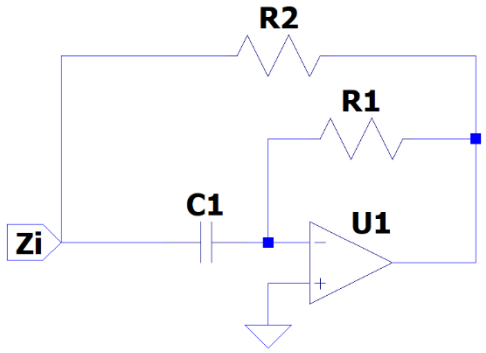
UTN.BA

UNIVERSIDAD TECNOLÓGICA NACIONAL
FACULTAD REGIONAL BUENOS AIRES

CORRECCIONES DEL TP1-G3

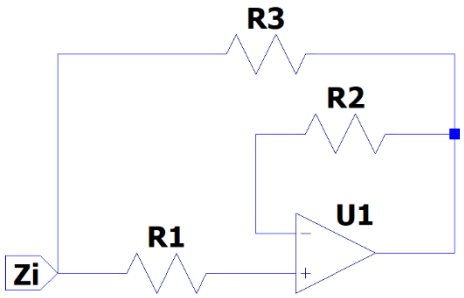
- Aclarar la topología de cada circuito (Ejercicio3)
- Simulación (Ejercicio 4)
- Transferencia de circuito de 2do orden (Ejercicio 7)

Ejercicio 3



$$Z_i = \frac{R_2}{1 + SC_1(R_1 + R_2)}$$

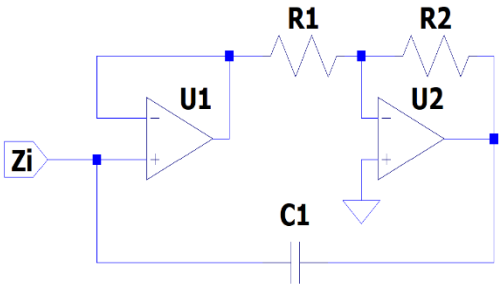
Es un capacitor en paralelo con un resistor, tal que el capacitor depende de los valores de las resistencias R1 y R2.



$$Z_i = \frac{R_3(1 + SCR_1)}{SC(R_3 + R_1)} = \frac{R_3}{SC(R_3 + R_1)} + \frac{R_3 \cdot R_1}{(R_3 + R_1)}$$

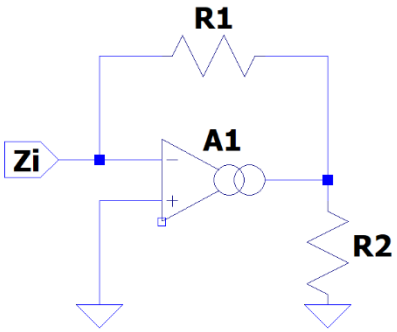
$$Z_i = \frac{1}{SC_e} + (R_3||R_1) \; tal \; que \; C_e = C \cdot \frac{(R_3 + R_1)}{R_3}$$

Dos resistencias en paralelo (R1//R3), que a su vez están conectadas en serie con un capacitor, que su valor depende de las resistencias.



$$Z_i = \frac{R_1}{SC_1(R_1 + R_2)} = \frac{1}{S[kC_1]} \;\; tal \; que \; k = \frac{R_1 + R_2}{R_1}$$

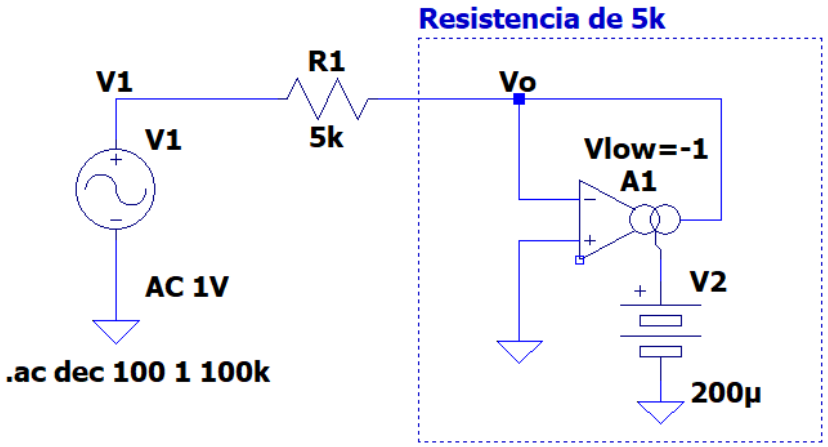
El circuito forma un capacitor variable que depende de las resistencias R1 y R2

