EE2019

27/2/2018

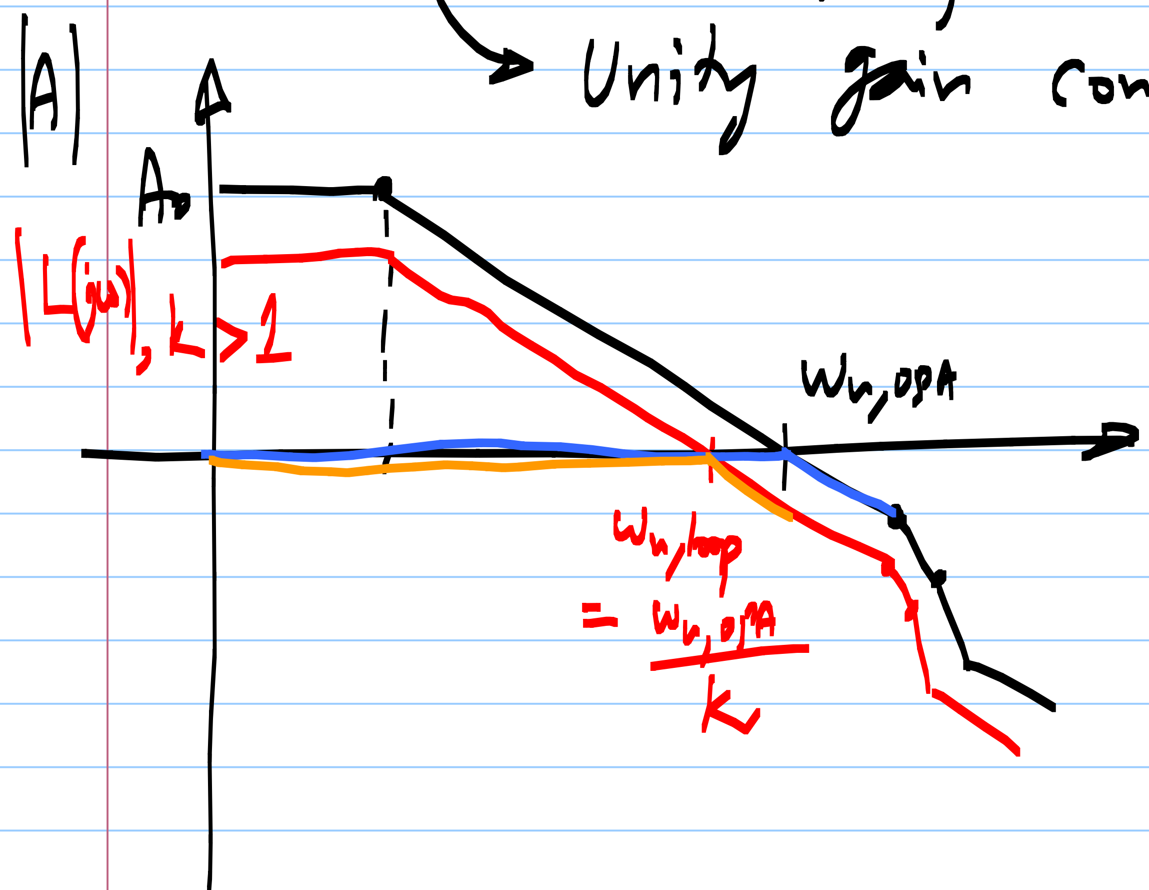
Stabilizing opamps (feedback amplifier)

