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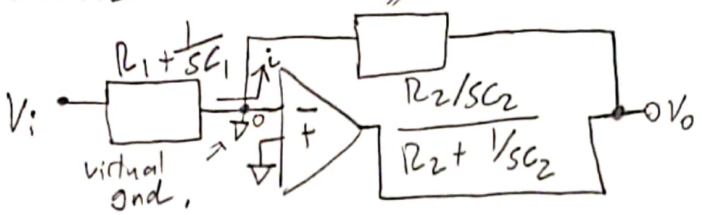
Assignment 1

Nanang S12

$V = IR$

[1]



$i = \frac{V_i}{(R_1 + \frac{1}{sC_1})} \Rightarrow V_i = i\left(R_1 + \frac{1}{sC_1}\right)$

$V_i = \frac{i}{sC_1}(R_1 sC_1 + 1)$

$$V_o = i\,\frac{R_2/sC_2}{R_2 + 1/sC_2} = i\,\frac{R_2}{R_2 sC_2 + 1}$$

$$\therefore \frac{V_o}{V_i} = \frac{i}{i} sC_1\,\frac{R_2/(R_2 sC_2 + 1)}{1 + R_1 sC_1} = \boxed{\frac{R_2 sC_1}{(1 + R_1 sC_1)(1 + R_2 sC_2)}}$$

[2] $C_1 \frac{dh_1}{dt} = q_1$, $C_2 \frac{dh_2}{dt} = q - q_1 - q_2$ | $\frac{h_2 - h_1}{R_1} = q_1$, $\frac{h_2}{R_2} = q_2$

$sC_1 H_1(s) = \frac{H_2(s) - H_1(s)}{R_1} = Q_1(s)$ | $sC_2 H_2(s) = Q(s) - Q_1(s) - Q_2(s)$ | $\frac{H_2(s)}{R_2} = Q_2(s)$

$(1 + sR_1C_1)H_1(s) = H_2(s)$ | $sC_2 H_2(s) = Q(s) - sC_1 H_1(s) - \frac{H_2(s)}{R_2}$

$\therefore q_{in}$ & $h_{2out} \Rightarrow sC_2 H_2(s) = Q(s) - \frac{sC_1 H_2(s)}{(1 + sR_1C_1)} - \frac{H_2(s)}{R_2} \Rightarrow$

$$\boxed{\frac{H_2(s)}{Q(s)} = \frac{1}{sC_2 + \frac{sC_1}{1 + sR_1C_1} + \frac{1}{R_2}}}$$

[3] $T_F(s) = \frac{C(s)}{R(s)} = \frac{C(s)}{X(s)}\,\frac{X(s)}{R(s)}$

$X(s) = G_1 R(s) + R(s)$

$C(s) = X(s) G_2 + R(s) = G_2[G_1 R(s) + R(s)] + R(s)$

$C(s) = R(s)[G_2(G_1 + 1) + 1]$

$$\therefore \boxed{\frac{C(s)}{R(s)} = G_2(G_1 + 1) + 1}$$