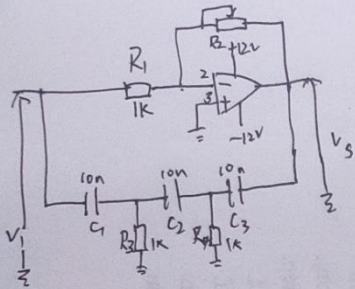


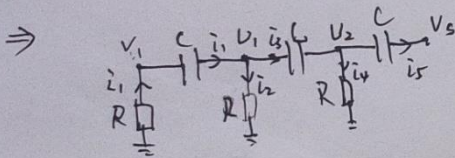
Devoir 3
Jules SY1924105

1.



Soit $R_1 = R_3 = R_4 = R$
 $C_1 = C_2 = C_3 = C$

$U_2 = U_{3+} = 0V$



$i_1 = \frac{0 - V_1}{R} = j\omega C(V_1 - U_1) \Rightarrow U_1 = (1 + \frac{1}{j\omega CR})V_1$

$i_1 = i_2 + i_3$

$i_2 = \frac{U_1}{R}$

$i_3 = j\omega C(U_1 - U_2)$

$i_3 = i_4 + i_5$

$i_4 = \frac{U_2}{R}$

$i_5 = j\omega C(U_2 - V_5)$

$U_2 = (2 + \frac{1}{j\omega CR})U_1 - V_1$

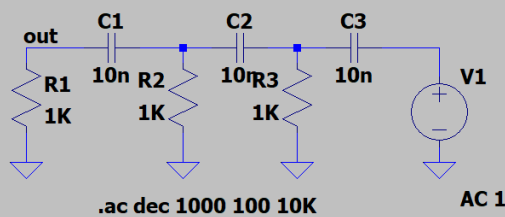
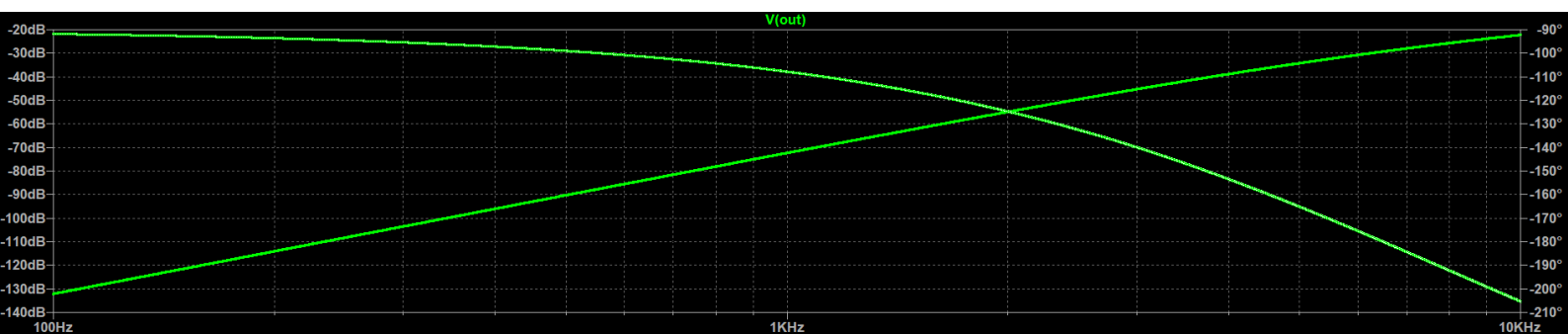
~~$U_1 = \frac{(2 + \frac{1}{j\omega CR})U_1 - V_1}{(j\omega C + \frac{1}{R})(3 + \frac{1}{j\omega CR})}$~~

$U_1 = \frac{(2j\omega CR + \frac{1}{R})V_1 + j\omega CV_5}{(j\omega C + \frac{1}{R})(3 + \frac{1}{j\omega CR})}$

$$\frac{V_5}{V_5} = \frac{1}{1 + \frac{6}{j\omega CR} + \frac{5}{(j\omega CR)^2} + (j\omega CR)^3}$$

$$= \frac{1}{1 - \frac{5}{(\omega CR)^2} - j(\frac{6}{\omega CR} - \frac{1}{(\omega CR)^3})}$$

2.



