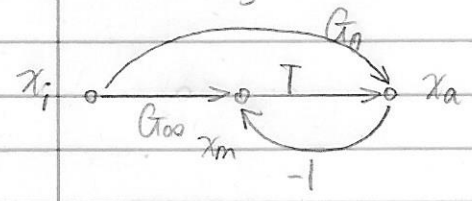
Lect 8

ECE264A Asymptotic Gain Relation

1. block diagram



$\Delta = 1+T$

① $G_1\Delta_1 = G_\infty T$

② $G_2\Delta_2 = G_0$

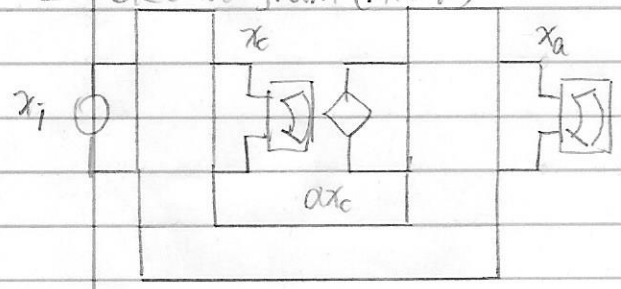
$x_m = \frac{1}{1+T}(G_\infty - G_0)$

$G = \frac{1}{\Delta}(G_1\Delta_1 + G_2\Delta_2)$

$= G_\infty \frac{T}{1+T} + G_0 \frac{1}{1+T}$

T is the return ratio

2. ckt diagram (ntwk)



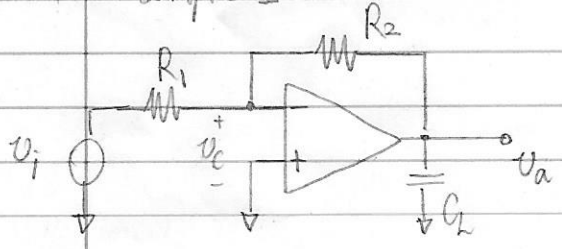
$G = \frac{x_a}{x_i}$

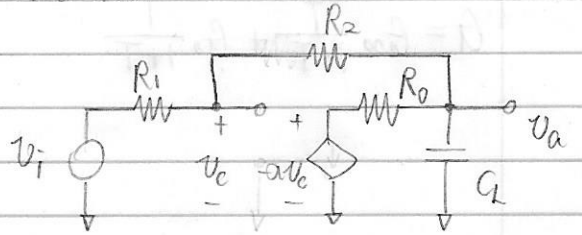
3. compare the two

$T = -\alpha \frac{x_c}{x_x}$

$G_\infty = G|_{\alpha=\infty}$, $G_0 = G|_{\alpha=0}$

4. Example 1





① $G_0 = \frac{R_0 // \frac{1}{sC_L}}{R_1 + R_2 + (R_0 // \frac{1}{sC_L})} = \frac{R_0}{(R_1+R_2)(1+sC_L R_0) + R_0}$

KCL at v_a

$(sC_L + \frac{1}{R_0} + \frac{1}{R_2})v_a = \frac{1}{R_2}v_c - \frac{1}{R_0}\alpha v_c$

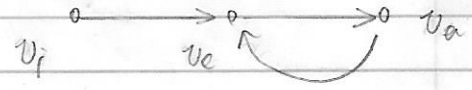
KCL at v_c

$(\frac{1}{R_1} + \frac{1}{R_2})v_c = \frac{1}{R_1}v_i + \frac{1}{R_2}v_a$

$(*)\quad v_a = \frac{1}{sC_L + \frac{1}{R_0} + \frac{1}{R_2}}\left(\frac{1}{R_2} - \frac{\alpha}{R_0}\right)v_c$

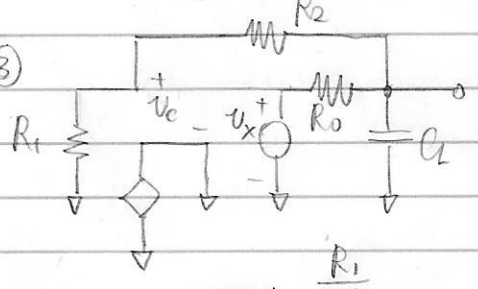
$(**)\quad v_c = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}}\left(\frac{1}{R_1}v_i + \frac{1}{R_2}v_a\right)$

$v_a = R_2\left(\left(\frac{1}{R_1}+\frac{1}{R_2}\right)v_c - \frac{1}{R_1}v_i\right)$



② $G_\infty = -\frac{R_2}{R_1}$

③



$v_c = \frac{(R_1+R_2)//\frac{1}{sC_L}}{R_0 + (R_1+R_2)//\frac{1}{sC_L}} \frac{R_1}{R_1+R_2} v_x = \frac{R_1}{R_0(1+s(R_1+R_2)C_L) + R_1 + R_2} v_x$

$T = -\frac{-\alpha v_c}{v_x} = \frac{\alpha R_1}{R_0(1+s(R_1+R_2)C_L) + R_1 + R_2}$

$$G = G_{\infty} \frac{T}{1+T} + G_0 \frac{1}{1+T}$$