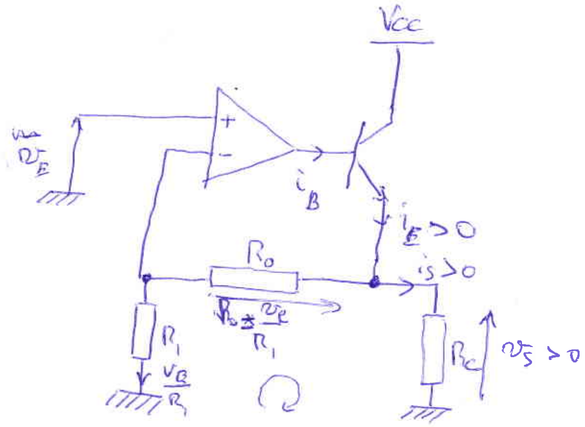
Exercice n°3 11/04 ①

Rétroaction < 0 ⟹ Mode linéaire

$V^+ = V^- = v_e$



$$V^- = \frac{\frac{V_s}{R_0}}{\frac{1}{R_1} + \frac{1}{R_0}} = \frac{R_2 V_s}{R_1 + R_0} = v_e$$

$$A_v = \frac{v_s}{v_e} = \left(\frac{R_1 + R_0}{R_1}\right)$$

$$v_e + \frac{R_0 v_e}{R_1} - v_s = 0 \Rightarrow v_s = \left(1 + \frac{R_0}{R_1}\right) v_e$$

$$v_{s\,max} = \left(1 + \frac{R_0}{R_1}\right) V_{E\,max} = 50 \times 200.10^{-3} = \underline{10V}$$

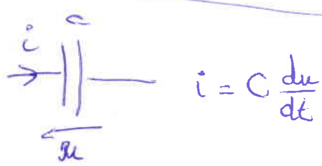
$$i_{b\,max} = 30\,mA \Rightarrow i_{E\,max} = (\beta + 1)\, i_{b\,max} \approx 3A$$

$$i_{s\,max} = i_{E\,max} - \frac{v_{e\,max}}{R_1} = 3 - \frac{200.10^{-3}}{1.10^{+3}} = 3 - 20.10^{-6} \approx 3A$$

$$\Rightarrow R_{c\,min} = \frac{10}{3}\,\Omega$$

PARTIE 2 : 1)

$$u = \underbrace{V^-}_{V^+ = 0} - v_s = -v_s \Rightarrow i = -C \frac{dv_s}{dt}$$



$$v_e = Ri = -RC\frac{dv_s}{dt} \Rightarrow v_s = \frac{1}{RC}\int v_e\, dt$$

$V^- = V^+ = 0$

$$V^- = \frac{\frac{V_E}{R} + V_s jC\omega}{\frac{1}{R} + jC\omega} = 0$$

$$\frac{V_s}{1} = \frac{-V_E}{R + jC\omega}$$

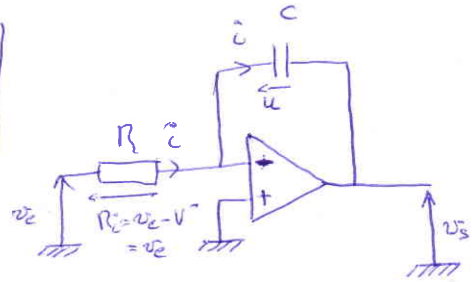
$$\frac{1}{V_s} = \frac{-Rjc\omega}{V_E}$$

$$\frac{V_E}{V_s} = R.jc\omega.$$

$$\Rightarrow \frac{V_s}{V_E} = \frac{-1}{Rjc\omega}$$

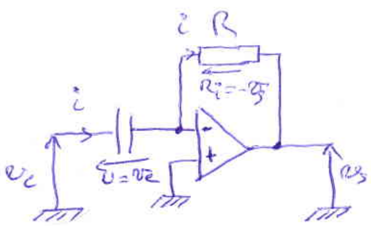
$$A(\omega) = |T| = \frac{1}{RC\omega} \quad \begin{cases} \xrightarrow[\omega \to 0]{TBF} \infty \\ \xrightarrow[\omega \to \infty]{THF} 0 \end{cases}$$

⟹ Filtre passe-bas.



2)

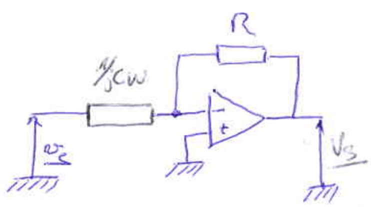
$$V^- = \frac{\frac{V_E}{\frac{1}{jC\omega}} + \frac{V_s}{R}}{jC\omega + \frac{1}{R}} = 0 \Leftrightarrow \frac{V_E}{\frac{1}{jC\omega}} + \frac{V_s}{R} = 0.$$



$$\Rightarrow V_s = \frac{-V_E}{\frac{1}{jc\omega}} \times R = -V_E RjC\omega \Leftrightarrow \frac{V_s}{V_e} = -Rjc\omega$$

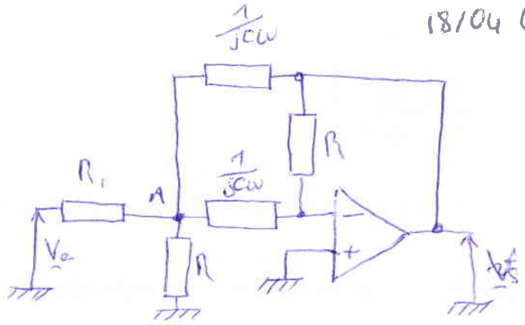
$$A(\omega) = RC\omega \quad \begin{cases} \xrightarrow{\omega \to 0} 0 \\ \xrightarrow{\omega \to \infty} \infty \end{cases}$$

⟹ Filtre passe haut.



4) Millman sur l'entrée :

18/04 ①



$$V^- = \frac{\frac{V_A}{\frac{1}{jC\omega}} + \frac{V_s}{R}}{\frac{1}{\frac{1}{jC\omega}} + \frac{1}{R}} = 0$$

$$jC\omega V_A + \frac{V_s}{R} = 0$$

$$jRC\omega V_A + V_s = 0 \quad (1)$$

Millman sur A :

$$V_A = \frac{\frac{V_e}{R_1} + jC\omega V_s}{\frac{1}{R_1} + jC\omega + jC\omega + \frac{1}{R}}$$

$$V_A = \frac{RV_e + jR_1RC\omega V_s}{R+R_1+2jR_1RC\omega} \quad (2)$$

(2) → (1)

$$jRC\omega \cdot \frac{RV_e + jR_1RC\omega V_s}{R+R_1+2jR_1RC\omega} + V_s = 0$$

$$j^2R_1R^2C^2\omega^2 V_s + (R+R_1+2jR_1RC\omega)V_s = -jR^2C\omega V_e$$

$$V_s(R+R_1+2jR_1RC\omega - R_1R^2C^2\omega^2) = -jR^2C\omega V_e$$

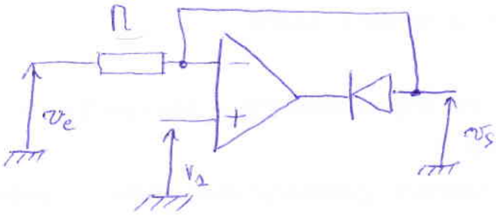
$$\underline{T}(\omega) = \frac{-jR^2C\omega}{R+R_1+2jRR_1C\omega - R_1R^2C^2\omega^2}$$

$$\underline{T}(\omega) = A_0 \cdot \frac{Num(\omega)}{1 + 2j\sigma\frac{\omega}{\omega_0} - \left(\frac{\omega}{\omega_0}\right)^2}$$

D bloquée si $V_D < 0$

si $V_s - V_{out} < 0$

Exercice n°4



1er cas : $V_{out} = -V_{SAT}$

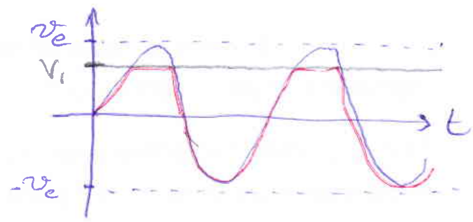
$V_s + V_{SAT} < 0$

$v_e < -V_{SAT}$

⇒ IMPOSSIBLE

Or $\begin{cases} -V_e \leq v_e \leq V_e \\ V_e < V_{SAT} \end{cases}$

$\Rightarrow -V_{SAT} < v_e < V_{SAT}$



2e cas : $v_{out} = V_{SAT}$ $\varepsilon > 0$

$v_e - V_{SAT} < 0$

$v_e < V_{SAT} \Rightarrow$ OK Possible

$\varepsilon > 0$ si $V^+ - V^- > 0$ si $V^+ > V^-$

si $V_1 > v_e$