Electronique

Oscillateur à déphaseur

Etude théorique

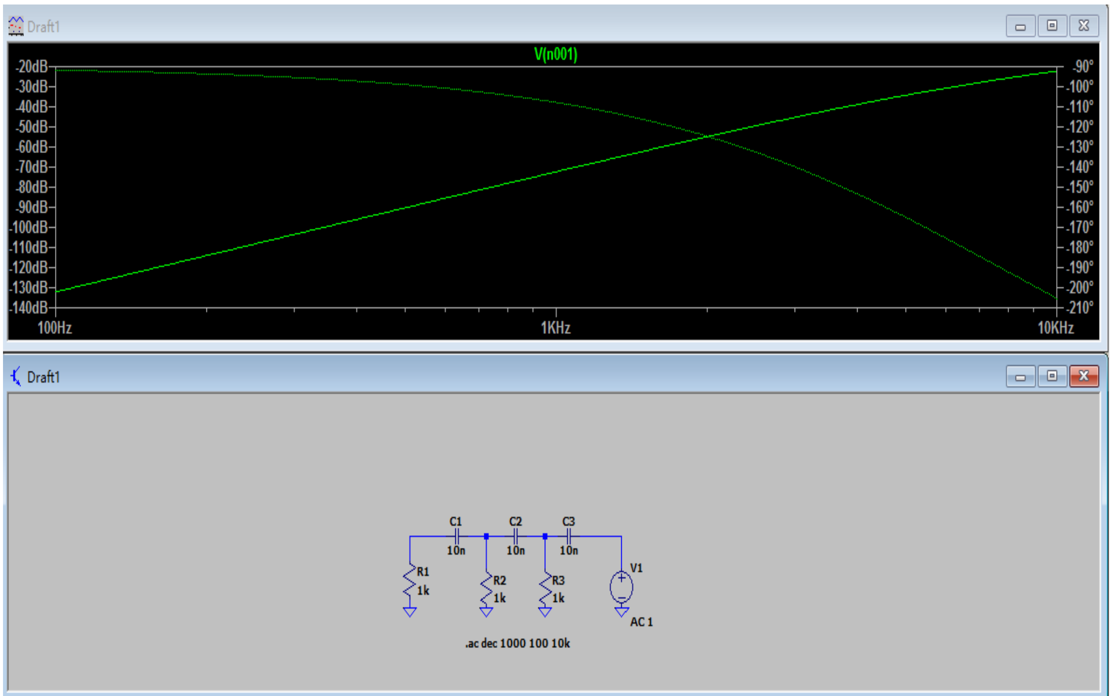
Q1.

On a étudié dans les cours que $H(j\omega) = \frac{A}{1-A\beta(j\omega)}$, ici $A = -\frac{R_2}{R_1}$, et on doit calculer le $\beta(j\omega)$.

On peut obtenir que $\beta(j\omega) = \frac{V_1}{V_2} = \frac{1}{1-\frac{5}{(\omega RC)^2}-j(\frac{6}{\omega RC}-\frac{1}{(\omega RC)^3})}$ après calculation.

Etude numérique

Q2.



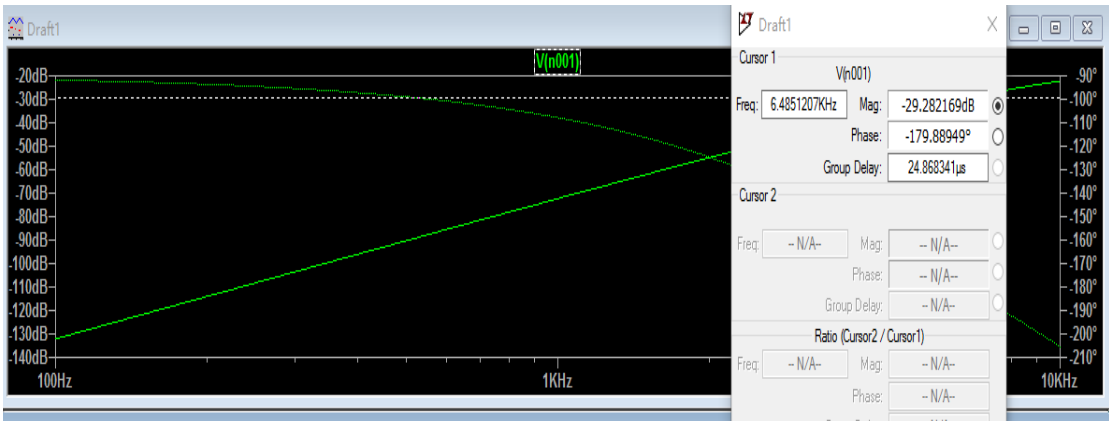
Q3.

