Electronique

Oscillateur à déphaseur RC

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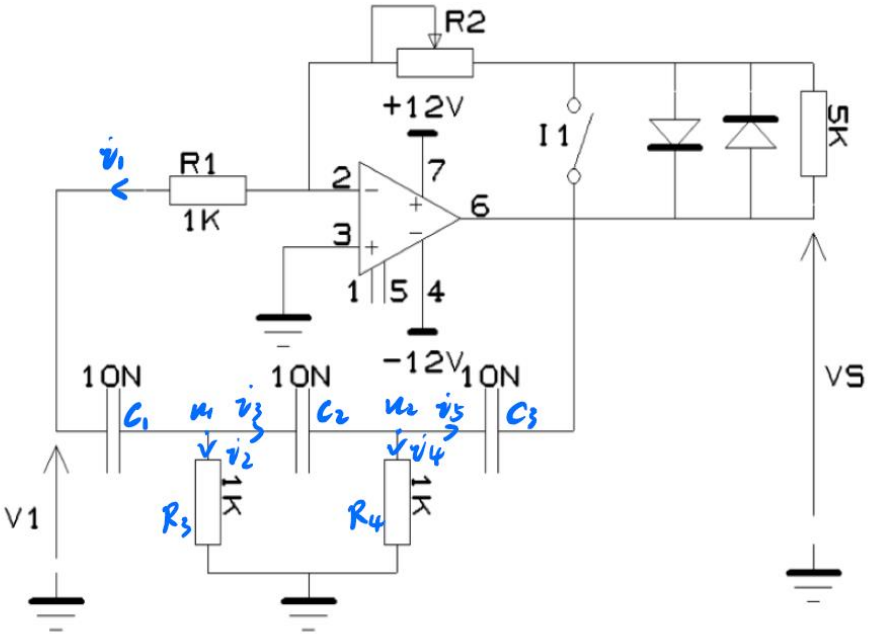
1. Etude théorique

1. On calculer la function de transfert :



On a $R_1 = R_3 = R_4 = 1K\Omega = R$

$C_1 = C_2 = C_3 = 10nF = C$

$i_1 = -\frac{V_1}{R} = jwC(V_1 - u_1) \Rightarrow u_1 = V_1 + \frac{V_1}{jwCR} = V_1(1 + \frac{1}{jwCR})$

$i_1 = i_2 + i_3 = \frac{u_1}{R} + jwC(u_1 - u_2) \Rightarrow u_2 = u_1(2 + \frac{1}{jwCR}) - V_1$

$i_3 = i_4 + i_5 = \frac{u_2}{R} + jwC(u_2 - V_3) \Rightarrow V_S = u_2(2 + \frac{1}{jwCR}) - u_1$

