NOM : ..... PRENOM : 2025-2026

PCPI – 1 TS CIRA Vizille BTS CIRA Contrôle Industriel et Régulation Automatique	Chapitre 4 Dipôles en sinusoïdal et puissances	Electricité

CORRECTION

FICHE EXERCICES 8

EXERCICE 1

1- $\underline{Z_{éq}} = \underline{Z_1} + \underline{Z_2}$ (série)

$= R - \frac{j}{C\omega} = 150 - \frac{j}{22\times10^{-6}\times 2\pi\times 50} = 150 - j145\ \Omega$ (a = 150, b = −145)

2- $|\underline{Z_{éq}}| = \sqrt{a^2+b^2} = \sqrt{150^2+(-145)^2} = 209\ \Omega$

3- $\varphi = \arctan\frac{b}{a} = \arctan\frac{-145}{150} = -0{,}77$ rad

4- $I_{eff} = \frac{U_{eff}}{|Z_{éq}|} = \frac{230}{209} = 1{,}1$ A

5- $P = U_{eff}\times I_{eff}\times\cos\varphi = 230\times 1{,}1\times\cos(-0{,}77) = 182$ W

$P = P_R + P_C = U_{effR}\times I_{eff}\times\cos 0 + U_{effC}\times I_{eff}\times\cos\left(-\frac{\pi}{2}\right)$

$= R\times I_{eff}\times I_{eff}\times 1 + 0$

$= 150\times 1{,}1^2 = 182$ W

EXERCICE 2

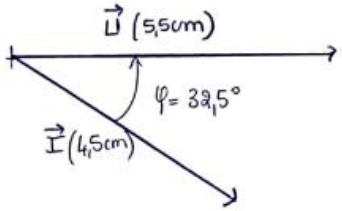
1- $S_{RC} = U_{eff}\times I_{eff} = 230\times 1{,}1 = 253$ VA

2- $S_R = U_{effR}\times I_{eff} = R\times I_{eff}^2 = 150\times 1{,}1^2 = 181{,}5$ V.A

3- $S_C = U_{effC}\times I_{eff} = \frac{I_{eff}}{C\times\omega}\times I_{eff} = \frac{1{,}1^2}{22\times10^{-6}\times 2\pi\times 50} = 175{,}1$ VA

4- $S_R + S_C \neq S_{RC}$

EXERCICE 3



$U_{eff} = 5{,}5\times 10 = 55$V

$I_{eff} = 4{,}5\times 1 = 4{,}5$A

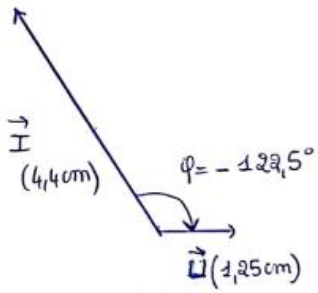
$\varphi = 32{,}5°$

$P = U_{eff}\times I_{eff}\times\cos\varphi = 55\times 4{,}5\times\cos(32{,}5°) = 209$W

$Q = U_{eff}\times I_{eff}\times\sin\varphi = 55\times 4{,}5\times\sin(32{,}5°) = 133$ VAR

$S = U_{eff}\times I_{eff} = 55\times 4{,}5 = 247{,}5$ VA

$S = \sqrt{P^2+Q^2} = \sqrt{209^2+133^2} = 247$ VA



$U_{eff} = 1{,}25\times 50 = 12{,}5$V

$I_{eff} = 4{,}4\times 1 = 4{,}4$ A

$\varphi = -122{,}5°$

$P = U_{eff}\times I_{eff}\times\cos\varphi = 12{,}5\times 4{,}4\times\cos(-122{,}5) = -29$W

$Q = U_{eff}\times I_{eff}\times\sin\varphi = 12{,}5\times 4{,}4\times\sin(-122{,}5) = -46{,}4$ VAR

$S = U_{eff}\times I_{eff} = 12{,}5\times 4{,}4 = 55$ VA

$S = \sqrt{P^2+Q^2} = \sqrt{(-29)^2+(-46{,}4)^2} = 55$ V.A

EXERCICE 4

1- $P = U_{eff} \times I_{eff} \times \cos\varphi$

2- $P_R = U_{eff_R} \times I_{eff} \times 1 = R \times I_{eff}^2 = \frac{U_{eff_R}^2}{R}$

3- $P_L = U_{eff_L} \times I_{eff} \times 0 = 0\,W$

4- $Q = U_{eff} \times I_{eff} \times \sin\varphi$

5- $Q_R = U_{eff_R} \times I_{eff} \times 0 = 0\,VAR$

6- $Q_L = U_{eff_L} \times I_{eff} \times 1 = L \times \omega \times I_{eff}^2 = \frac{U_{eff_L}^2}{L \times \omega}$