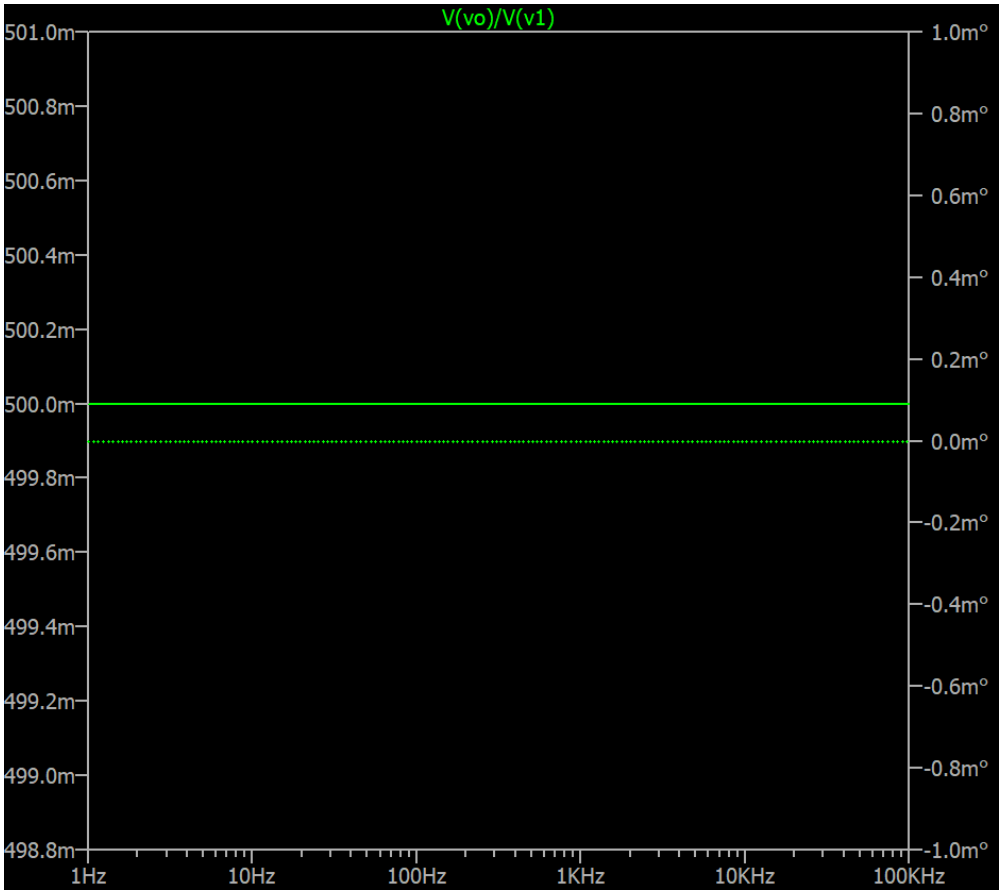


$$Z_i = \frac{R_1 + R_2}{1 - gmR_2} = \frac{R_1}{1 - gmR_2} + \frac{R_2}{1 - gmR_2}$$