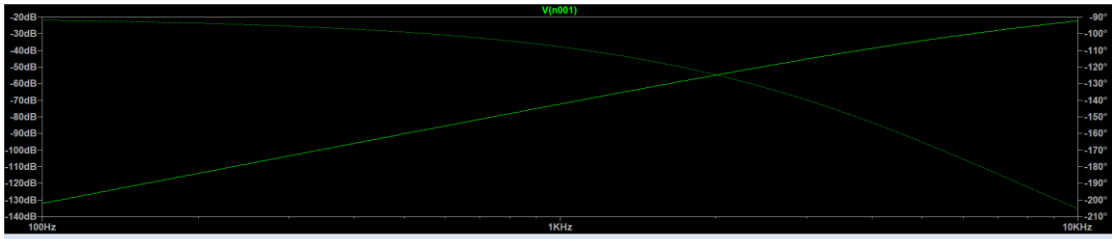
alors on a

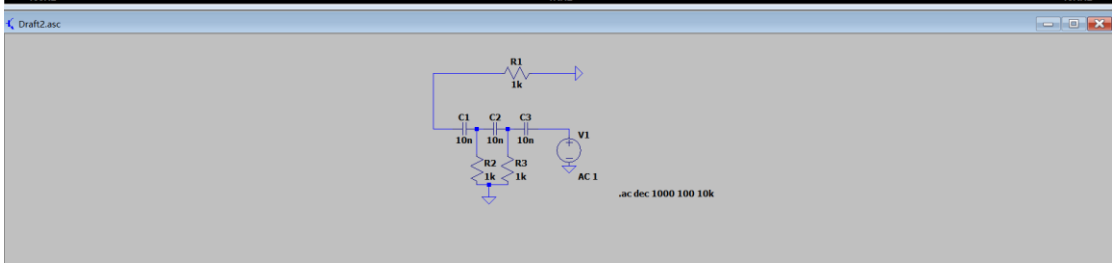
$$V_S = [u_1(2 + \frac{1}{jwCR}) - V_1](2 + \frac{1}{jwCR}) - u_1$$
$$= [V_1(1 + \frac{1}{jwCR})(2 + \frac{1}{jwCR}) - V_1](2 + \frac{1}{jwCR}) - V_1(1 + \frac{1}{jwCR})$$
$$= V_1[(1 + \frac{3}{jwCR} - \frac{1}{(wCR)^2})(2 + \frac{1}{jwCR}) - (1 + \frac{1}{jwCR})]$$

Donc $$\frac{V_1}{V_3} = \frac{1}{1 - \frac{5}{(wCR)^2} + \frac{6}{jwCR} - \frac{1}{j(wCR)^3}}$$
$$= \frac{1}{1 - \frac{5}{(wCR)^2} - j(\frac{6}{wCR} - \frac{1}{(wCR)^3})}$$