7- $S = U_{eff} \times I_{eff}$ $\qquad S = \sqrt{P^2 + Q^2}$

8- $P_{totale} = P_L + P_R = P_R = R \times I_{eff}^2$

$Q_{totale} = Q_L + Q_R = Q_L = L \times \omega \times I_{eff}^2$

9- $U_{eff}^2 \times I_{eff}^2 = P^2 + Q^2$

$U_{eff} \times I_{eff}^2 = R^2 \times I_{eff}^4 + L^2\omega^2 \times I_{eff}^4$

$U_{eff} = R^2 \times I_{eff}^3 + L^2\omega^2 \times I_{eff}^2 \Rightarrow I_{eff} = \frac{U_{eff}}{\sqrt{R^2 + L^2\omega^2}} = 9,73\,A$

10- $\cos\varphi = \frac{P}{U_{eff} \times I_{eff}} = \frac{R \times I_{eff}^2}{U_{eff} \times I_{eff}} = \frac{R \times I_{eff}}{U_{eff}} = \frac{10 \times 9,73}{230} = 0,032$

EXERCICE 5

1- $I_{eff} = \frac{P}{U_{eff} \times \cos\varphi} = \frac{1500}{230 \times 0,87} = 7,5\,A$

2- $S = U_{eff} \times I_{eff} = 230 \times 7,5 = 1725\ V.A$

3- $Q = U_{eff} \times I_{eff} \times \sin\varphi = 230 \times 7,5 \times \sin(\arccos(0,87)) = 850\ VAR$

EXERCICE 6

① $I_{eff_1} = \frac{U_{eff}}{R} = \frac{220}{440} = 0,5A$

$I_{eff_2} = U_{eff} \times C \times \omega = 230 \times 5 \times 10^{-6} \times 2\pi \times 50 = 0,35A$

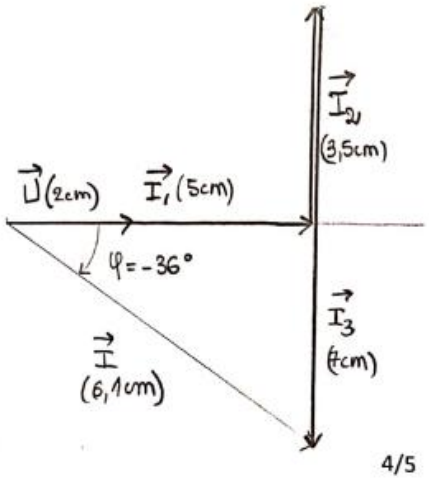
$I_{eff_3} = \frac{U_{eff}}{L \times \omega} = \frac{220}{1 \times 2\pi \times 50} = 0,7A$

② 1 cm ↔ 0,1A
1 cm ↔ 110V

② $\varphi_1 = 0\,rad$
$\varphi_2 = +\pi/2\,rad$
$\varphi_3 = -\pi/2\,rad$

⑤ $\vec{I} = \vec{I_1} + \vec{I_2} + \vec{I_3}$
$i(t) = i_1(t) + i_2(t) + i_3(t)$

⑦ $I_{eff} = 6,1 \times 0,1 = 0,61A$
$10\_\_36°$



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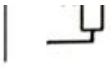
EXERCICE 7

1- $P_{totale} = \underbrace{P_C + P_L}_{=0} + P_R = R \times I_{eff}^2$
$= 440 \times 2^2$
$= 1760\,W$

$L = 1\,H$
$C = 5\,\mu F$



2- $S_{totale} = Q_C + Q_L + \underbrace{Q_R}_{=0} = L\omega I_{eff}^2 - \frac{I_{eff}^2}{C\omega} = -1289\,VAR$

3- $S = \sqrt{P^2 + Q^2} = \sqrt{1760^2 + 1289^2} = 2182\,VA$

4- $U_{eff} = \frac{S}{I_{eff}} = \frac{2182}{2} = 1091\,V$

5- $\cos\varphi = \frac{P}{U_{eff} \times I_{eff}} = \frac{1760}{2182} = 0{,}81$

EXERCICE 8

1- $P = 20 \times 100 + 3 \times 1500 = 6500\,W$

2- $Q_L = 0\,VAR$

3- $Q_n = U_{eff} \times I_{eff_N} \times \sin\varphi$
↳ $I_{eff_N} = \frac{P}{U_{eff} \times \cos\varphi} = \frac{1500 \times 3}{230 \times 0{,}80} = 24\,A$

$Q_n = 230 \times 24 \times \sin(\arccos(0{,}80)) = 3375\,V.A.R$

4- $Q_{tot} = 3375\,VAR$

5- $S = \sqrt{P^2 + Q^2} = \sqrt{6500^2 + 3375^2} = 7324\,V.A$

6- $I_{eff} = \frac{S}{U_{eff}} = \frac{7324}{230} = 32\,A$
$I_{eff} = \frac{P}{U_{eff} \times \cos\varphi} = \frac{6500}{230 \times 0{,}80} = 35\,A$
$\neq$

7- non $P_C = 0\,W$

8- $I_{eff}' = \frac{P}{U_{eff} \times \cos\varphi'} = \frac{6500}{230 \times 0{,}93} = 30\,A$

9- $I_{eff}' < I_{eff}$
I ↓ donc moins pertes par effet joule.