.ac dec 1000 100 10K

AC 1

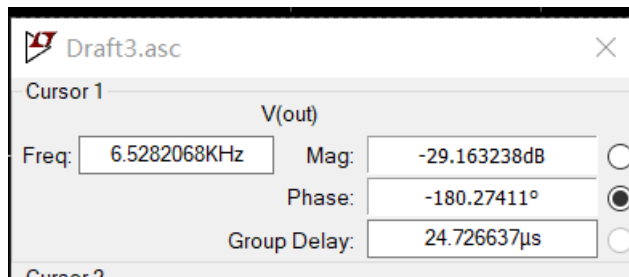
3.

$$\varphi = -\arctan \frac{6(\omega CR)^2 - 1}{(\omega CR)^3 - 5\omega CR} = -\pi$$

$$\omega = \frac{1}{\sqrt{6CR}}$$

$$f_0 = \frac{\omega}{2\pi} = \frac{1}{2\pi\sqrt{6CR}} \approx 6497.5 \text{ Hz}$$

$$A = \frac{1}{|\beta|} = 29$$



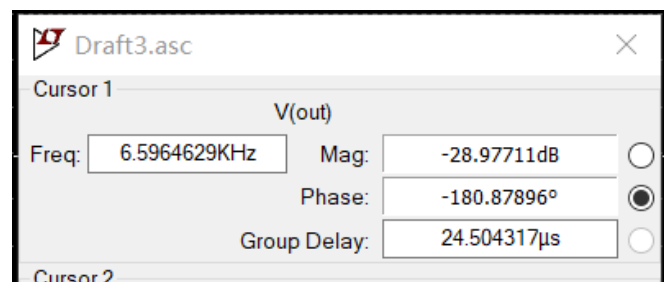
On trouve que $f_0 = 6.5 \text{ kHz}$.

$A = 29.16$

4.

$$d\varphi = -\frac{1}{1 + \left(\frac{6(\omega CR)^2 - 1}{(\omega CR)^3 - 5\omega CR}\right)^2} \times \frac{12\omega CR((\omega CR)^3 - 5\omega CR) - (3(\omega CR)^2 - 5)(6(\omega CR)^2 - 1)}{((\omega CR)^3 - 5\omega CR)^2} \times CR d\omega$$

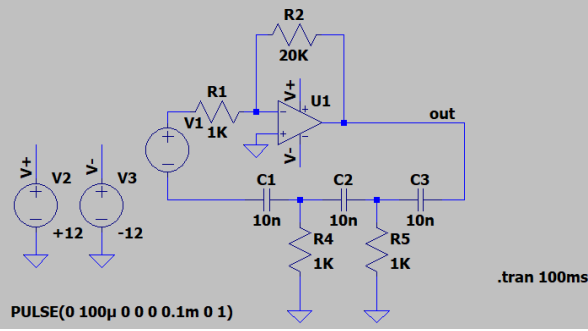
$$\left. \frac{d\varphi}{d\omega} \right|_{\omega=\omega_0} = -\frac{12\omega CR}{(\omega CR)^3 - 5\omega CR} \times CR \omega \Big|_{\omega=\omega_0} = \frac{12\sqrt{6}}{29} \approx 1.01$$