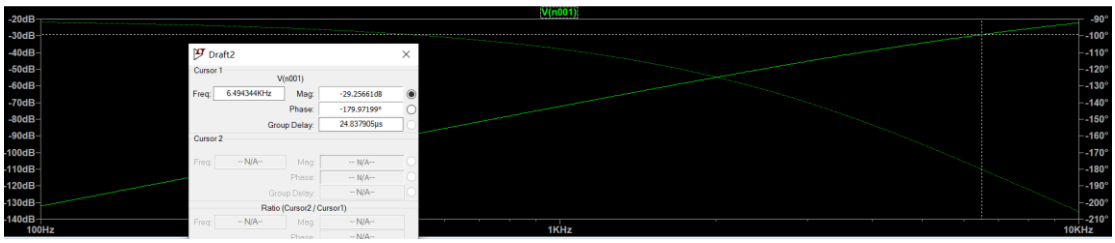
2. Etude numérique

2. On simule la réponse en fréquence :



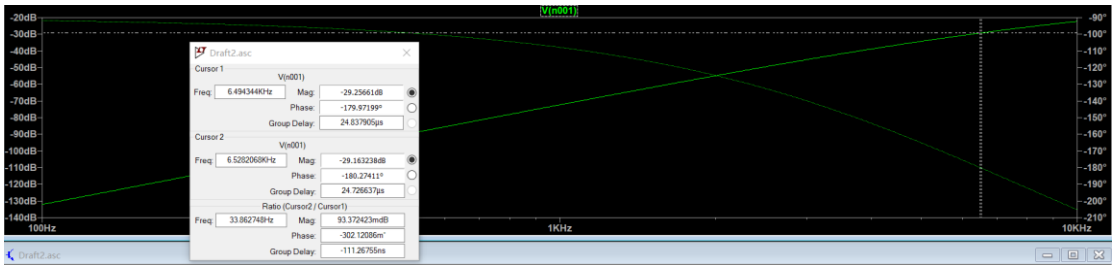


3. On a$F_0 = \frac{1}{2\pi\sqrt{6}RC} = 6.49kHz; A = \frac{1}{|\beta|} = 29.26$



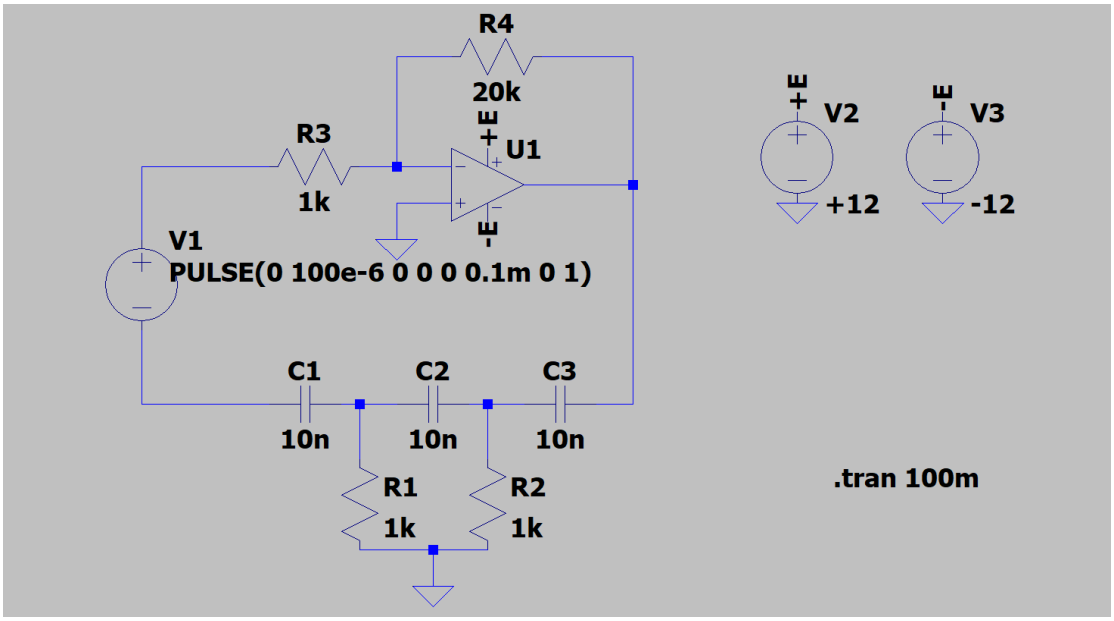
4. D'après la simulation, on peut trouver que

$$S(\omega_0) = \left|\frac{d\varphi}{d\frac{\omega}{\omega_0}}\right| = \left|\frac{\omega_0}{2\pi}\frac{d\varphi}{df}\right| = \left|\frac{\omega_0}{2\pi}\frac{-\frac{0.302}{180} * \pi}{33.863}\right| = 1.012$$

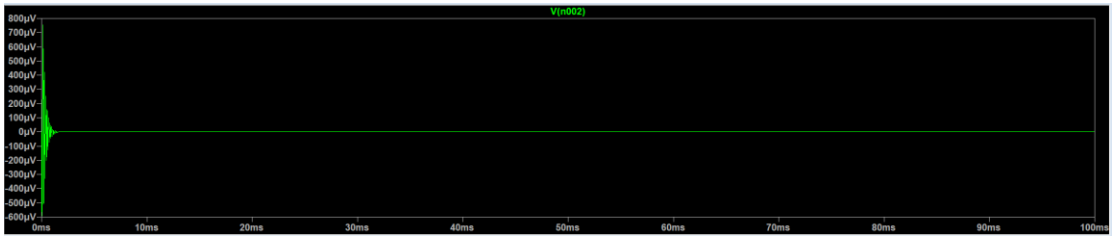


Et le valeur théorique est 1.01, donc ils sont presque le même valeur.

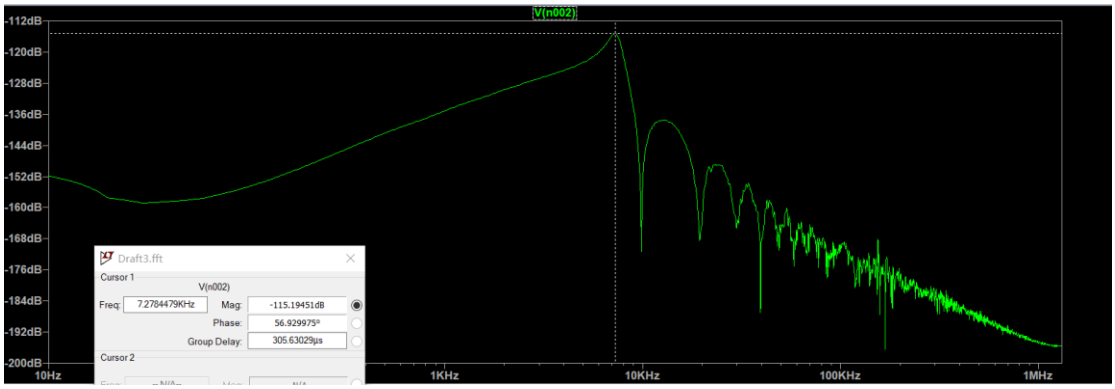
5. On a l'oscillateur complet :



