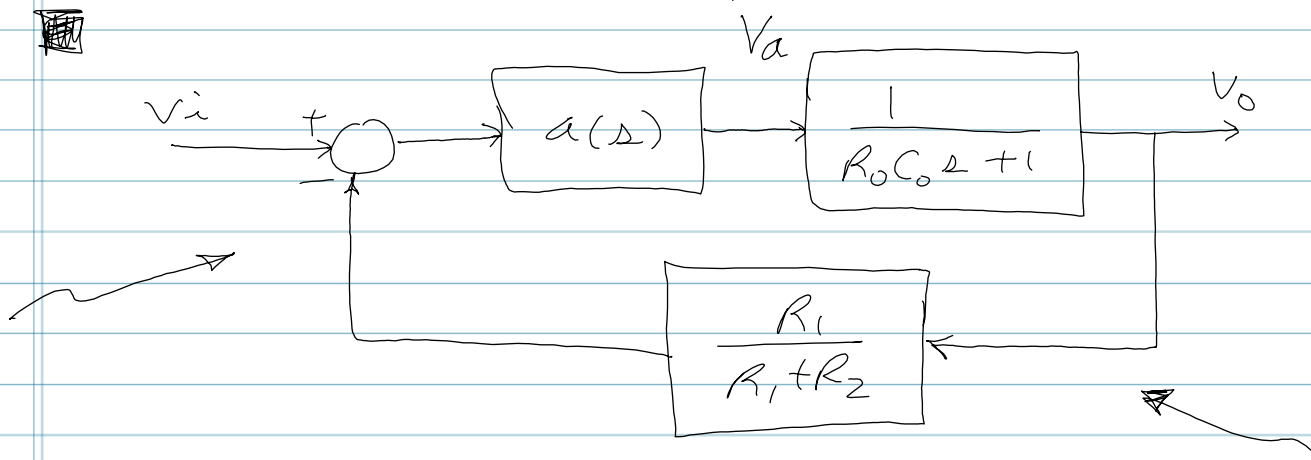
①

## Lab 3 Circuit Analysis



Key assumption:  $i' \approx 0$  if  $R_2 \gg R_o$

Under this assumption:



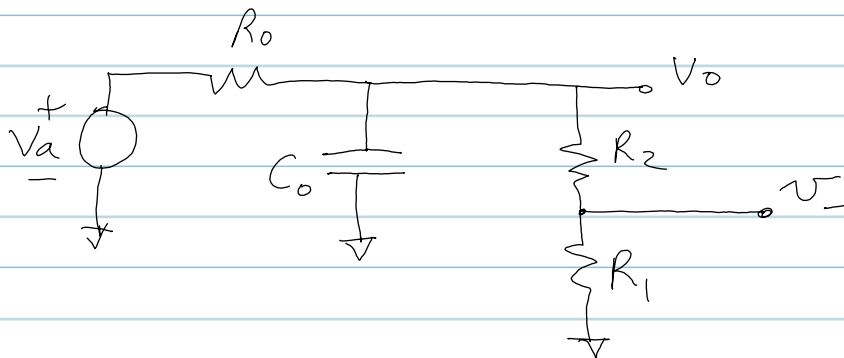
Here in Lab 3,  $R_2 = 100 \Omega$

$R_o = 10 \Omega$

which is OK to allow decoupling divider from RC circuit.

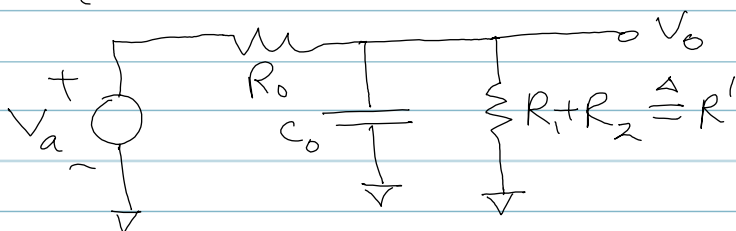
2

# Exact Analysis



If we know  $V_0$ , then  $v = V_0 \frac{R_1}{R_1 + R_2}$

So: find  $V_0$

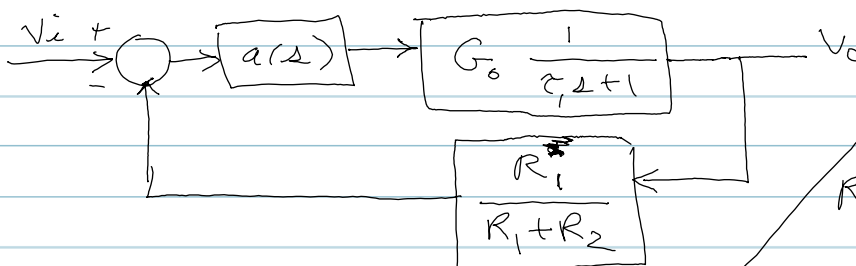
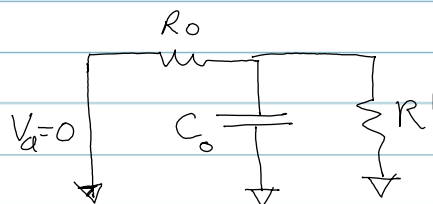


$$\frac{V_0}{V_a}(s) = G_0 \frac{1}{\tau_1 s + 1}$$

DC gain:  $\frac{V_0}{V_a} |_{DC} = \frac{R_1 + R_2}{R_0 + R_1 + R_2} = \frac{R'}{R_0 + R'} \triangleq G_0$

Time constant:

$$\tau_1 = (R_0 \parallel R') C_0$$



Let  $R_2 = 100k$   
 $R_1 = 10\Omega$   
 $R_0 = 10\Omega$   
 $C_0 = C_0$   
 $R' = 110k$   
 $G_0 = \frac{110}{10+110} = 0,917 \approx 1$   
 $\tau_1 = 0,917 R_0 C_0 \approx R_0 C_0 = \tau$

If  $R' \gg R_0$ :  $G_0 \approx 1$

$$\tau_1 \approx R_0 C_0$$

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2.14 / 2.140 Analysis and Design of Feedback Control Systems  
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