On peut calculer la pente k avec les deux figure,

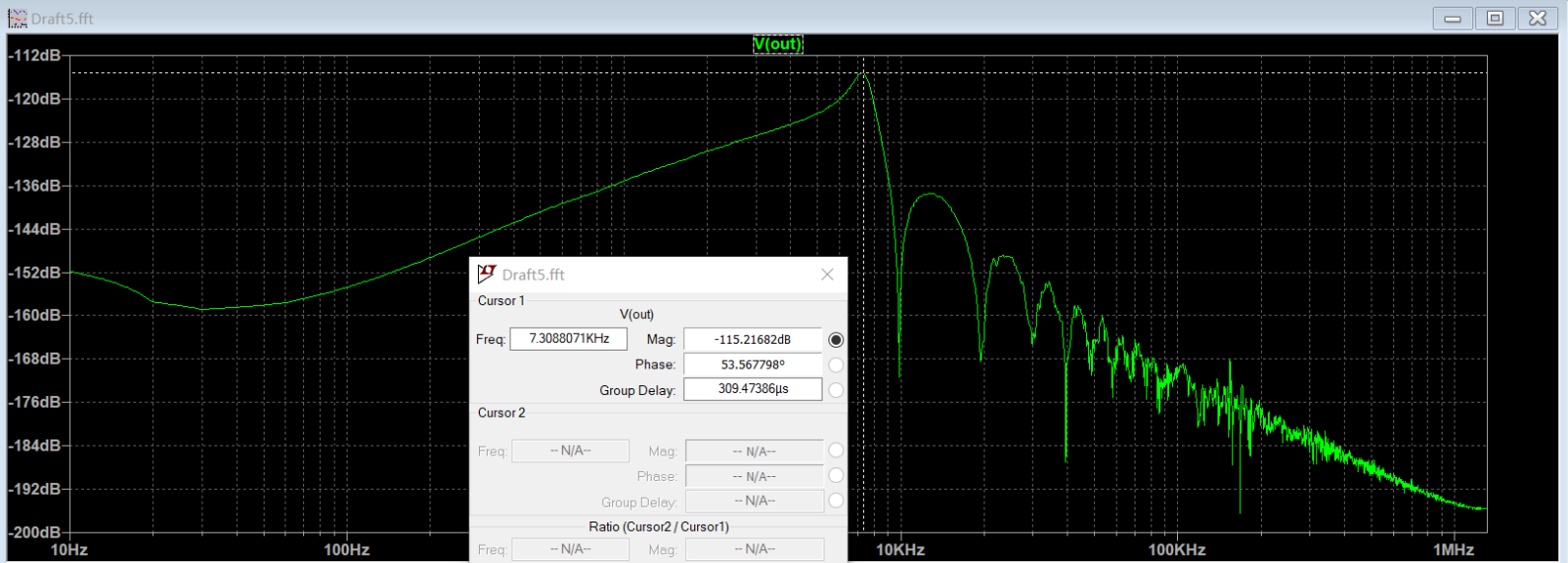
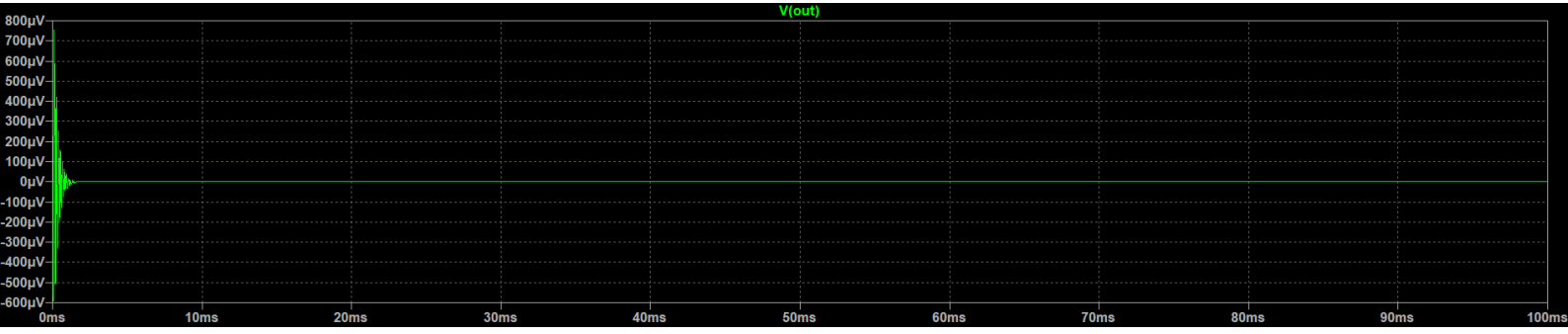
$$\left| \frac{d\varphi}{d\omega} \right|_{\omega=\omega_0} = \left| \frac{\omega_0}{2\pi} \frac{d\varphi}{df} \right| = \left| \frac{\omega_0}{2\pi} \frac{(-180.27411^\circ + 180.87896^\circ) / 180^\circ \times \pi}{6528.2068 - 6596.4629} \right| = 1.005$$

5.