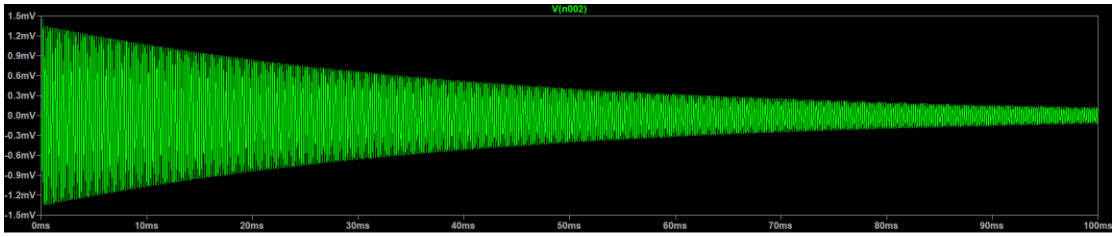
6. On a $A\beta(j\omega) < 1; R_2 = 20k\Omega$



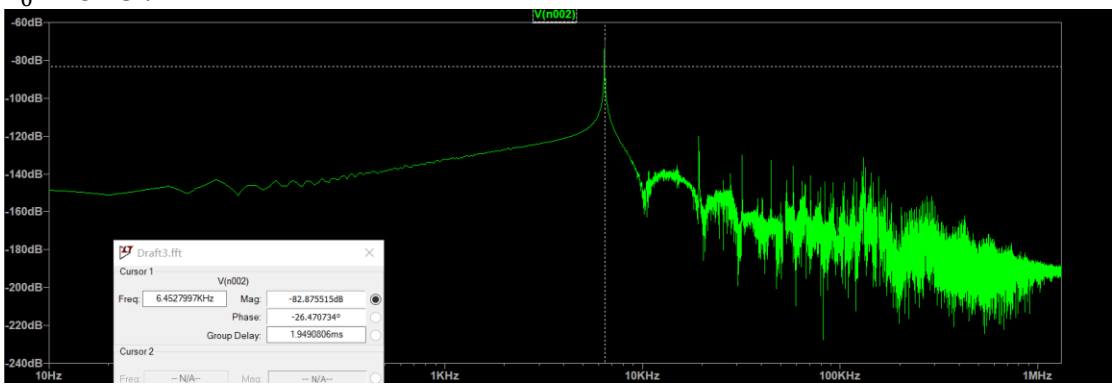
$F_0 = 7.28kHz$



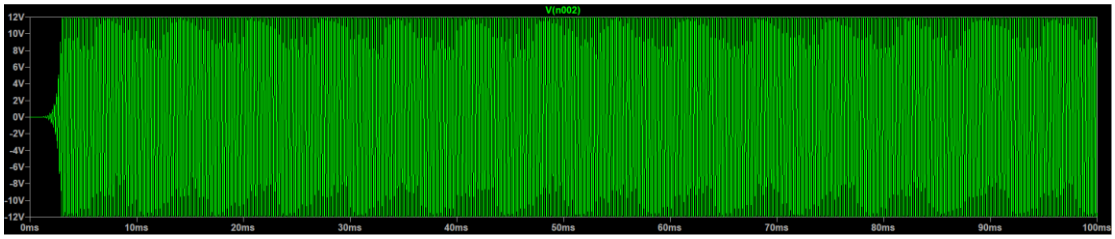
On a $A\beta(j\omega) = 1; R_2 = 29k\Omega$



