* on cherche S_1S_3

$S_1S_3 = KE\left(\cos\left(\theta+\frac{4\pi}{3}\right) - \cos\left(\theta+\frac{2\pi}{3}\right)\right)$

$= KE\left(\cos\theta\cdot\cos\frac{4\pi}{3} - \sin\theta\cdot\sin\frac{4\pi}{3} - \cos\theta\cos\frac{2\pi}{3} + \sin\theta\cdot\sin\frac{2\pi}{3}\right)$

$= KE\left(\cos\theta\left(-\frac{1}{2}+\frac{1}{2}\right)\sin\theta\left(\frac{\sqrt{3}}{2}+\frac{\sqrt{3}}{2}\right)\right)$

$\boxed{S_1S_{3\,eff} = KE\sin\theta\cdot\sqrt{3}}$ OK

on sait que $E = 115\,V$ $K = 0,45$

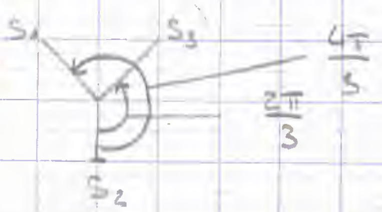
$S_1S_3 = 115\times 0,45\times\sqrt{3}\times\sin\theta \approx \boxed{89,6\sin\theta}$ OK

* on cherche aussi S_1S_2 et S_1

on sait que $S_1S_3 = KE\sin\theta\sqrt{3} \approx 89,6\sin\theta$

$S_2S_{1\,eff} \approx 89,6\sin\left(\theta+\frac{4\pi}{3}\right) = U_{12} = V_{S1-S2}$ OK

$S_2S_{3\,eff} \approx 89,6\sin\left(\theta+\frac{2\pi}{3}\right)$



* Vérifier la somme de $S = S_3S_2 + S_2S_1 + S_2S_3 = 0$

$S = 89,6\left(\sin\theta + \sin\left(\theta+\frac{4\pi}{3}\right) + \sin\left(\theta+\frac{2\pi}{3}\right)\right)$

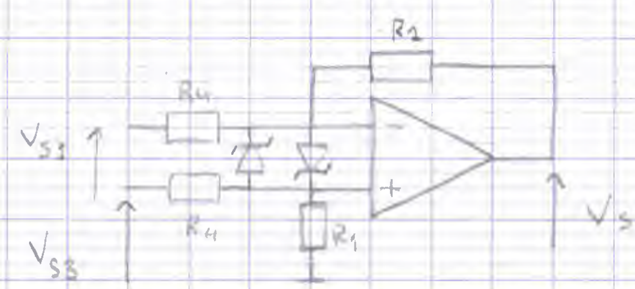
$S = 89,6\left(\sin\theta + \sin\theta\cos\frac{4\pi}{3} + \cos\theta\sin\frac{4\pi}{3} + \sin\theta\cos\frac{2\pi}{3} + \cos\theta\sin\frac{2\pi}{3}\right)$

$S = 89,6\left(\sin\theta\cdot\left(1+\cos\frac{4\pi}{3}+\cos\frac{2\pi}{3}\right) + \cos\theta\cdot\left(\sin\frac{4\pi}{3}+\sin\frac{2\pi}{3}\right)\right)$

$S = 89,6\,(0+0)$

$\boxed{S = 0}$ OK

on étudie A2



on cherche V_+ => pont div de tension

$$V_+ = V_{S3} \cdot \frac{R_1}{R_1 + R_4}$$

$$V_- = \frac{\frac{V_{S1}}{R_4} + \frac{V_S}{R_1}}{\frac{1}{R_4} + \frac{1}{R_1}} = \frac{V_{S1} R_1 + V_S R_4}{R_4 + R_1}$$

$$V_+ = V_- \iff V_{S3} \cdot \frac{R_1}{R_1 + R_4} = \frac{V_{S1} R_1 + V_S R_4}{R_4 + R_1}$$