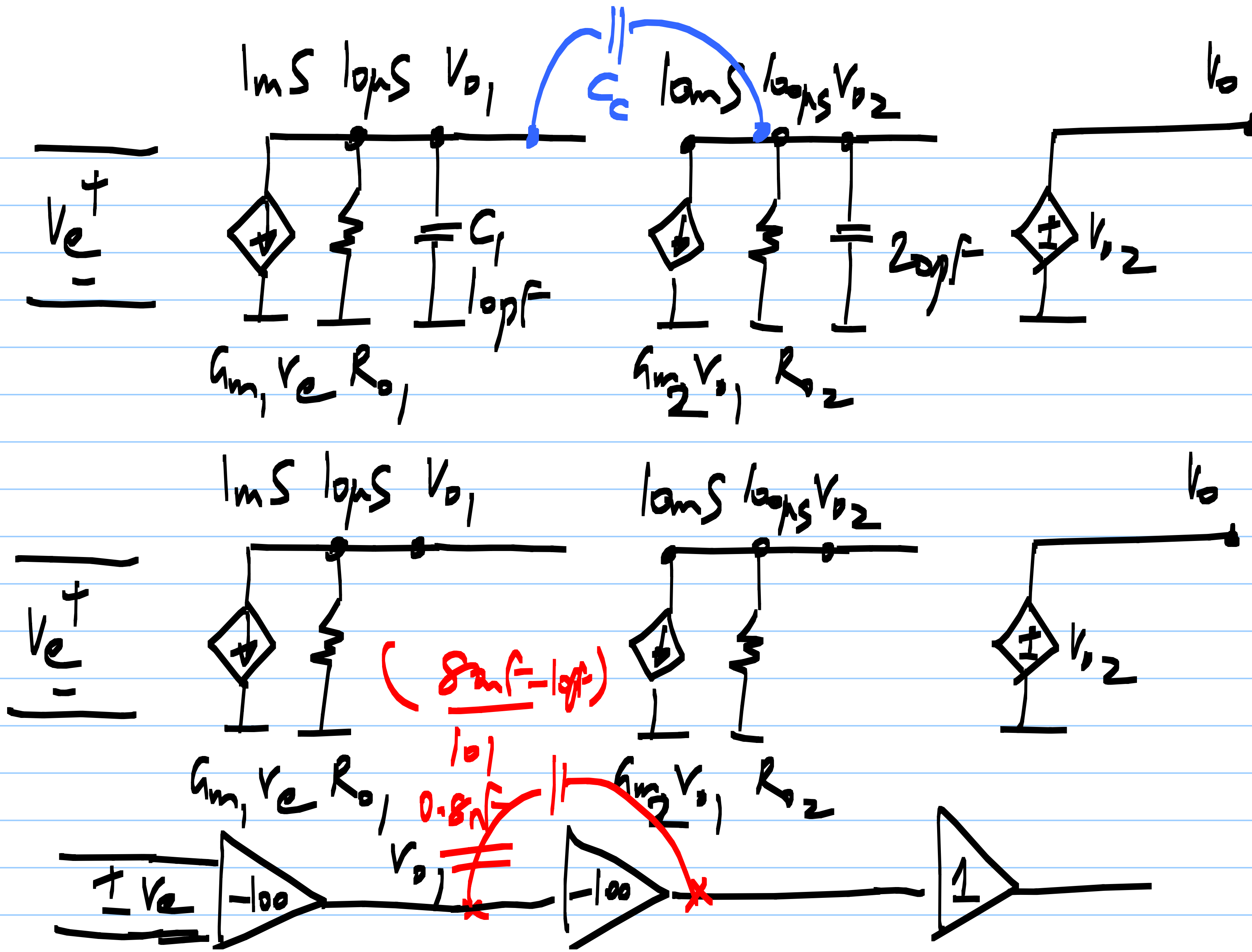
Freq. compensation
- Dominant pole compensation
- Unity gain compensated