On calcule la fréquence $f_0 = \frac{1}{2\pi\sqrt{6}RC} \approx 6497.5Hz$, $A = \frac{1}{\|\beta(j\omega_0)\|} = 29$

Dans notre simulation, on peut voir que $f_0 \approx 6.5kHz$ et A $\approx$ 29.2.

Q4.

On peut calculer la stabilité $S(\omega_0) = \left\| \frac{d\varphi(\beta(j\omega))}{d\left(\frac{\omega}{\omega_0}\right)} \right\|_{\omega=\omega_0} \approx 1.01$



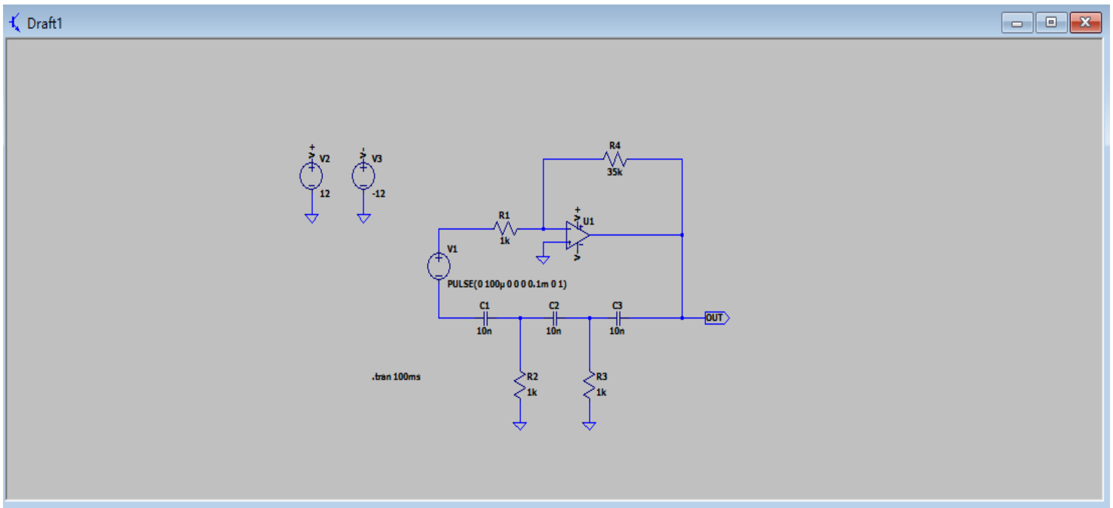
Dans notre simulation, on peut caiculer que:

$$\left\| \frac{d\varphi(\beta(j\omega))}{d\left(\frac{\omega}{\omega_0}\right)} \right\|_{\omega=\omega_0} = \left\| \frac{\omega_0}{2\pi} \frac{d\varphi}{df} \right\|_{\omega=\omega_0}$$

$$= \left\| 6497 \times \frac{-180.1385° + 179.8895°}{360°} \times \frac{2\pi 132}{6512.9877 - 6485.1207} \right\|$$