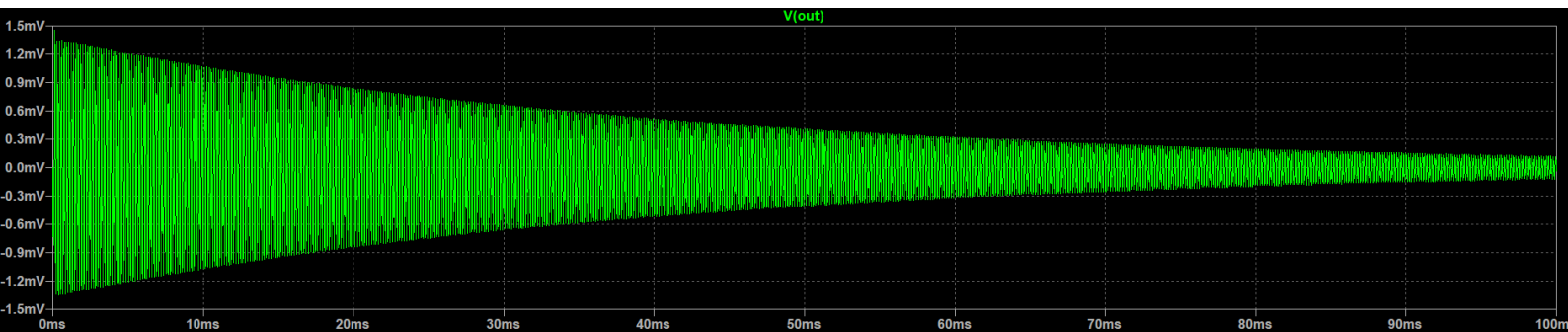


6.