opamp: $A(s)$

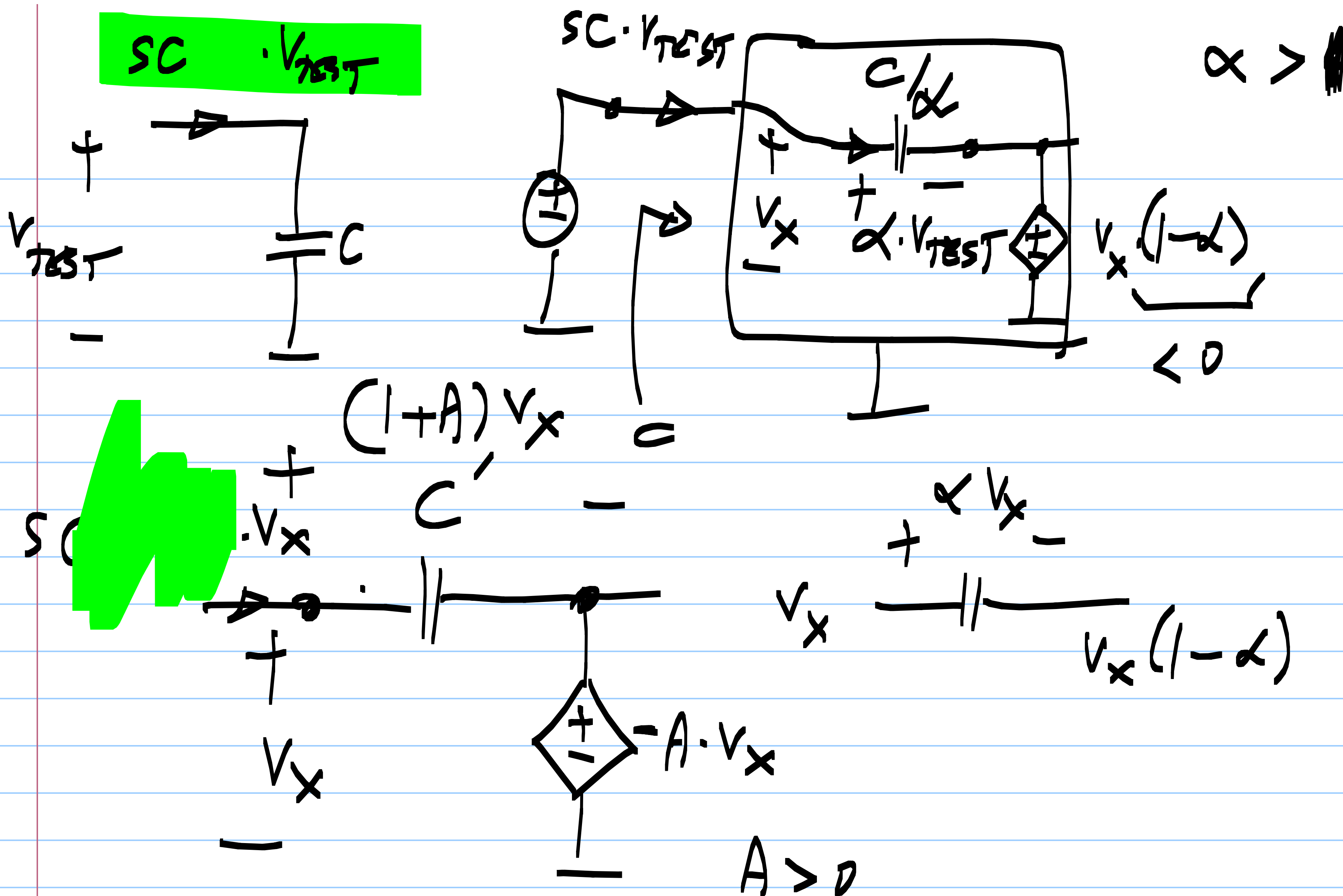
Noninv. amp

$$L(s) = \frac{A(s)}{k}$$



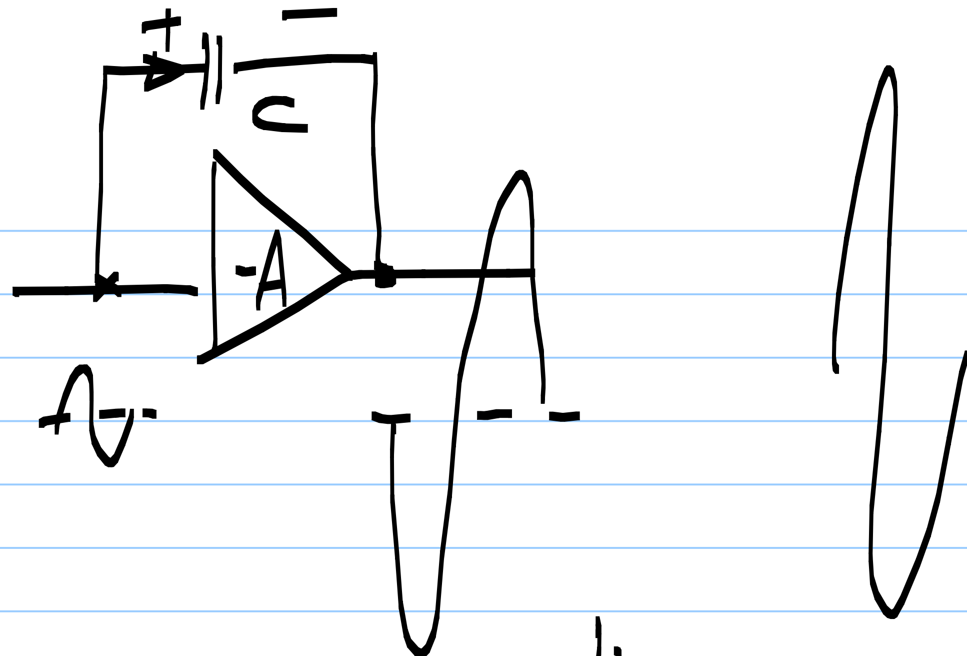


1mS
10μS
V_{o1}
C_c
10mS
100μS
V_{o2}
V_o
V_e
C_1
10pF
20pF
V_{o2}
$G_{m1}V_e$
R_{o1}
$G_{m2}V_{o1}$
R_{o2}
1mS
10μS
V_{o1}
10mS
100μS
V_{o2}
V_o
V_e
V_{o2}
(8nF − 10pF) / 101
0.8nF
$G_{m1}V_e$
R_{o1}
$G_{m2}V_{o1}$
R_{o2}
V_e
−100
V_{o1}
−100
1

