Exercice 1

1)

$$\bar{I}_a = \frac{\bar{V}_a}{Z_{eq}}$$

$Z_L = j3\ \Omega \quad R_1 = 18\ \Omega \quad R_2 = 12\ \Omega$

$$\bar{V}_a = \frac{346}{\sqrt{3}}\angle 0°\ V = 199{,}76\angle 0°\ V$$

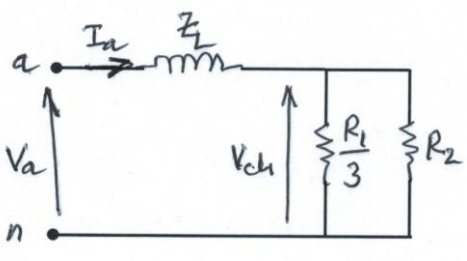


Schéma monophasé équivalent

$$Z_{eq} = Z_L + \left(R_2 \parallel \frac{R_1}{3}\right) = j3 + \frac{(12)\left(\frac{18}{3}\right)}{12 + \frac{18}{3}} = 4 + j3$$

$$= 5\angle 36{,}87°\ \Omega$$

$$\bar{I}_a = \frac{199{,}76\angle 0°}{5\angle 36{,}87°} = 39{,}95\angle -36{,}87°\ A$$

2) $\bar{S} = 3\bar{V}_a\bar{I}_a^{\,*} = 3 \times 199{,}76 \times (39{,}95\angle -36{,}87°)^* = 23942\angle 36{,}87° = 19154 + j14365\ VA$

donc $P = 19154\ W \quad et \quad Q = 14365\ VAr$

3) $\overline{V_{ch}} = \bar{V}_a - Z_L\bar{I}_a = 199{,}76 - (j3)(39{,}95\angle -36{,}87°) = 159{,}81\angle -36{,}87°\ V$

donc $U_{ch} = V_{ch}\sqrt{3} = 159{,}81\sqrt{3} = 276{,}8\ V$

Exercice 2

1) $Z = zl = (0{,}1 + j0{,}5) \times 100 = 10 + j50 = 51\angle 78{,}69°\ \Omega$

$Y = yl = j6.10^{-6} \times 100 = j0{,}6 \times 10^{-3}\ S$

$$A = 1 + \frac{YZ}{2} = 1 + \frac{j0{,}6 \times 10^{-3}(10 + j50)}{2} = 0{,}985 + j3.10^{-3} = 0{,}985\angle 0{,}17°$$

$B = Z = 51\angle 78{,}69°\ \Omega$

2)

$$\bar{V}_R = \frac{U_R}{\sqrt{3}} = \frac{132}{\sqrt{3}} = 76{,}2\angle 0°\ kV$$

$$I_R = \frac{S_R}{\sqrt{3}U_R} = \frac{125.10^6}{\sqrt{3} \times 132.10^3} = 546{,}7\ A$$

$$\arccos(0{,}9) = 25{,}84° \rightarrow \quad \bar{I}_R = 546{,}7\angle -25{,}84°\ A$$

$$\bar{V}_S = A.\bar{V}_R + B.\bar{I}_R = (0{,}985\angle 0{,}17°)(76{,}2\angle 0°) + (51\angle 78{,}69°)(546{,}7 \times 10^{-3}\angle -25{,}84°)$$

$$= 91{,}9 + j22{,}45 = 94{,}6\angle 13{,}73°\ kV$$

$$U_S = \sqrt{3}V_S = \sqrt{3}.94{,}6 = 163{,}8\ kV$$

3)

$$V_{R0} = \frac{V_S}{|A|} = \frac{94.6}{0.985} = 96.04\ kV$$

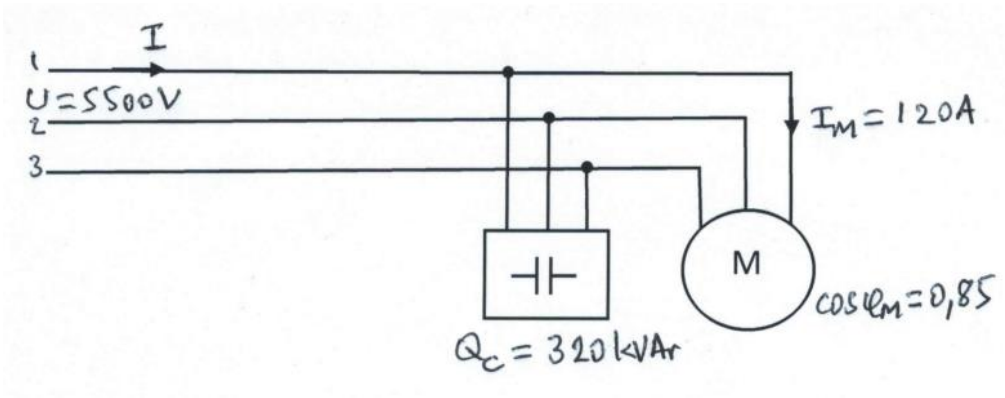
$$RV = \frac{V_{R0} - V_R}{V_R} = \frac{96.04 - 76{,}2}{76{,}2} = 0.26 = 26\%$$

ou

$$RV = \frac{V_S - |A|V_R}{|A|V_R} \times 100 = \frac{94{,}6 - 0.985 \times 76{,}2}{0.985 \times 76{,}2} \times 100 = 26\%$$

Exercice 3

1)

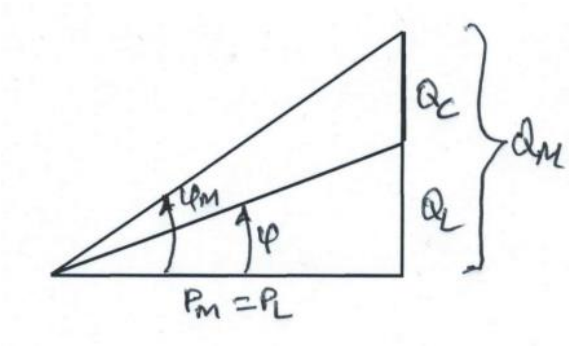


2) $S_M = \sqrt{3}UI_M = \sqrt{3} \times 5500 \times 120 = 1143,2\ kVA$

$P_M = S_M.cos\varphi_M = 1143,2 \times 0,85 = 971,7\ kW$

$Q_M = S_M.sin\varphi_M = 1143,2 \times \sin(\arccos(0,85)) = 602,2\ kVAr$

3)



4) $Q_L = Q_M - Q_C$

$= 602,2 - 320 = 282,2\ kVAr$

5) $P_L = P_M$

$S_L = \sqrt{P_L^2 + Q_L^2} = \sqrt{971,7^2 + 282,2^2}$

$= 1011,8\ kVA$

$cos\varphi = \frac{P_L}{S_L} = \frac{971,7}{1011,8} = 0,96$

$I = \frac{S_L}{\sqrt{3}U} = \frac{1011,8.10^3}{\sqrt{3} \times 5500} = 106,2\ A$