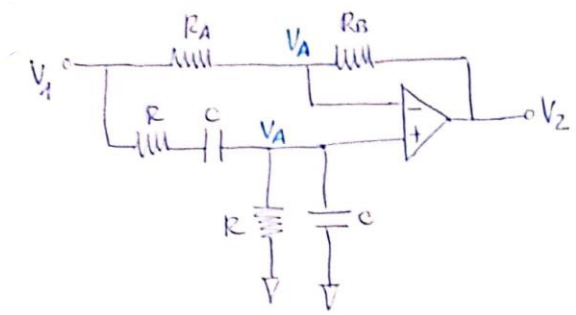
Dos resistencias en serie que dependen de R1, R2 y gm, de tal manera que se puede llegar a obtener resistencias negativas

Ejercicio 4


Resistencia de 5k
V1
R1
5k
Vo
V1
Vlow=-1
A1
AC 1V
V2
200µ
.ac dec 100 1 100k


V(vo)/V(v1)
501.0m
500.8m
500.6m
500.4m
500.2m
500.0m
499.8m
499.6m
499.4m
499.2m
499.0m
498.8m
1.0m°
0.8m°
0.6m°
0.4m°
0.2m°
0.0m°
-0.2m°
-0.4m°
-0.6m°
-0.8m°
-1.0m°
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz

Ejercicio 7



$$V_A\left(G+SC+\frac{1}{R+\frac{1}{SC}}\right)=V_1\left(\frac{1}{R+\frac{1}{SC}}\right) \qquad V_A\left(\frac{1}{R_A}+\frac{1}{R_B}\right)=\frac{V_1}{R_A}+\frac{V_2}{R_B}$$

$$V_A=\frac{R_B V_1+R_A V_2}{R_A+R_B}$$

$$V_A\left(\frac{1}{R}+SC+\frac{SC}{RSC+1}\right)=V_1\frac{SC}{RSC+1}$$

$$V_A\,\frac{RSC+1+S^2C^2R^2+SCR+SCR}{R(RSC+1)}=V_1\frac{SC}{RSC+1}$$

$$\frac{R_B V_1}{R_A+R_B}+\frac{R_A V_2}{R_A+R_B}=V_1\,\frac{SCR}{S^2C^2R^2+3SCR+1}$$

$$V_2\,\frac{R_A}{R_A+R_B}=V_1\left(\frac{SCR}{S^2C^2R^2+3SRC+1}-\frac{R_B}{R_A+R_B}\right)$$

$$V_2\,\frac{R_A}{R_A+R_B}=V_1\,\frac{RSCR_A+SCR_BR-(S^2C^2R^2R_B+3SRR_BC+R_B)}{(S^2C^2R^2+3SRC+1)(R_A+R_B)}$$

$$\frac{V_2}{V_1}=\frac{SRR_AC+SCRR_B-S^2C^2R^2R_B-3SRR_BC-R_B}{S^2C^2R^2+3SRC+1}$$

$$\frac{V_2}{V_1}=-\frac{C^2R^2R_B}{C^2R^2R_A}\cdot\frac{S^2+\left(\frac{2RR_BC-RR_AC}{C^2R^2R_B}\right)S+\frac{R_B}{C^2R^2R_B}}{S^2+\frac{3RC}{C^2R^2}S+\frac{1}{C^2R^2}}$$

$$\boxed{\frac{V_2}{V_1}=-\frac{R_B}{R_A}\,\frac{S^2+\frac{1}{RC}\left(2-\frac{R_A}{R_B}\right)+\frac{1}{R^2C^2}}{S^2+\frac{3}{RC}S+\frac{1}{R^2C^2}}}$$

$$\frac{V_2}{V_1} = -\frac{1}{5}\cdot\frac{s^2+\frac{3}{RC}s+\frac{1}{R^2C^2}}{s^2+\frac{3}{RC}s+\frac{1}{R^2C^2}} \qquad \begin{cases} Q=\frac{1}{3} \\ \omega_0 = \frac{1}{RC} \\ K=\frac{1}{5} \end{cases}$$