$$V_{S3} R_1 = V_{S1} R_1 + V_S R_4$$

$$V_S = \frac{R_1 (V_{S3} - V_{S1})}{R_4}$$

$$\boxed{V_S = \frac{R_1}{R_4}(V_{S3} - V_{S1})}$$

$$V_S = \frac{R_1}{R_4} U_{31} = \boxed{\frac{R_1}{R_4} 90 \sin\theta}$$

OK

$$V_S = \sqrt{3} KE \sin\theta \cdot \frac{R_1}{R_4}$$

115

comme $\Rightarrow \sqrt{3} KE = 90V \quad \theta = 90°$

0,45

on a $R_1 = 11 \text{ k}\Omega \quad R_4 = 590 \text{ K}$

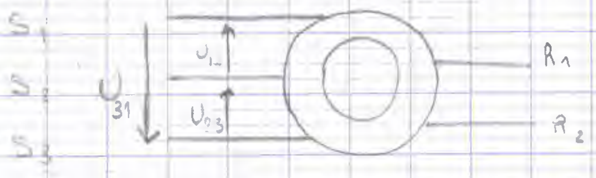
$$V_S = 90 \sin(90) \cdot \frac{11}{590}$$

$$= 1,5 \text{ V}$$

$\times\ U_{31} = 90 \sin\theta \cos(\omega t) = V_3 - V_1$

$\times\ U_{12} = 90 \sin(\theta + \frac{4\pi}{3}) \cos\omega t = V_1 - V_2$

$\times\ U_{23} = 90 \sin(\theta + \frac{2\pi}{3}) \cos\omega t = V_2 - V_3$



pour A_3 :

$V_2 = V_{2GND}$

Pont div $\quad V_+ = V_2 \cdot \frac{R_2}{R_4 + R_2}$

$a V_{NGND} - V_{GNGN} - V_{NG}$

$(a-2) U_{NGND}$

$a = 2$

$V_- = \frac{R_3 V_s + R_2 (V_3 + V_1)}{2R_2 + R_3} = \frac{V_3/R_3 + V_1/R_3 + V_S/R_2}{2/R_3 + 1/R_2}$

$V_S = \frac{R_2}{R_3}\left(V_{2GND}(2R_2 + R_3)\cdot \frac{1}{R_4 + R_2} - (V_{3GND} + V_{1GND})\right)$

$= \frac{R_2}{R_3}\left[a V_{2N} - V_{3N} - V_{1N}\right] + (a-2) V_{NGND}$ $\quad a = \frac{1}{R_4 + R_2}(2R_2 + R_3)$

$= \frac{R_2}{R_3} K E\cancel{ff}\left(a \cos\theta - \cos(\theta + \frac{2\pi}{3}) - \cos(\theta + \frac{4\pi}{3})\right)$

$= \frac{R_2}{R_3} K E\cancel{ff}\left(a \cos\theta + \frac{1}{2}\cos\theta + \frac{\sqrt{3}}{2}\sin\theta + \frac{1}{2}\cos\theta - \frac{\sqrt{3}}{2}\sin\theta\right)$

$= \boxed{\frac{R_2}{R_3} K E\cancel{ff}(a+1)\cos\theta} = \frac{R_2}{R_3} 90(a+1)\cos\theta$

$K E \sqrt{3} = V_{S,ll}$

R_1 / R_4

$I = \frac{R_1}{\ } \sqrt{2} K E \sin\theta$ $\quad 2R_2 + R_3 = 2$

on a $V_A = \dfrac{R_2}{R_3} KE(a+1)\cos\theta$

$V_B = \dfrac{R_1}{R_4} KE \sin\theta$

$V_S = \dfrac{V_B}{V_A}$

$\Leftrightarrow V_S = \dfrac{\dfrac{R_1}{R_4} KE \sin\theta}{\dfrac{R_2}{R_3} KE(a+1)\cos\theta}$

$\Leftrightarrow V_S = \dfrac{R_1 R_3}{R_2 R_4 (a+1)} \cdot \tan\theta$ | $a = \dfrac{1}{R_4 + R_2}(2R_2 + R_3)$

$V_{S_2 / N} = KE \sin\theta$ $\quad V_{S_2 / GND} = KE \sin\theta + V_{N GND}$

$V_{S_{GND}} = \dfrac{R_1}{R_4}\left[V_{S_2 GND} - V_{S_1 GND}\right]$

$= \dfrac{R_1}{R_4}\left[KE\cos\theta + \cancel{V_{N GND}} - KE\cos\left(\theta + \frac{2\pi}{3}\right) - \cancel{V_{N GND}}\right]$

$V_{S_1 GND} - V_{S_2 GND} = \left(V_{S_1 N} + V_{N GND}\right) - \left(V_{S_2 N} + V_{N GND}\right)$

$= V_{S_1 N} - V_{S_2 N}$