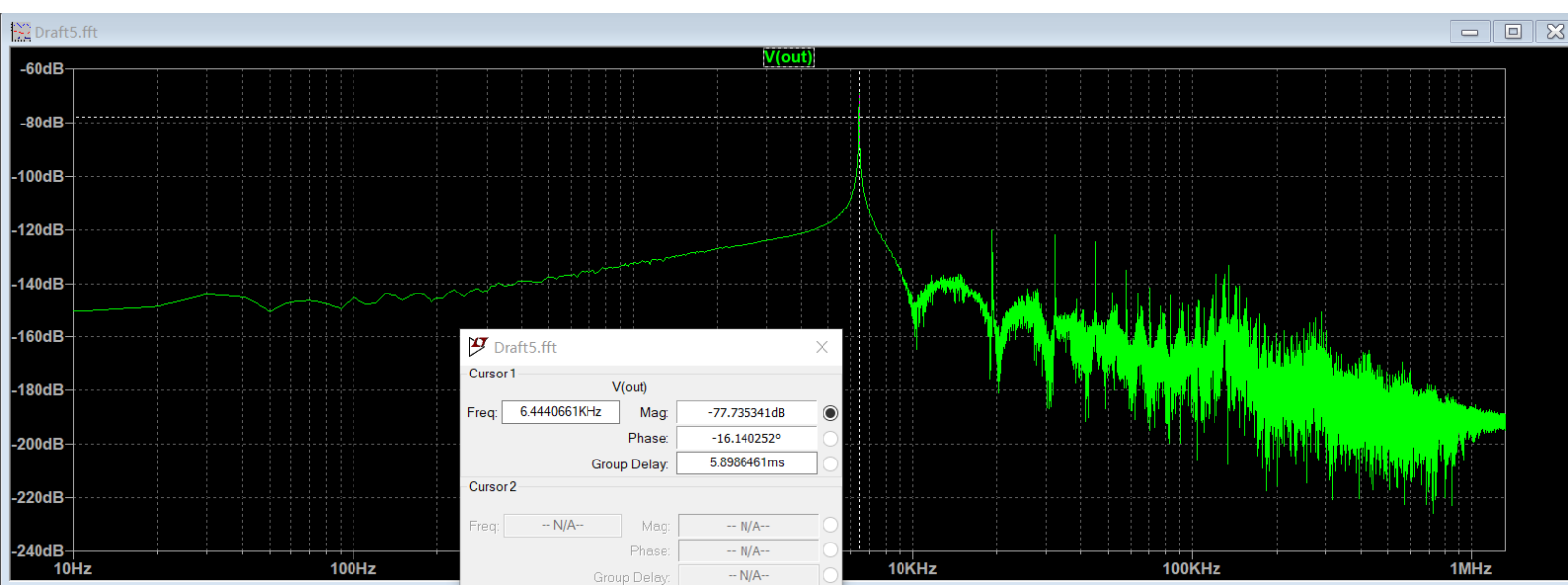
cas R2=20K, $A\beta < 1$,



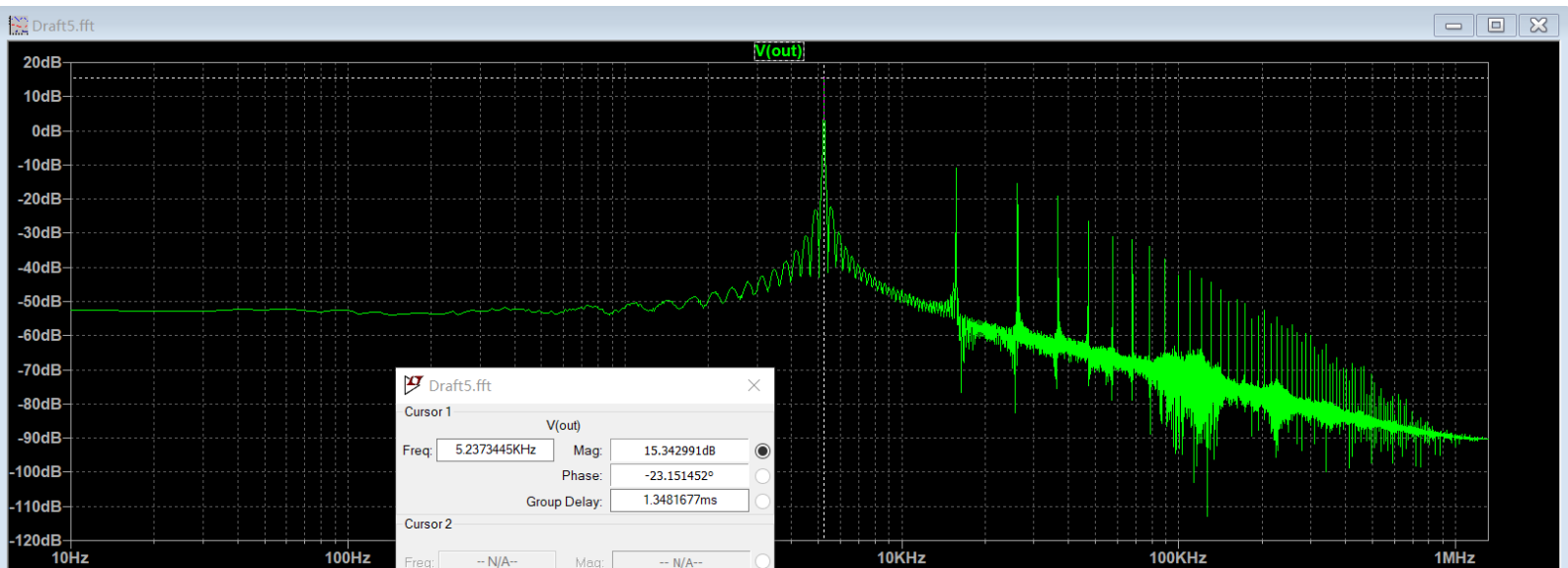
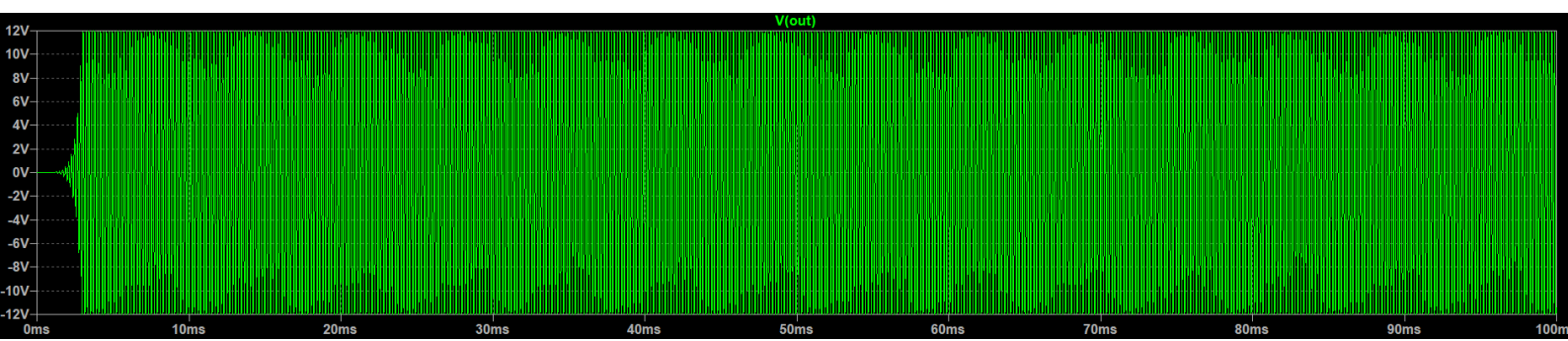
cas R2=29K, $A\beta = 1$,