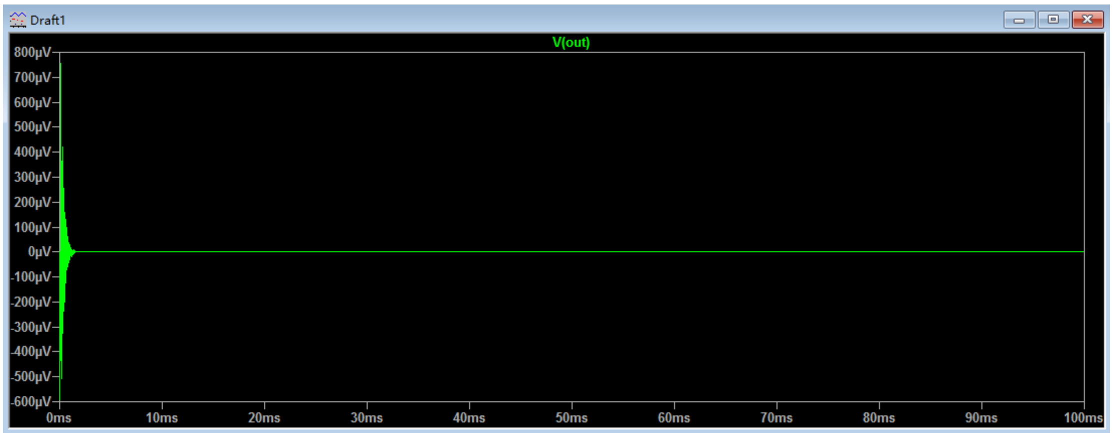
$$\approx 1.0132$$

Q5.

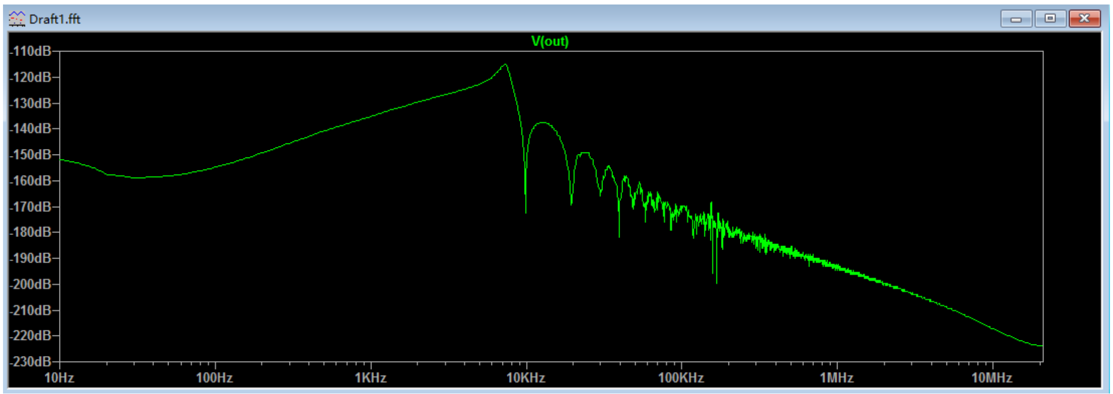


Q6.

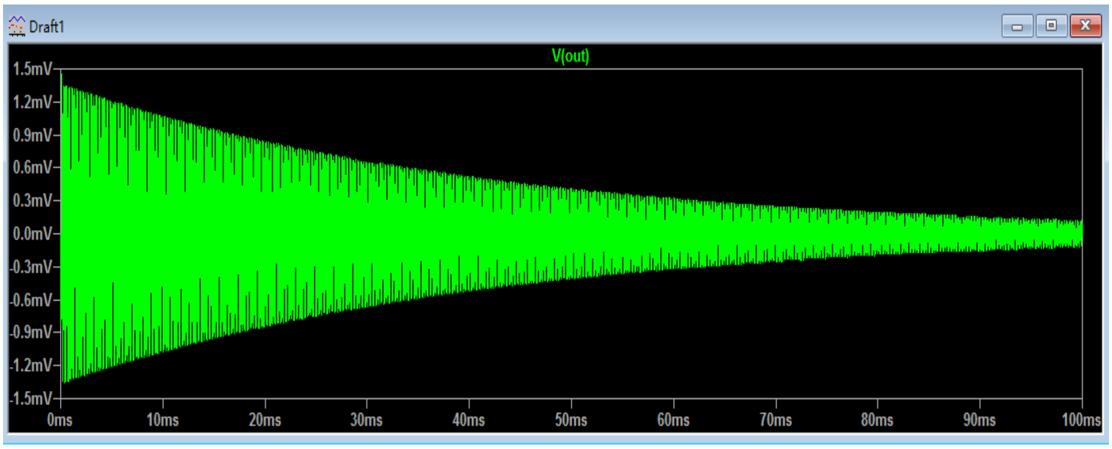
Quand R_4=20kΩ, et Aβ<1, le résultat est:



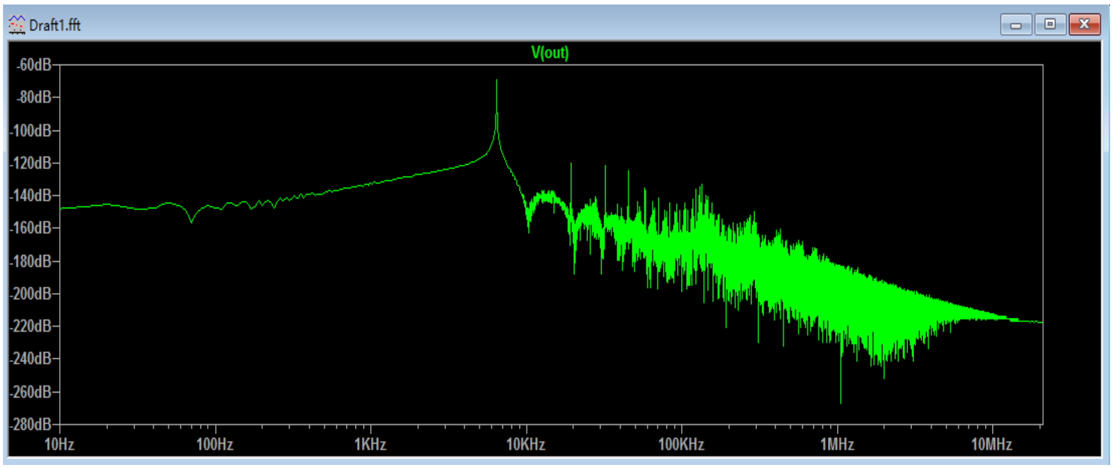
On fait la FFT:



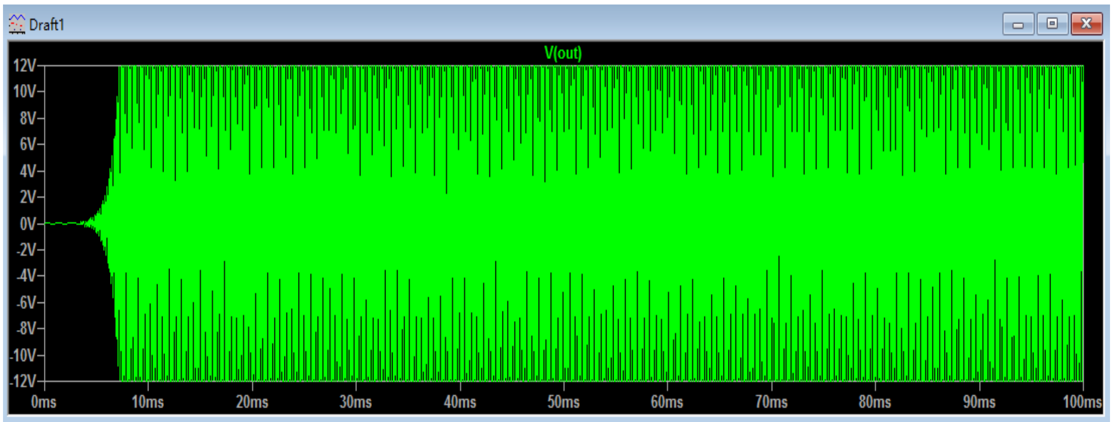
Quand R_4=29kΩ, et Aβ=1, le résultat est:

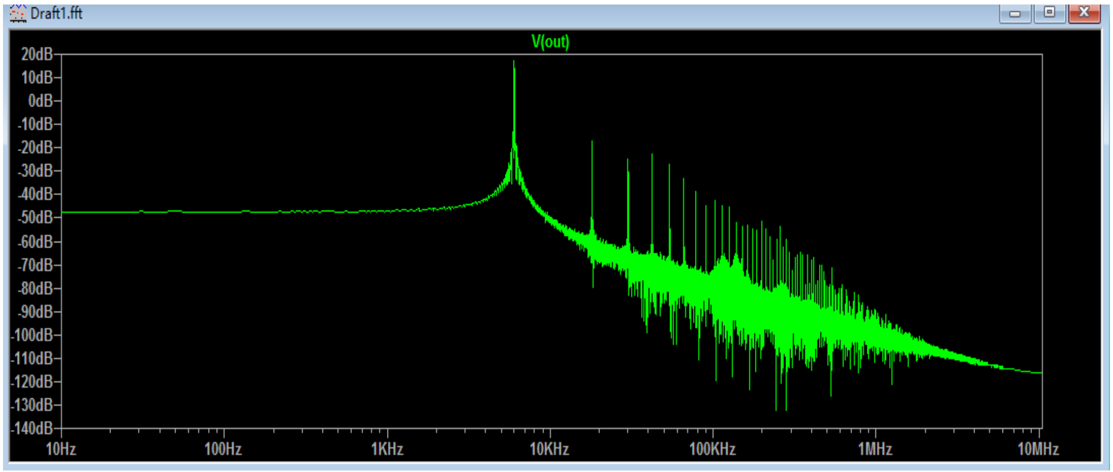


On fait la FFT et on peut voir que $f_0 \approx 6.5kHz$:

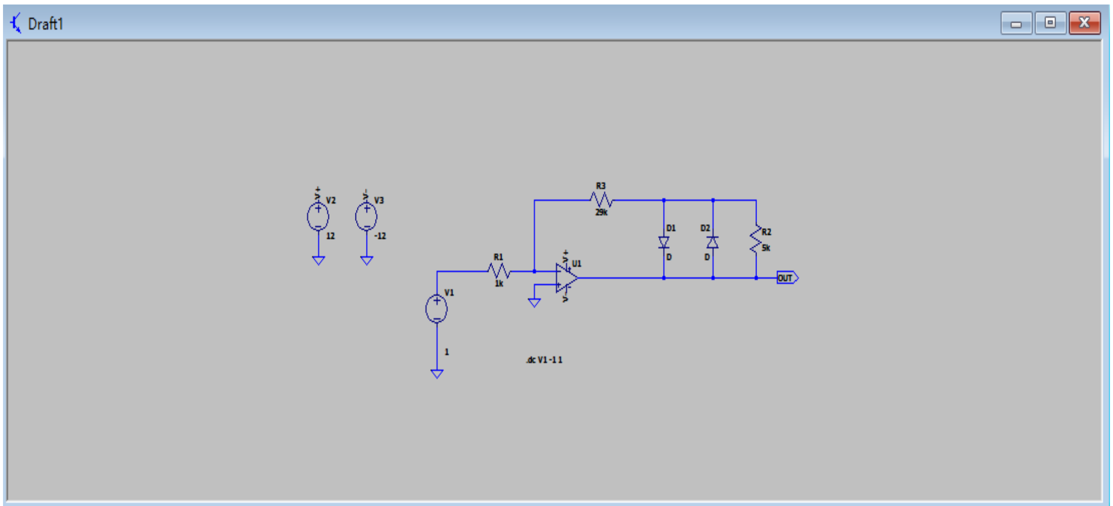


Quand R_4=35kΩ, et Aβ>1, le résultat est:


Draft1
V(out)
12V
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
-12V
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms
100ms

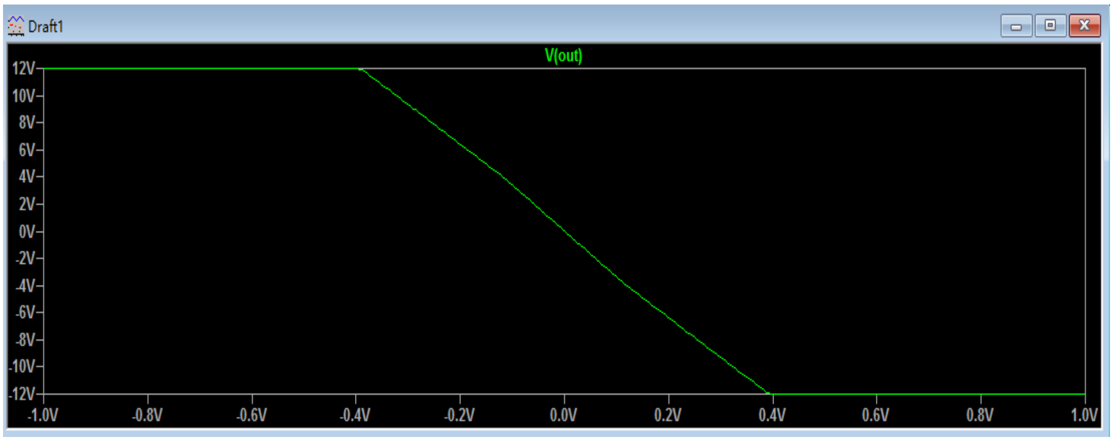

Draft1.fft
V(out)
20dB
10dB
0dB
-10dB
-20dB
-30dB
-40dB
-50dB
-60dB
-70dB
-80dB
-90dB
-100dB
-110dB
-120dB
-130dB
-140dB
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz

Q7.