$Q=\frac{1}{3}$

$\omega_0 = 1 \rightarrow \boxed{R=1} \wedge \boxed{C=1}$

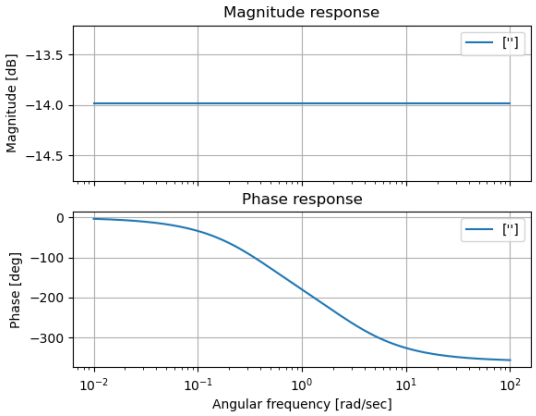
$$\frac{V_2}{V_1} = -K\cdot\frac{s^2-\frac{\omega_0}{Q}s+\omega_0^2}{s^2+\frac{\omega_0}{Q}s+\omega_0^2} \rightarrow \boxed{\frac{V_2}{V_1} = -\frac{1}{5}\cdot\frac{s^2-3s+1}{s^2+3s+1}}$$

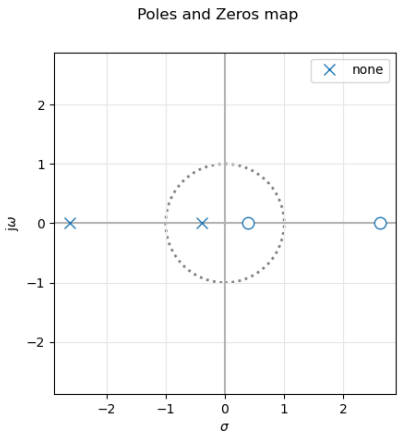
$R = N_\Omega \cdot R_N = 1K\Omega \rightarrow \boxed{N_\Omega = 1000\Omega}$

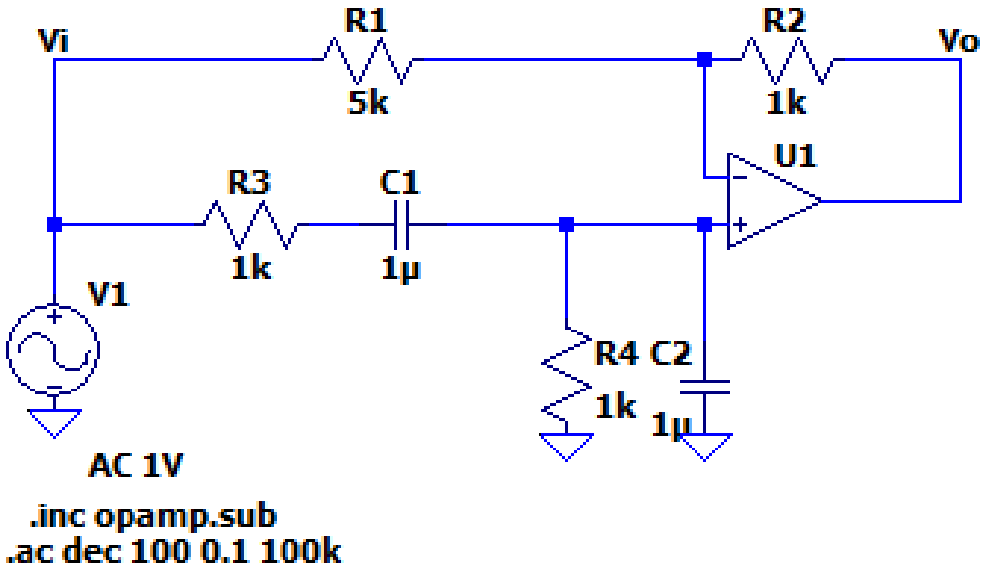
$\frac{R'_A}{R'_B} = 5 \rightarrow R'_A = 5 \rightarrow \boxed{R_A = 5K\Omega}$, $R'_B = 1 \rightarrow \boxed{R_B = 1K\Omega}$