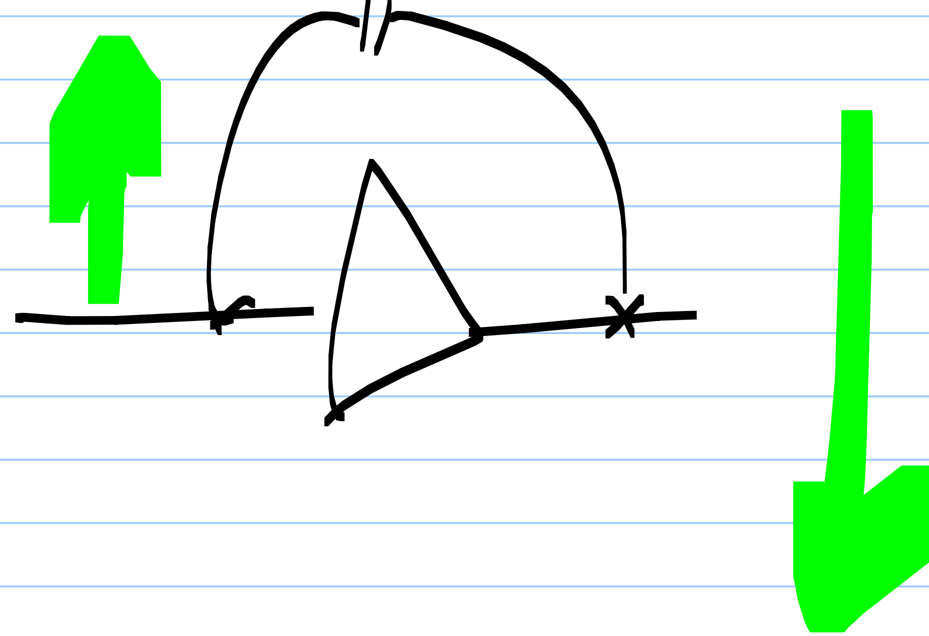


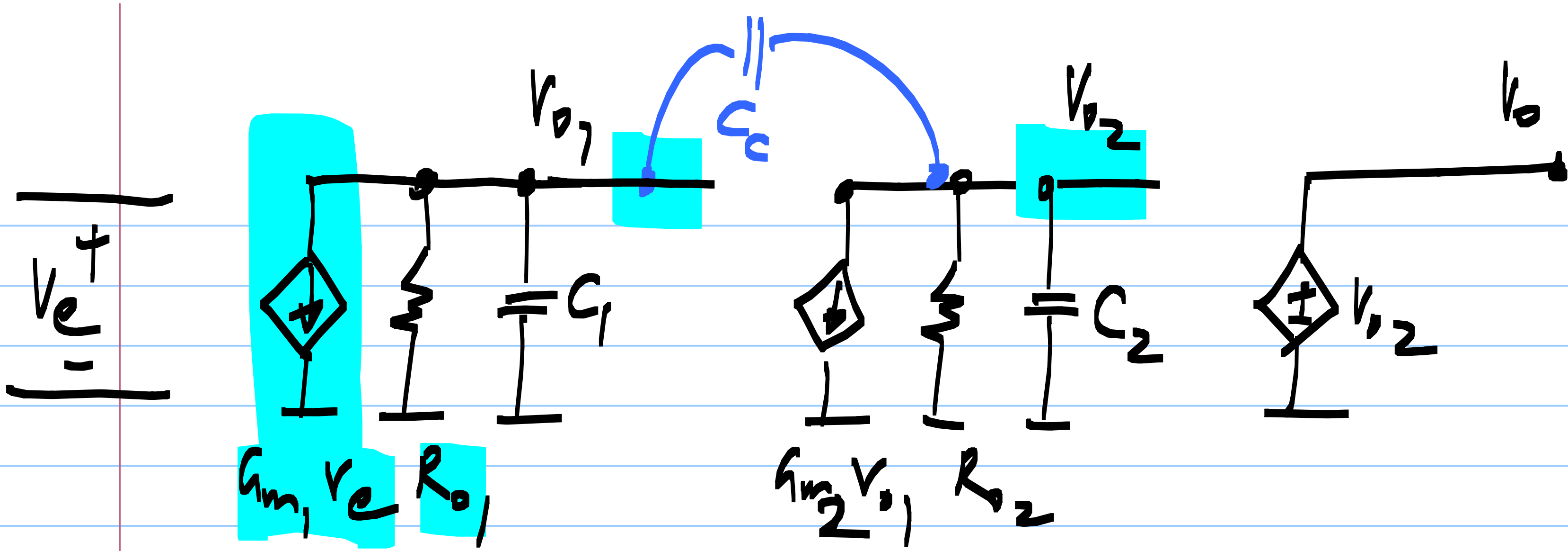
SC · V_TEST
V_TEST
C
SC · V_TEST
C/α
V_x
α · V_TEST
V_x (1 − α)
< 0
α >
C
(1 + A) V_x
S C
· V_x
C'
V_x
A · V_x
A > 0
α V_x
V_x
V_x (1 − α)

Miller effect



$C(1+A)$





$$\begin{bmatrix} G_{o_1} + s(C_1 + C_c) & -sC_c \\ -sC_c + G_{m_2} & G_{o_2} + s(C_2 + C_c) \end{bmatrix} \begin{bmatrix} V_{o_1} \\ V_{o_2} \end{bmatrix} = \begin{bmatrix} -G_{m_1} V_e \\ 0 \end{bmatrix}$$

$$V_{o2} = \frac{\begin{vmatrix} s(C_c+C_1)+G_{o1} & -G_{m1}V_e \\ +G_{m2}-sC_c & 0 \end{vmatrix}}{\begin{vmatrix} s(C_c+C_1)+G_{o1} & -sC_c \\ G_{m2}-sC_c & s(C_c+C_2)+G_{o2} \end{vmatrix}}$$

$s=0$

$C_c=0$

zero @ $+\frac{G_{m2}}{C_c}$

$$\frac{V_{o2}}{V_e} = \frac{G_{m1}(G_{m2}-sC_c)}{s^2(C_1C_c+C_cC_2+C_2C_1)+s\left[C_c(G_{m2}+G_{o2}+G_{o1})+C_1G_{o2}+C_2\cdot G_{o1}\right]+G_{o1}G_{o2}}$$

with $c_c = 0$, pole @ $-\frac{\omega_{01}}{c_1}$, $-\frac{\omega_{02}}{c_2}$

with $c_c \neq 0$, ? $\frac{-b \pm \sqrt{b^2-4c}}{2a}$

$$ax^2 + bx + c = 0$$

x_1, x_2

$|x_2| \gg |x_1|$

$$a x_2^2 + b x_2 + \cancel{c}$$

$$x_2 = \left\{ 0, \boxed{-\frac{b}{a}} \right.$$

$$a x_1^2 + b x_1 + c$$

$$x_1 = -\frac{c}{b}$$