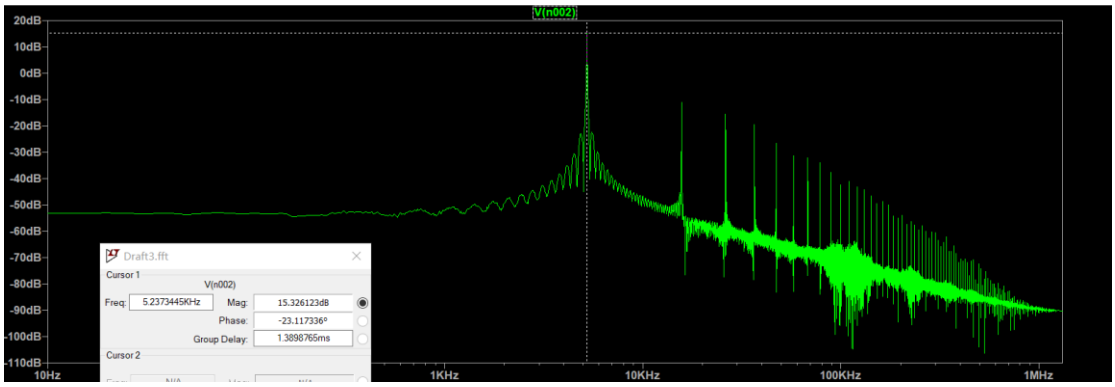
$F_0 = 6.45kHz$



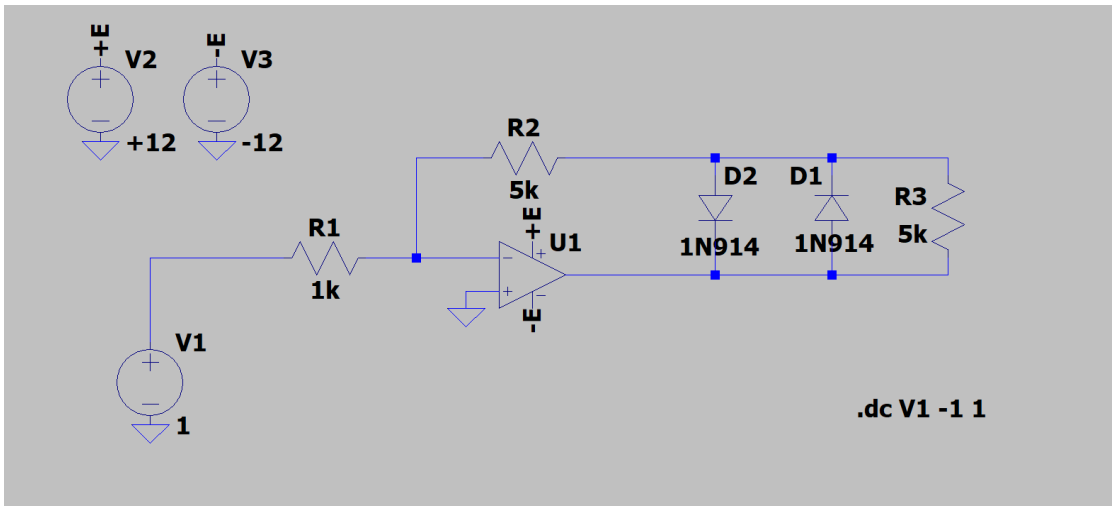
On a $A\beta(j\omega) > 1; R_2 = 50k\Omega$



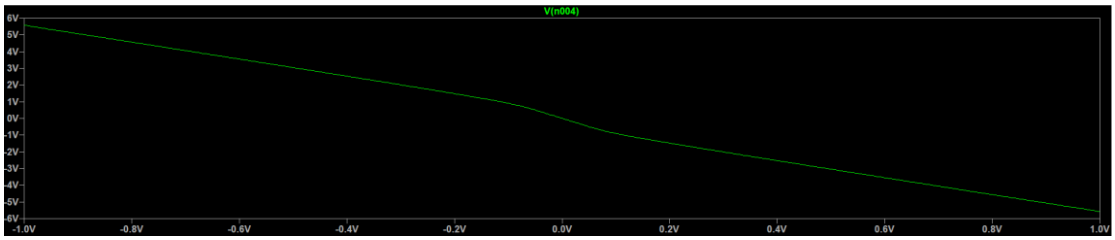
$F_0 = 5.24kHz$



7. Le schéma de l'amplificateur opérationnel seul, avec I1 ouvert :



8. On fait la simulation de type "DC sweep" :



On peut trouver que le gain introduite par les diodes n’est pas linéaire.