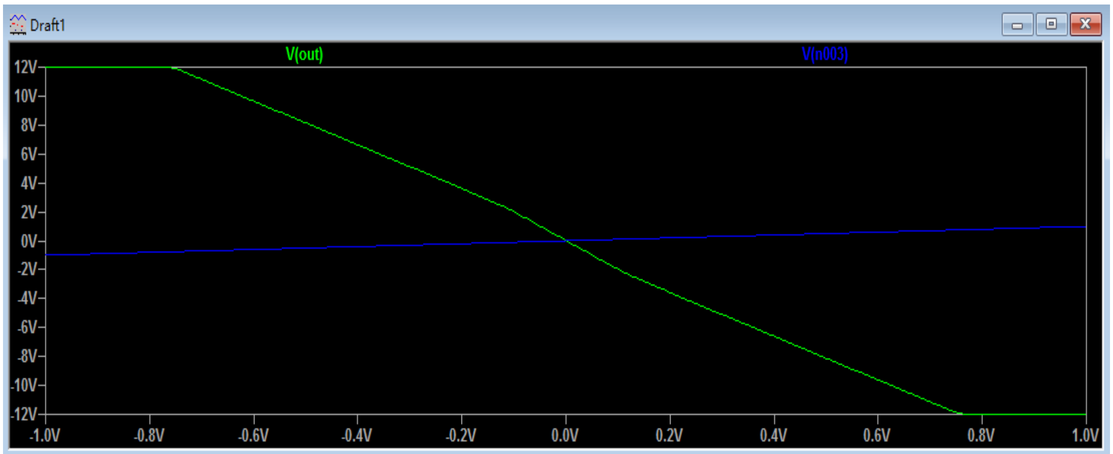

Draft1
V2
12
V3
-12
R3
29k
D1
D2
D
R2
5k
R1
1k
U1
V1
1
OUT
.dc V1 -1 1

<u>Q8.</u>

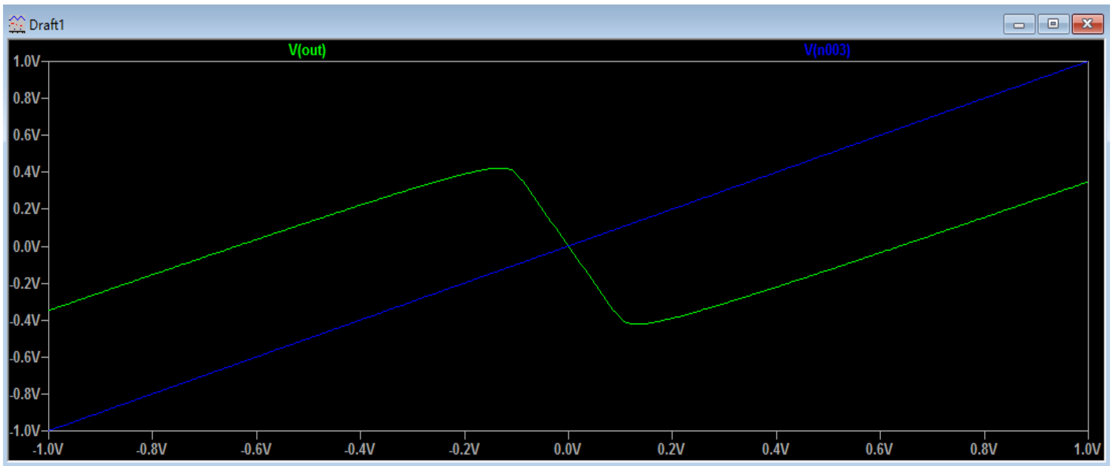
Quand R_3=29kΩ:



Quand R_3=15kΩ:



Quand R_3=-1kΩ:



Il y a une non-linéarité du gain.