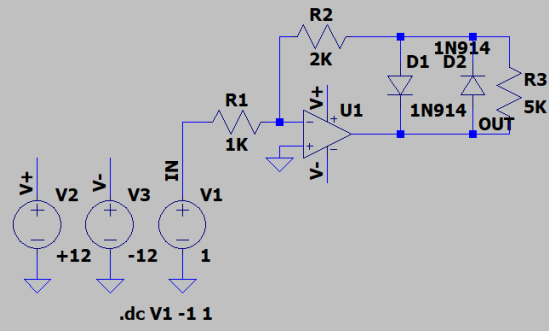
On peut voir que $f = 6.4K \approx 6.5K = f_0$.



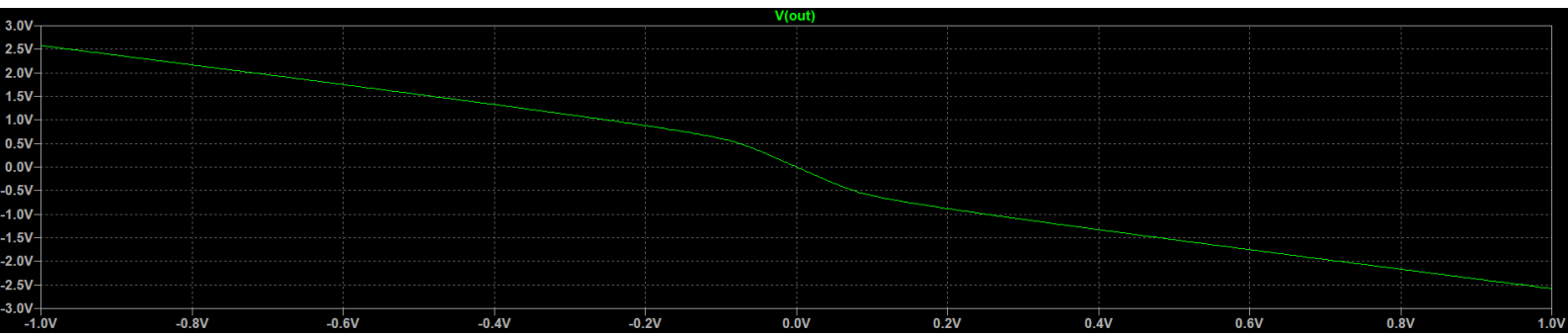
cas $R_2 = 50K, A\beta > 1$



7.



8.



Ici, ce n'est pas linéaire.