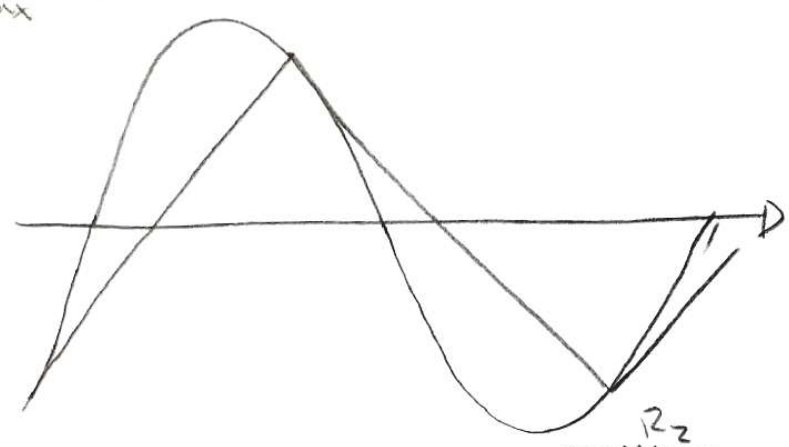
Examen partiel 2019

a) $1 - L(s) = 0$, $L(j\omega_0) = A(j\omega_0)\beta(j\omega_0) = 1$

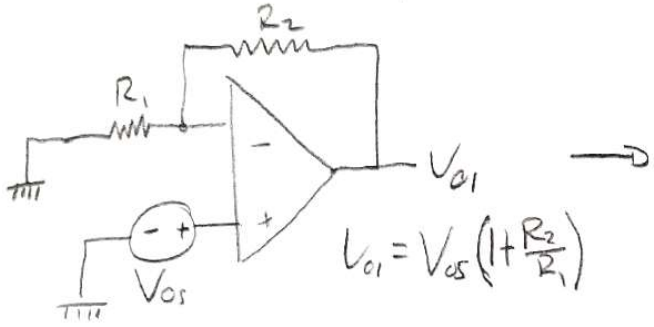
$\Rightarrow$ $Re[L(j\omega_0)] = 1$ et $Im[L(j\omega_0)] = 0$

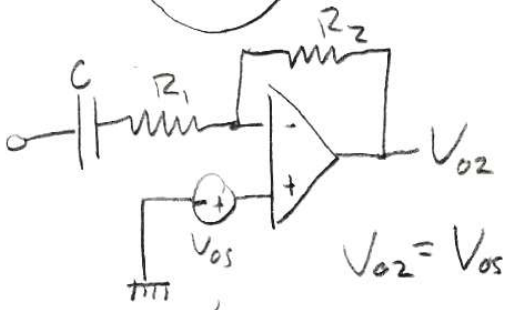
b) $SR = 5V/\mu s$, $V_{omax} = 10V$

$$f_m \leq \frac{SR}{2\pi V_{omax}} = 79,5\ KHz$$

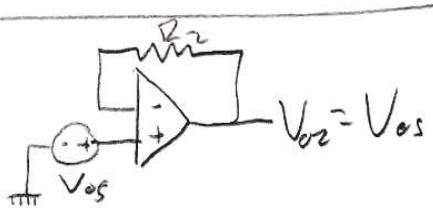


c)





En DC :



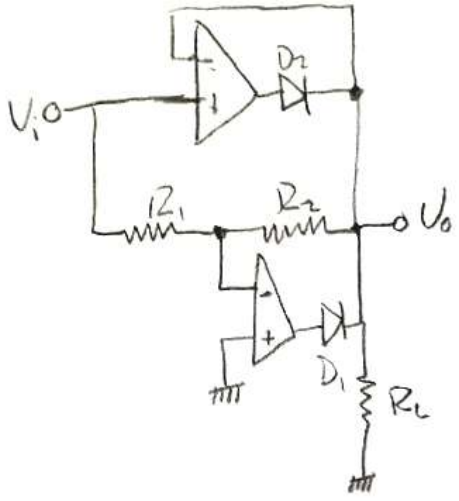
d) Bloc 1 et Bloc 2 sont des ampli en configuration log.

Bloc 3 est un additionneur

Bloc 4 est en configuration exponentielle

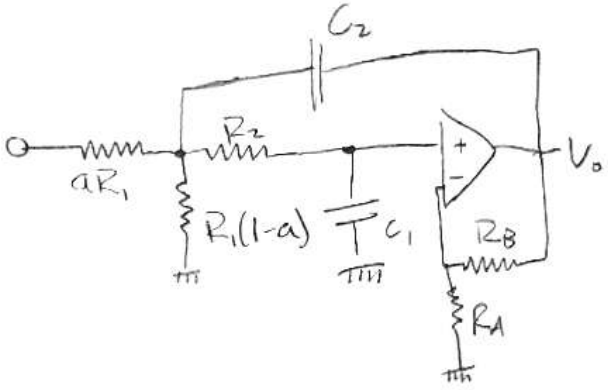
Le circuit est un multiplicateur

e)



3. $R_1 = R_2 = R_A = R$

$C_1 = C_2 = C$



$$T(s) = \frac{ak \cdot 1/R^2C^2}{s^2 + s\left[\frac{1}{R} + \frac{1}{R}(2-K)\right]\frac{1}{C} + \frac{1}{R^2C^2}}$$

$$= \frac{ak \cdot 1/R^2C^2}{s^2 + s(3-K)\cdot\frac{1}{RC} + 1/R^2C^2}$$

$$R = \frac{1}{\omega_0 C} = \frac{1}{2\pi \cdot 10\,kHz \cdot 1nF} = 15915\,\Omega$$

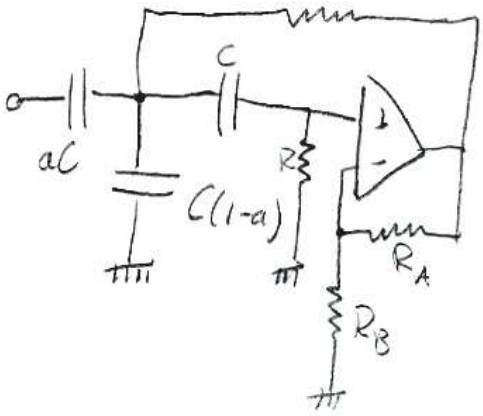
$Q = 0{,}707$

$K = 3 - 1/Q = 1{,}59$, $R_B = (2 - 1/Q)R_A = 9319\,\Omega$

$ak = 1 \rightarrow a = 1/k = 0{,}63$

Pour passe-haut : $C_{i_{hp}} = \frac{1}{\omega_0 R_{i_{hp}}}$, $R_{i_{hp}} = \frac{1}{\omega_0 C_{hp}}$

$$T(s) = \frac{s^2}{s^2 + s\left(\frac{2\pi\,10kHz}{0{,}707}\right) + (2\pi\,10kHz)^2}$$



b) $A_{max} = 1dB$

$$\varepsilon = \sqrt{10^{A_{max}/10} - 1} = 0,5088$$

$$A(j\omega_s) = 10\log\left[1 + \varepsilon^2 (\omega_s/\omega_p)^{2N}\right] \geq A_{min}$$

Si: $N = 2 \rightarrow A(j\omega_s) = 13,418dB$

$N = 3 \rightarrow A(j\omega_s) = 22,78dB > 20dB$

Polynome normalisé: $\dfrac{1}{(1+s)(1+s+s^2)}$

Dénormalisation: $s = s/\omega_0 \Rightarrow$

$$\frac{k}{(1+s/\omega_0)(1+s/\omega_0 + s^2/\omega_0^2)} = \frac{k}{\left(\frac{\omega_0+s}{\omega_0}\right)\left(\frac{\omega_0^2+s\omega_0+s^2}{\omega_0^2}\right)}$$

$$= \frac{k\,\omega_0^3}{(s+\omega_0)(s^2+s\omega_0+\omega_0^2)}$$

$$\omega_0 = \omega_p (1/\varepsilon)^{1/N} = 2\pi\, 20kHz\,(1/0,5088)^{1/3} = 2\pi\, 25kHz$$

c) Portion par inductance simulée: $\dfrac{K\omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$

$\omega_0 = 2\pi 25kHz$

$Q = 1/1 = 1$

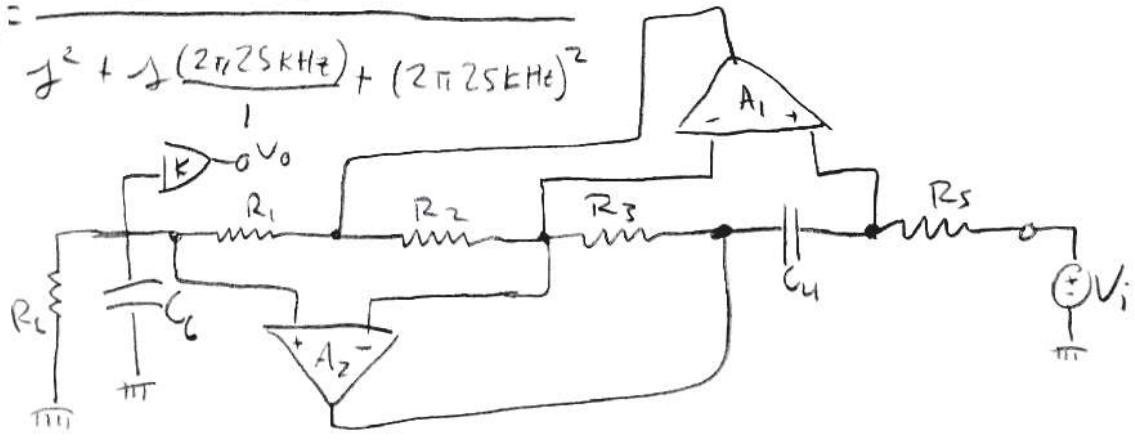
$C = 1nF$

$R = R_1 = R_2 = R_3 = R_5$

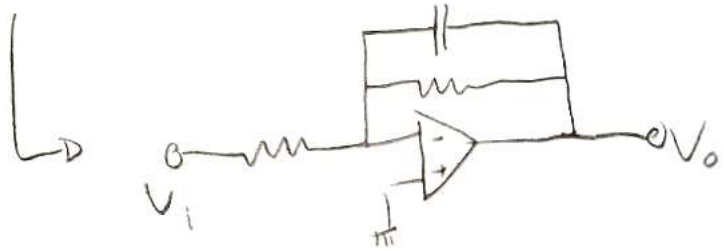
$C_6 = 1nF \Rightarrow R = 1/\omega_0 C = 6366\Omega$

$\dfrac{\omega_0}{Q} = \dfrac{1}{R_6 C_6} \Rightarrow R_6 = 6366\Omega$

$$T(s) = \frac{(2\pi 25kHz)^2}{s^2 + s\frac{(2\pi 25kHz)}{1} + (2\pi 25kHz)^2}$$



d) $\frac{1}{(s+1)} \cdot \frac{1}{(s^2+s+1)}$



Question 2.

a) $Z_{in} = \infty$

$A_{cm} = 1$

b) $TRMC = 20 \log \frac{A_d}{A_{cm}}$

$SNR_o = SNR_i + TRMC$

$20 \log \frac{10 . 10 . 0{,}05V}{0{,}01} = 20 \log \frac{0{,}05}{2} + TRMC$

$TRMC = 54 \, dB + 32 \, dB = 86 \, dB.$

c) $v_1 = -0{,}05/2 \cos 2\pi f_1 t + 2{,}0 \cos 2\pi f_2 t$

$v_2 = 0{,}05/2 \cos 2\pi f_1 t + 2 \cos 2\pi f_2 t$

$v_{o1} = -0{,}5/2 \cos 2\pi f_1 t + 2{,}0 \cos 2\pi f_2 t$

$v_{o2} = 0{,}5/2 \cos 2\pi f_1 t + 2{,}0 \cos 2\pi f_2 t$

* $v_o = -5 \cos 2\pi f_1 t + 0{,}02 \cos 2\pi f_2 t.$

d) $TRMC = 20 \log \frac{A_d}{A_{cm}}$ → $A_d = 100 V/V$ (circled)

$TRMC = 80 \, dB.$

$A_{cm} = \frac{100}{\left(10^{\frac{80}{20}}\right)} =$ ~~1×10^{-4}~~ V/V $\quad 0{,}01 \, V/V$

* si $TRMC_{diff.} = 60 \, dB$

$A_{cm \, diff} = \frac{10}{10^{\frac{60}{20}}} = 0{,}01 \, V/V$