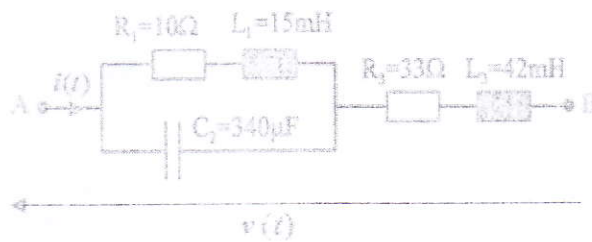


Corrigé type de l'examen final

~~Calculer le courant i(t) et la tension v(t) à l'instant t = 0~~

Exercice 1: (7pts)



1) Phaseur tension.

$$V(t) = 220\sqrt{2} \sin 314t$$

$$\underline{V} = 220 \angle 0^\circ$$

(1)

2) calcul des impédances de branches

$$\underline{Z}_1 = R_1 + jL_1\omega = 10 + j25 \cdot 10^{-3} \cdot 314 = 10 + j7,85$$

$$\underline{Z}_2 = -j \frac{1}{C_1\omega} = -j \frac{1}{340 \cdot 10^{-6} \cdot 314} = -j9,37$$

$$\underline{Z}_3 = R_3 + jL_3\omega = 33 + j42 \cdot 10^{-3} \cdot 314 = 33 + j13,18$$

3) Impédance équivalente

$$\underline{Z}_{eq} = (\underline{Z}_1 \parallel \underline{Z}_2) + \underline{Z}_3$$

$$= \frac{(10 + j7,85)(-j9,37)}{10 + j7,85 - j9,37} + (33 + j13,18)$$

$$= \frac{93,7 - j73,44}{10 - j1,52} + (33 + j13,18)$$

$$= (7,21 - j6,07) + (33 + j13,18) = 40,21 + j7,17$$

$$|\underline{Z}_{eq}| = \sqrt{40,21^2 + 7,17^2} = 40,84 \quad \Rightarrow \underline{Z} = 40,84 \angle 10,2^\circ$$

$$\varphi = \tan^{-1} \left(\frac{7,17}{40,21} \right) = 10,2^\circ$$

4) calcul du courant

$$\underline{I} = \frac{\underline{V}}{\underline{Z}} = \frac{220 \angle 0^\circ}{40,84 \angle 10,2^\circ} = 5,39 \angle -10,2^\circ$$

(1)

(2)

Charge 1:

$$\cos \varphi_1 = 0 \Rightarrow P_1 = 0$$

$$S_1 = \sqrt{P_1^2 + Q_1^2} = \sqrt{0^2 + (-500)^2} = 500 \text{ VA}$$

Charge 2:

$$S_2 = \sqrt{P_2^2 + Q_2^2} = \sqrt{(-400)^2 + (-100)^2} = 412,3 \text{ VA}$$

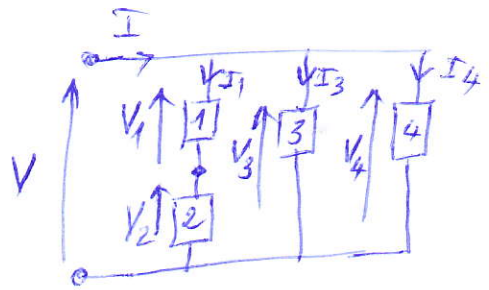
$$\cos \varphi_2 = \frac{P_2}{S_2} = \frac{-400}{412,3} = 0,97 \text{ AV}$$

$$S_{12} = \sqrt{(P_1 + P_2)^2 + (Q_1 + Q_2)^2} = \sqrt{(-400)^2 + (-600)^2} = 721,11 \text{ VA}$$

$$I_1 = I_2 = \frac{S_{12}}{V} = \frac{721,11}{220} = 3,28 \text{ A}$$

$$S_1 = V_1 I_1 \longrightarrow V_1 = S_1 / I_1 = \frac{500}{3,28} = 152,44 \text{ V}$$

$$S_2 = V_2 I_2 \longrightarrow V_2 = S_2 / I_2 = \frac{412,3}{3,28} = 125,7 \text{ V}$$



Charge 3:

$$S_3 = \frac{P_3}{\cos \varphi_3} = \frac{500}{0,97} = 515,46 \text{ VA}$$

$$Q_3 = \sqrt{S_3^2 - P_3^2} = \sqrt{(515,46)^2 - (500)^2} = 125,3 \text{ VAR}$$

$$I_3 = \frac{S_3}{V} = \frac{515,46}{220} = 2,343 \text{ A} \quad (V_3 = V = 220 \text{ V})$$

Charge 4:

$$P_4 = \sqrt{S_4^2 - Q_4^2} = \sqrt{632^2 - 600^2} = 198,55 \text{ [W]}$$

$$V_4 = V = 220 \text{ (V)}$$

$$I_4 = \frac{S_4}{V_4} = \frac{632}{220} = 2,87 \text{ A}$$

$$\cos \varphi_4 = \frac{P_4}{S_4} = \frac{198,55}{632} = 0,314$$

Tableau récapitulatif:

	Charge 1	Charge 2	Charge 3	Charge 4	Charge totale
Puissance active P [W]	0	-400	500	198,55	$P = \sum P_i = 298,55$
Puissance réactive Q [VAR]	-500	-100	125,3	600	$Q = \sum Q_i = 125,3$
Puissance apparente S [VA]	500	412,3	515,46	632	$S = \sqrt{P^2 + Q^2} = 323,78$
Courants I _i [A]	3,28	3,28	2,343	2,87	$I = \frac{S}{V} = 1,47$
Tensions V _i [V]	152,44	125,7	220	220	V = 220
Facteur de puissance Cos φ _i	0	0,97 AV	0,97 AV	0,314 AV	$\cos \varphi = \frac{P}{S} = \frac{298,55}{323,78} = 0,92 \text{ AV}$

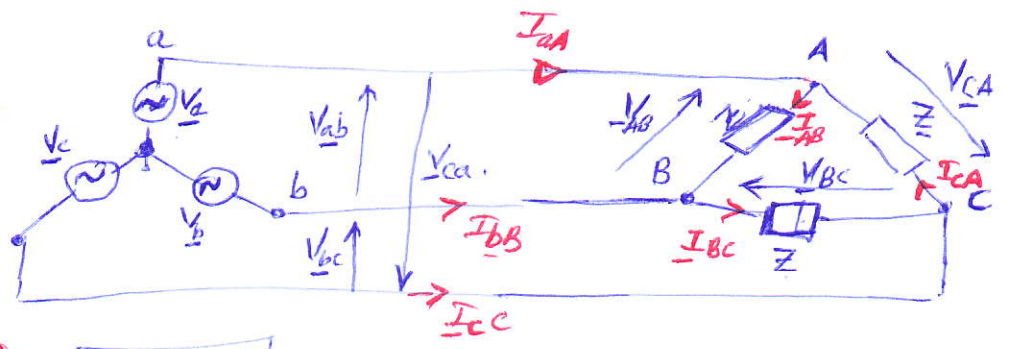
0: (6pts)

$$\underline{V}_{AB} = \underline{V}_{ab} = 69 \angle 0^\circ \text{ (kV)}$$

$$\underline{V}_{BC} = \underline{V}_{bc} = 69 \angle -120^\circ \text{ (kV)}$$

$$\underline{V}_{CA} = \underline{V}_{ca} = 69 \angle +120^\circ \text{ (kV)}$$

$$\underline{Z} = 600 + j450$$



$$= 750 \angle 36,87^\circ \quad (0,6) \quad \boxed{\varphi = 37,87^\circ}$$

1) calcul des courants de phase: \underline{I}_{AB} , \underline{I}_{BC} et \underline{I}_{CA} .

$$\underline{I}_{AB} = \frac{\underline{V}_{AB}}{\underline{Z}} = \frac{69000 \angle 0^\circ}{750 \angle 36,87^\circ} = 92 \angle -36,87^\circ \text{ [A]} \quad (0,6)$$

Par symetrie on a:

$$\underline{I}_{BC} = \underline{I}_{AB} \angle -120^\circ = 92 \angle -120^\circ - 36,87^\circ = 92 \angle -156,87^\circ \text{ [A]} \quad (0,6)$$

$$\underline{I}_{CA} = \underline{I}_{AB} \angle +120^\circ = 92 \angle +120^\circ - 36,87^\circ = 92 \angle +83,13^\circ \text{ [A]} \quad (0,6)$$

2) calcul des courants de lignes: \underline{I}_{aA} , \underline{I}_{bB} et \underline{I}_{cC}

$$\underline{I}_{aA} = \sqrt{3} \cdot \underline{I}_{AB} \angle -30^\circ = \sqrt{3} \cdot 92 \angle -36,87^\circ - 30^\circ = 159,35 \angle -66,87^\circ \quad (0,6)$$

Par symetrie on trouve:

$$\underline{I}_{bB} = \underline{I}_{aA} \angle -120^\circ = 159,35 \angle -66,87^\circ - 120^\circ = 159,35 \angle -186,87^\circ \quad (0,6)$$

$$\underline{I}_{cC} = \underline{I}_{aA} \angle +120^\circ = 159,35 \angle -66,87^\circ + 120^\circ = 159,35 \angle +53,13^\circ \quad (0,6)$$

3) calcul des puissances: P, Q et S

$$P = \sqrt{3} \underline{V}_{AB} \cdot \underline{I}_{aA} \cdot \cos \varphi = \sqrt{3} \cdot 69000 \cdot 159,35 \cos(36,87^\circ) = 15235306,3 \text{ [W]} \quad (0,6)$$

$$Q = \sqrt{3} \underline{V}_{AB} \cdot \underline{I}_{aA} \cdot \sin \varphi = \sqrt{3} \cdot 69000 \cdot 159,35 \sin(36,87^\circ) = 11426522,2 \text{ [VAR]} \quad (0,6)$$

$$S = \sqrt{P^2 + Q^2} = \sqrt{3} \cdot \underline{V}_{AB} \cdot \underline{I}_{aA} = \sqrt{3} \cdot 69000 \cdot 159,35 = 19040158,4 \text{ [VA]} \quad (0,6)$$