

1.

The diagram shows a series circuit with three nodes: C, B, and A. Node C is the input terminal with voltage V_1 . Node B is the first node after a capacitor. Node A is the second node after a capacitor. The output terminal is after a final capacitor with voltage V_2 . Each capacitor is connected in series with a resistor. The circuit is: V_1 (input) → Capacitor → Resistor → Node B → Capacitor → Resistor → Node A → Capacitor → Resistor → V_2 (output).

D'après loi des nœuds en B

$$\frac{V_1 - V_B}{j\omega C} + \frac{V_A - V_B}{j\omega C} = \frac{V_B}{R} \Rightarrow j\omega RC (V_1 - V_B + V_A - V_B) - V_B = 0$$

$$\Rightarrow j\omega RC V_1 + j\omega RC V_A = V_B (1 + 2j\omega RC)$$

D'après loi des nœuds en A

$$\text{on a } \frac{V_B - V_A}{j\omega C} + \frac{V_2 - V_A}{j\omega C} = \frac{V_A}{R} \Rightarrow j\omega RC V_B + j\omega RC V_2 = V_A (1 + 2j\omega RC)$$

Donc:
$$V_A = \frac{(j\omega RC)^2 V_1 + (j\omega RC)(1 + 2j\omega RC) V_2}{1 + 4j\omega RC + 3(j\omega RC)^2}$$

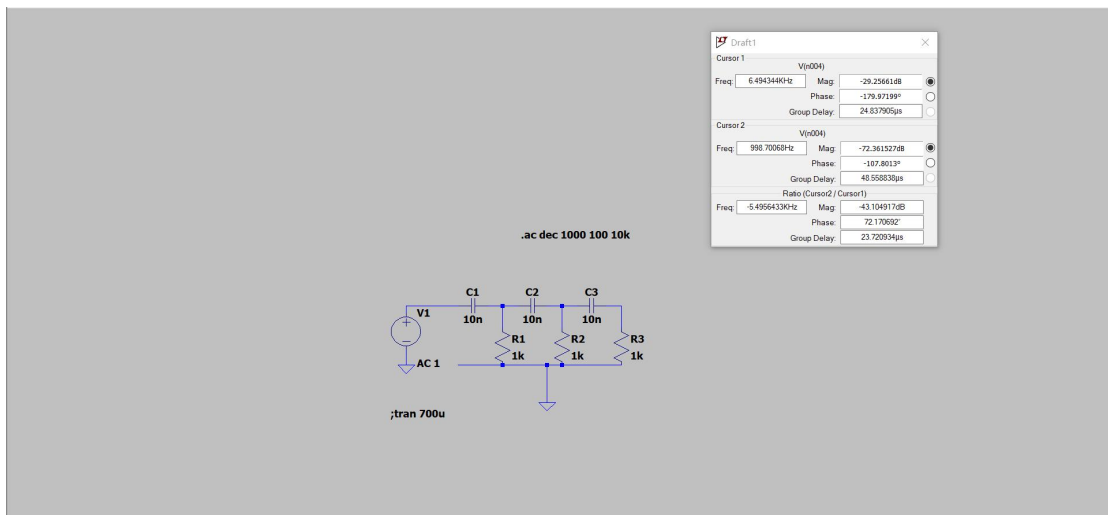
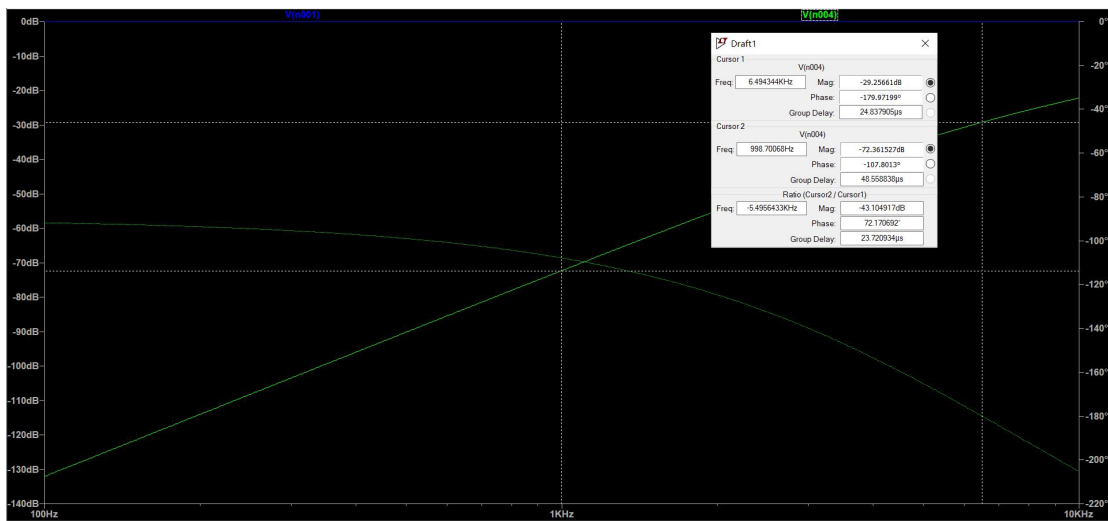
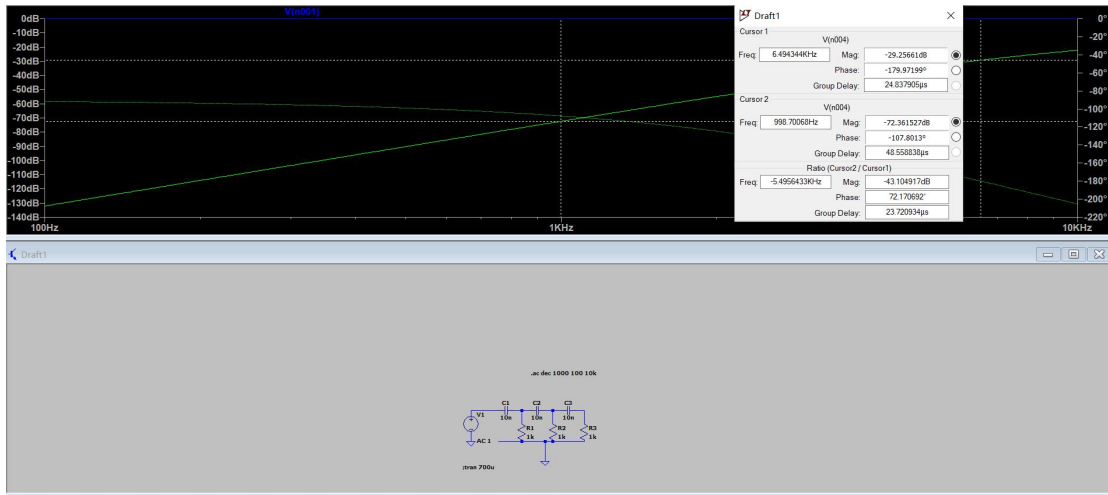
or
$$\frac{V_A}{\frac{1}{j\omega C} + R} = \frac{V_2}{R} \Rightarrow j\omega RC V_A = (1 + j\omega RC) V_2$$

Alors
$$(1 + 4j\omega RC + 3 \cdot (j\omega RC)^2) \cdot \frac{1 + j\omega RC}{j\omega RC} V_2 = (j\omega RC)^2 V_1 + (j\omega RC)(1 + 2j\omega RC) V_2$$

$$(1 + 4j\omega RC + 3 \cdot (j\omega RC)^2) V_2 + j\omega RC V_2 = (j\omega RC)^2 V_1 + (j\omega RC)^2 (1 + 2j\omega RC) V_2$$

$$\Rightarrow H = \frac{(j\omega RC)^2}{1 + 5j\omega RC + 6(j\omega RC)^2 + (j\omega RC)^3}$$

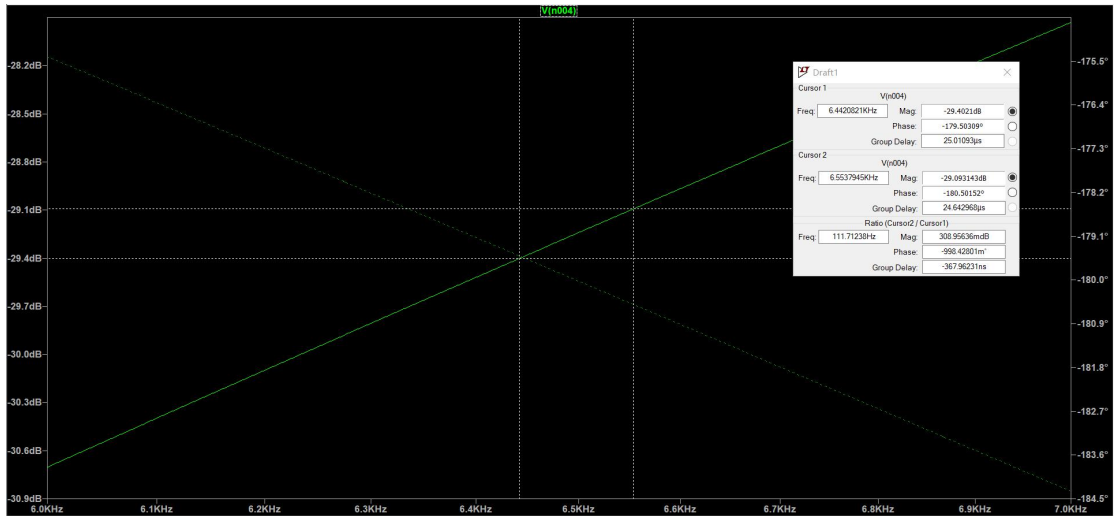
2.



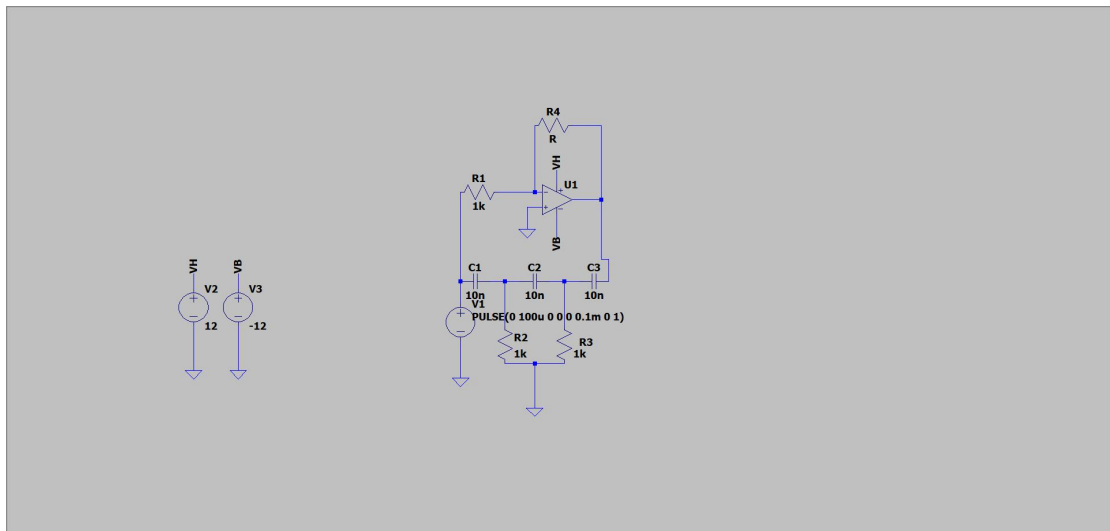
3. Donc on a $F_0 = 6.5\text{kHz}$ et A_0 est environs 29.

4. On sait que $S(\omega_0) = \left| \frac{d\varphi\beta(j\omega)}{d(\omega/\omega_0)} \right|_{\omega=\omega_0}$ Donc ici on a

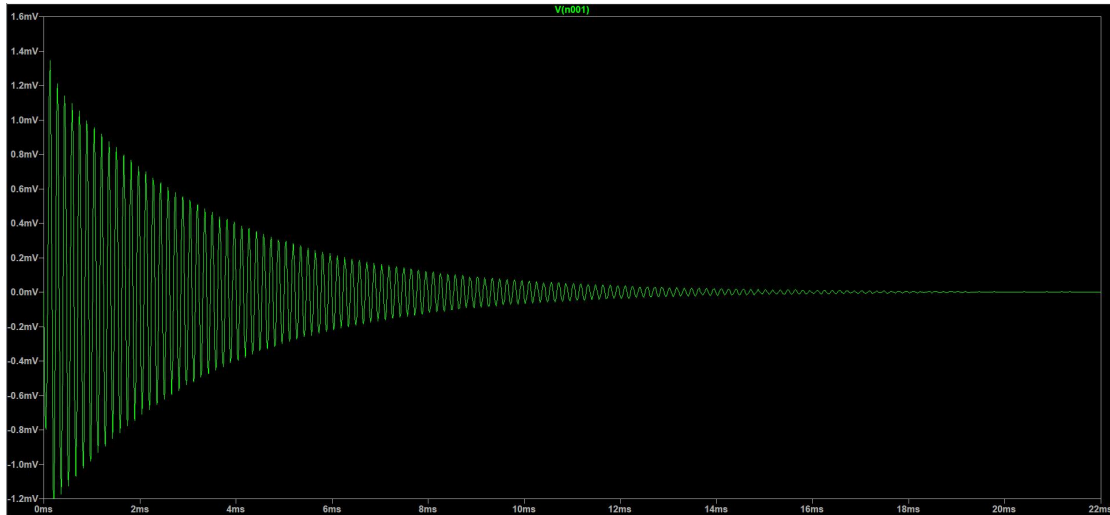
$S(\omega) = \left| \frac{[-180.5 - (-179.5)] \times \pi}{(6.55k - 6.44k) \times 180} \right| \times F0 = 1.03$ cette valeur est proche de la valeur 1.01 qui est dans le cour.



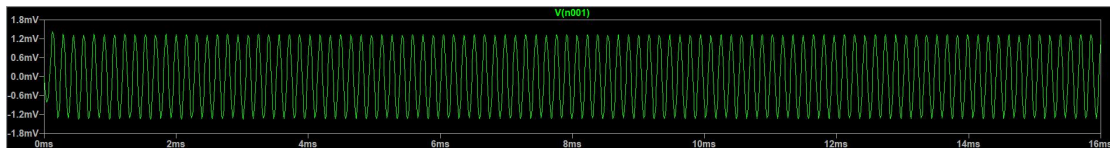
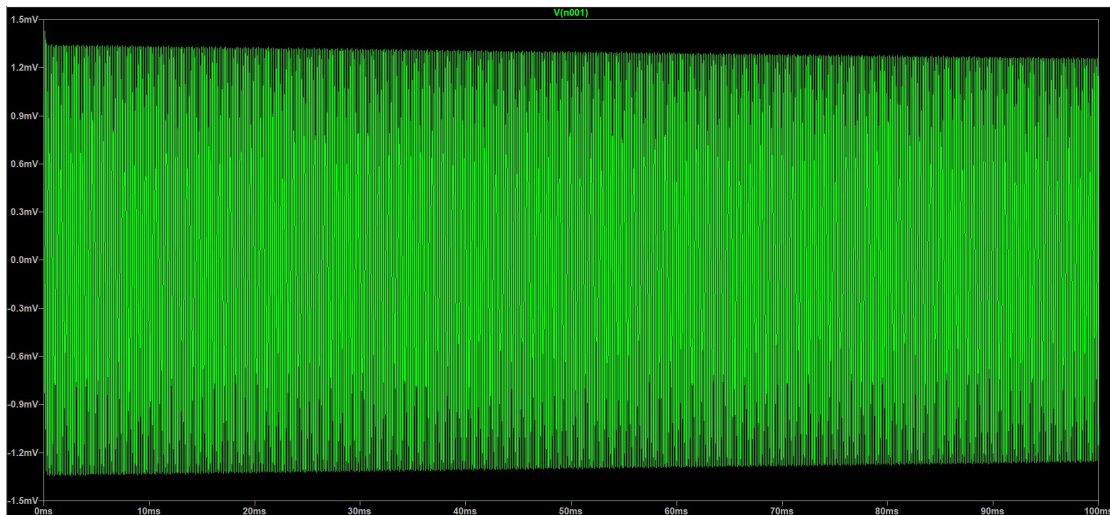
5. Le circuit est :



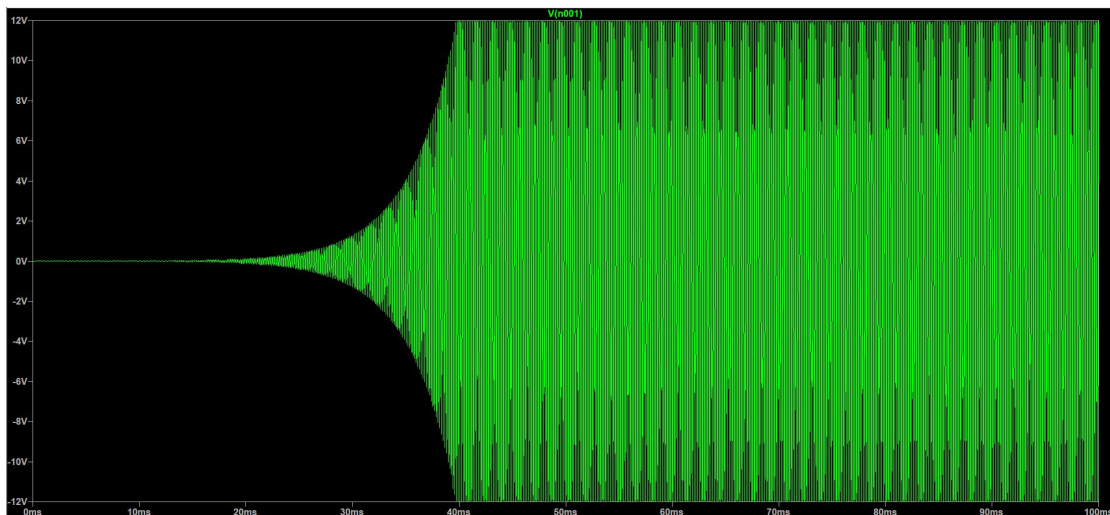
6. Quand $|A\beta(j\omega)| < 1$ on donne $R_2/R_1 < 29$ $R_2 < 29k\Omega$ $R_2 = 28k\Omega$



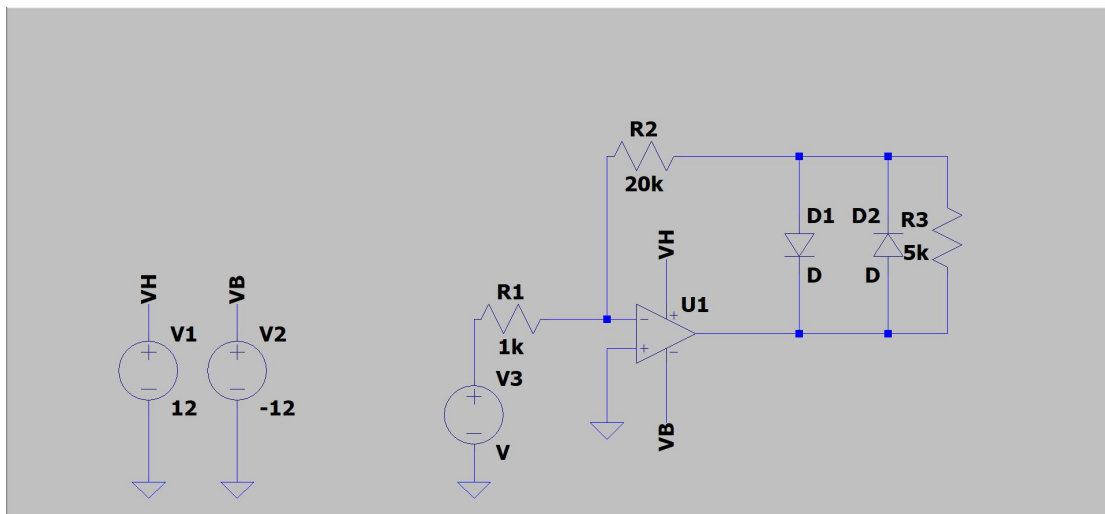
Quand $|A\beta(j\omega)| = 1$ on donne $R_2/R_1 = 29.09$ $R_2=29.09k\Omega$



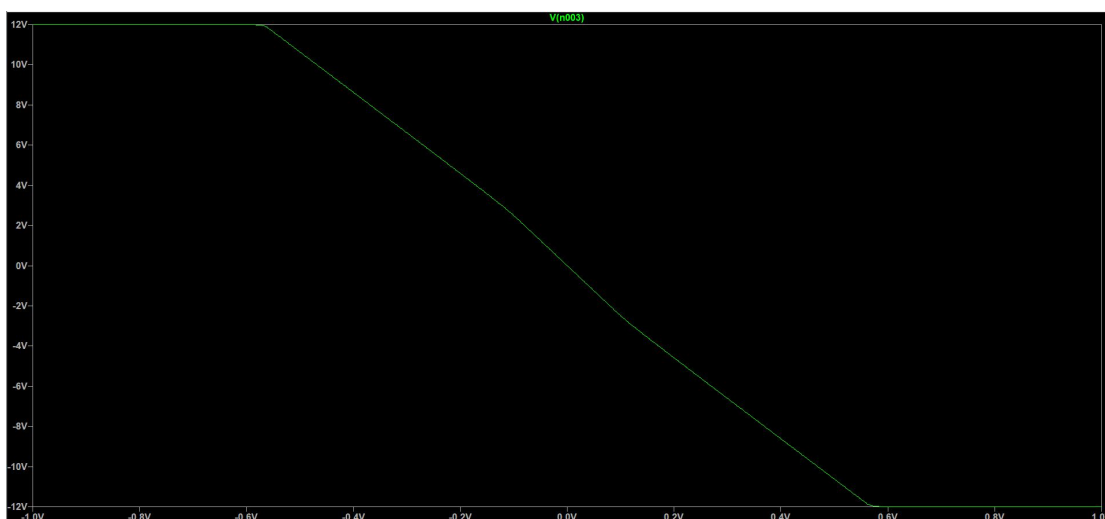
Quand $|A\beta(j\omega)| > 1$ on donne $R_2/R_1 > 29.09$ $R_2=30k\Omega$



7. Le circuit créer est si-dessous :



8. On peut voir le resultat



On peut voir clairement le non-linearite dans ce resultat.