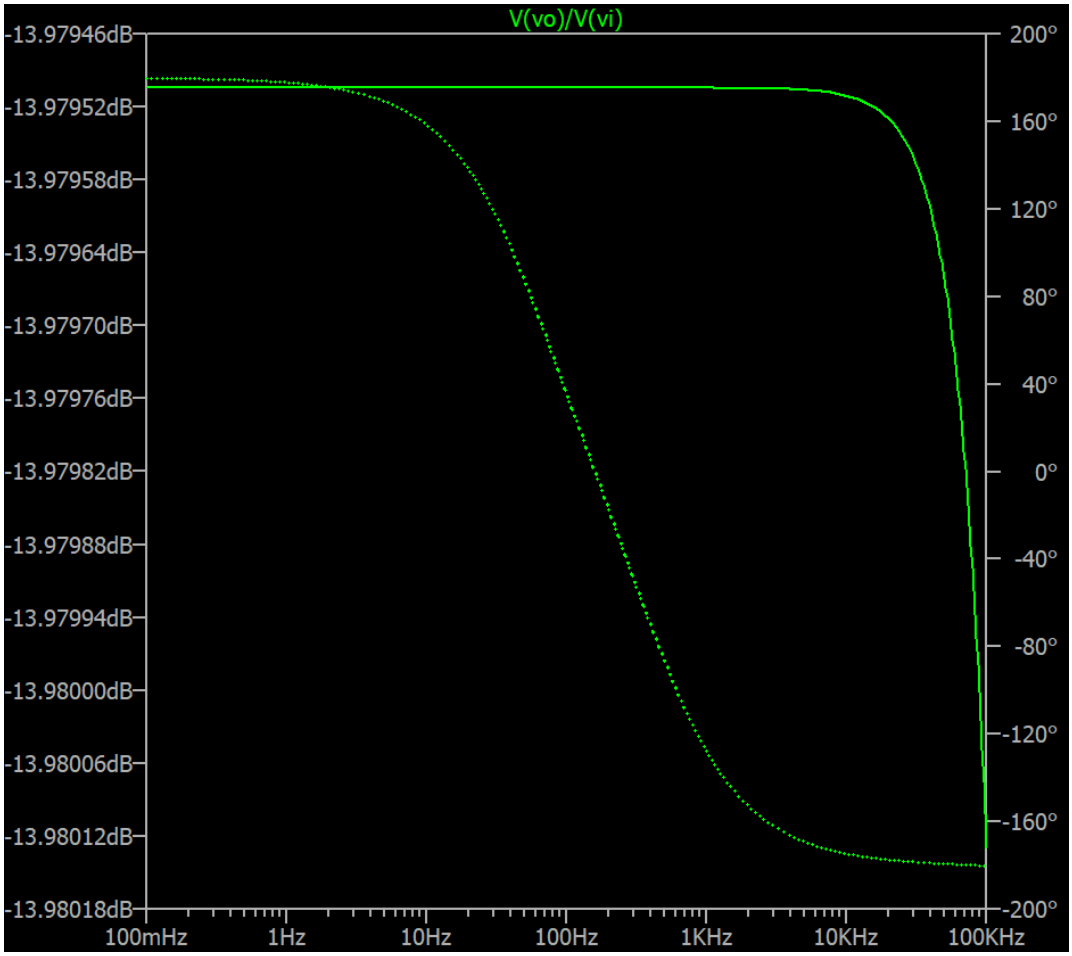
$C = \frac{C'}{N_\Omega \cdot N_Z} \rightarrow N_\Omega = \frac{C'}{C\cdot N_Z} = \frac{1}{1\mu F \cdot 1000} = 1000\,rad$

$\boxed{N_\Omega = 1000\,rad}$






Vi
R1
5k
R2
1k
Vo
U1
R3
1k
C1
1µ
V1
AC 1V
R4
1k
C2
1µ
.inc opamp.sub
.ac dec 100 0.1 100k


V(vo)/V(vi)
-13.97946dB
-13.97952dB
-13.97958dB
-13.97964dB
-13.97970dB
-13.97976dB
-13.97982dB
-13.97988dB
-13.97994dB
-13.98000dB
-13.98006dB
-13.98012dB
-13.98018dB
200°
160°
120°
80°
40°
0°
-40°
-80°
-120°
-160°
-200°
100mHz
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz