Corrigé de l'examen final BE 522

Exercice 1 — 4 pts

* $v(t) = V_m \sin \omega t$ (1)

$$\bar{V} = \frac{2}{T}\int_0^{\frac{T}{2}} V_m \sin \omega t \, dt = \frac{2V_m}{T}\left[\frac{1}{\omega}(-\cos \omega t)\right]_0^{\frac{T}{2}}$$

$$= \frac{2V_m}{T} \cdot \frac{T}{2\pi}\left(-\cos \omega.\frac{T}{2} + 1\right) = \frac{2V_m}{T} \cdot \frac{T}{2\pi} \cdot 2$$

$$\Rightarrow \boxed{\bar{V} = \frac{2V_m}{\pi}}$$ (1)

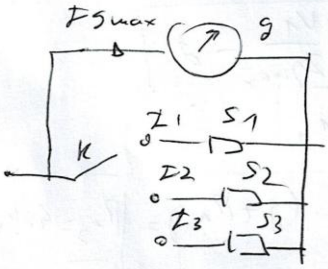
* $$V^2 = \frac{2}{T}\int_0^{\frac{T}{2}} V_m^2 \sin^2 \omega t . dt = \frac{2V_m^2}{T}\int_0^{\frac{T}{2}}\left(\frac{1}{2} - \cos\frac{2\omega}{2}\right)dt$$

$$= \frac{2V_m^2}{T}\left[\frac{t}{2} - \frac{\sin 2\omega t}{4\omega}\right]_0^{\frac{T}{2}} = \frac{2V_m^2}{T}\left[\frac{T}{4} - \frac{\sin 2\omega}{4\omega}\right|_0^{\frac{T}{2}}$$ (⇓ 0)

Car $\sin 2\pi - \sin 0 = 0$. $= 1 - 1$

$$\Rightarrow V^2 = \frac{2V_m^2}{T} \cdot \frac{T}{4} \Rightarrow \boxed{V = \frac{V_m}{\sqrt{2}}}$$ (2)

Exercice 2 — 6 pts



1/ Par définition $K_i = \frac{I_{cal}}{I_{gmax}}$ (1)

$$K_1 = \frac{I_1}{I_{gmax}} \Rightarrow K_1 = \frac{0,5}{0,5.10^{-3}} \Rightarrow \boxed{K_1 = 1000}$$

$$K_2 = \frac{I_2}{I_{gmax}} = \frac{0,2}{0,5.10^{-3}} \Rightarrow \boxed{K_2 = 400}$$ (2)

$$K_3 = \frac{I_3}{I_{gmax}} = \frac{0,05}{0,5\ 10^{-3}} \Rightarrow \boxed{K_3 = 100}$$ (2)

2/ * $g I_{gmax} = S_1 (I_1 - I_{gmax}) \Rightarrow \boxed{S_1 = \dfrac{g I_{gmax}}{I_1 - I_{gmax}}}$ (2)

$\Rightarrow S_1 = \dfrac{50 \cdot 0{,}5 \, 10^{-3}}{0{,}5 - 0{,}5 \, 10^{-3}} \Rightarrow \boxed{S_1 = 0{,}05 \, \Omega}$

* de même pour S_2 et S_3

$g \cdot I_{gmax} = S_2 (I_2 - I_{gmax}) \Rightarrow \boxed{S_2 = \dfrac{g I_{gmax}}{I_2 - I_{gmax}}}$

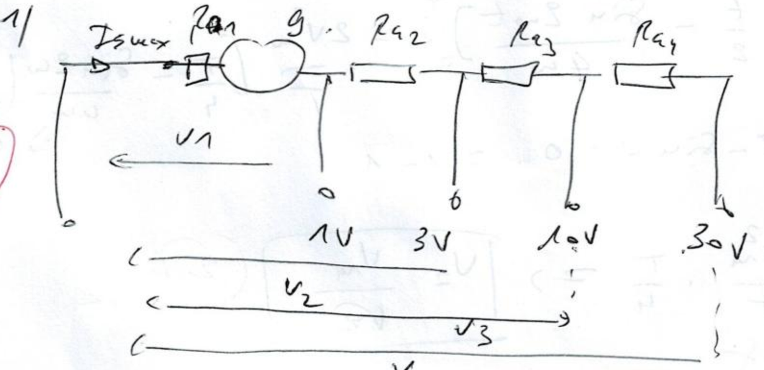
$S_2 = \dfrac{50 \cdot 0{,}5 \cdot 10^{-3}}{0{,}2 - 0{,}5 \cdot 10^{-3}} \Rightarrow \boxed{S_2 = 0{,}13 \, \Omega}$ (1)

* $g I_{gmax} = S_3 (I_3 - I_{gmax}) \Rightarrow \boxed{S_3 = \dfrac{g I_{gmax}}{I_3 - I_{gmax}}}$

$S_3 = \dfrac{50 \cdot 0{,}5 \cdot 10^{-3}}{0{,}05 - 0{,}5 \cdot 10^{-3}} \Rightarrow \boxed{S_3 = 0{,}5 \, \Omega}$ (2)

Exercice 3 8,5

1/



(2)

3/ Résistance spécifique (2)

$r = \dfrac{R_V}{V_1} = \dfrac{g + R_{a1}}{1}$

$\boxed{r = 20000 \, \Omega / V}$

2/ * $V_1 = g I_{gmax} + R_{a1} I_{gmax} \Rightarrow \boxed{R_{a1} = \dfrac{V_1}{I_{gmax}} - g}$

$\Rightarrow R_{a1} = \dfrac{1}{50 \cdot 10^{-6}} - 1000 \Rightarrow \boxed{R_{a1} = 19 \, k\Omega}$ (2)

* $V_2 = (g + R_{a1} + R_{a2}) I_{gmax} \Rightarrow \boxed{R_{a2} = \dfrac{V_2}{I_{gmax}} - (g + R_{a1})} \Rightarrow \boxed{R_{a2} = 40 \, k\Omega}$ (1)

* $V_3 = (g + R_{a1} + R_{a2} + R_{a3}) I_{gmax} \Rightarrow \boxed{R_{a3} = \dfrac{V_3}{I_{gmax}} - (g + R_{a1} + R_{a2})} \Rightarrow \boxed{R_{a3} = 140 \, k\Omega}$ (2)

* $V_4 = (g + R_{a1} + R_{a2} + R_{a3} + R_{a4}) I_{gmax} \Rightarrow \boxed{R_{a4} = \dfrac{V_4}{I_{gmax}} - (g + R_{a1} + R_{a2} + R_{a3})}$

$\Rightarrow \boxed{R_{a4} = 400 \, k\Omega}$ (2)