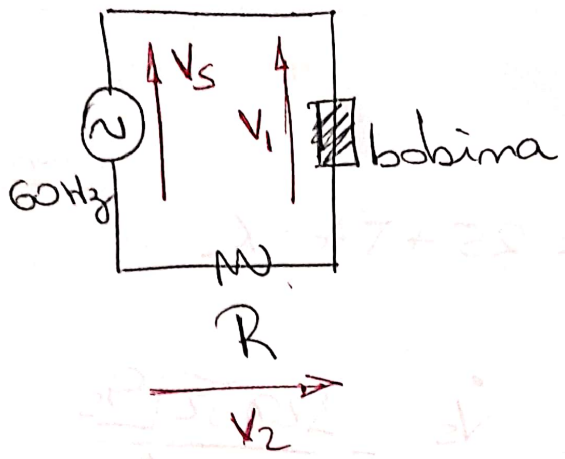
Questão 7



$V_S = 120V$

$V_1 = 84V$

$V_2 = 70V$

Sol

$$V_{rms} = \frac{\sqrt{2}}{2} V_p \Rightarrow V_p = V_{rms} \cdot \sqrt{2}$$

$$\dot{V} = V_{rms} \cdot \sqrt{2} \angle \theta$$

$$\dot{I} = I \angle \theta$$

$$\dot{Z}_R = R \angle 0°$$

$$\dot{V}_2 = V_2 \sqrt{2} \angle \theta_2$$

$$\Rightarrow \dot{V}_2 = Z_R \cdot \dot{I}$$

$$\dot{I} = \frac{\dot{V}_2}{Z_R} = \frac{V_2 \sqrt{2} \angle \theta_2}{R \angle 0°}$$

$$\dot{I} = \frac{70 \cdot \sqrt{2} \angle \theta_2}{25}$$

$$\boxed{\dot{I} = 3,96 \angle \theta_2 \, A}$$

$$\dot{V}_1 = V_1 \sqrt{2} \angle \theta_1$$

$$Z_{bobina} = r + jX_L$$

$$\Rightarrow \dot{V}_1 = Z_{bobina} \cdot \dot{I}$$

$$Z_{bobina} = \frac{\dot{V}_1}{\dot{I}}$$

$$Z_{bobina} = \frac{84\sqrt{2} \angle \theta_1}{\frac{70 \cdot \sqrt{2}}{25} \angle \theta_2} = 30 \angle \theta_1 - \theta_2$$

$$\boxed{Z_{bobina} = 30 \angle \theta_1 - \theta_2}$$

$$|Z_{bobina}| = 30 = \sqrt{r^2 + X_L^2}$$

$$r^2 + X_L^2 = 30^2$$

$$Z_T = Z_R + Z_{bobina} = 25 + r + jX_L$$

$$\dot{V}_S = V_S\sqrt{2}\,\angle\theta_S$$

$$\dot{V}_S = Z_T \cdot \dot{I} \Rightarrow Z_T = \frac{\dot{V}_S}{\dot{I}} = \frac{120\sqrt{2}\,\angle\theta_S}{\frac{40\sqrt{2}}{25}\angle\theta_2}$$

$$Z_T = \frac{300}{7}\angle\theta_S - \theta_2$$

$$\boxed{Z_T = 42,86\,\angle\theta_S - \theta_2\ \Omega}$$

$$\begin{cases} (r+R)^2 + X_L^2 = (42,86)^2 \\ r^2 + X_L^2 = 30^2 \end{cases}$$

$$(r^2 + R^2) - r^2 = (42,86)^2 - 30^2$$

$$(r + R + r)(r + R - r) = 936,98$$

$$(2r + R)R = 936,98$$

$$2r = \frac{936,98}{25} - 25$$

$$\boxed{r = 6,24\ \Omega}$$

$$X_L^2 + r^2 = 30^2 \Rightarrow X_L^2 = 30^2 - r^2$$

$$X_L = \sqrt{30^2 - (6,24)^2} =$$

$$\boxed{X_L = 29,34\ \Omega}$$

$$Z_{bobina} = r + jX_L$$

$$= 6,24 + j\,29,34\ \Omega$$

$$\boxed{Z_{bobina} = 6,24 + j29,34\ \Omega}$$

$$Z_{bobina} = |Z_{bobina}| \angle \theta_{bobina}$$

$$\theta_{bobina} = \operatorname{arctg}\left(\frac{29,34}{6,24}\right) = 78^\circ$$

$$\boxed{Z_{bobina} = 6,24 + j29,34 = 30 \angle 78^\circ\ \Omega}$$

$$\theta_1 - \theta_2 = 78^\circ$$

$$Z_T = 25 + 6,24 + j29,34 =$$

$$= 31,24 + j29,36$$

$$Z_T = |Z_T| \angle \theta_T$$

$$\theta_T = \operatorname{arctg}\left(\frac{29,36}{31,24}\right) = 43,21^\circ$$

$$Z_T = 31,24 + j29,36 = 42,86 \angle 43,21^\circ$$

$$\begin{cases} \theta_S - \theta_2 = 43{,}21 \\ \theta_1 - \theta_2 = 78^\circ \end{cases}$$

$\theta_S = 0^\circ$

$\theta_1 = 78 - 43{,}21$

$\theta_1 = 34{,}79$

$\theta_2 = \theta_1 - 78 = 78 - 43{,}21 - 78$

$= -43{,}21$

$\dot{I} = 3{,}96 \angle -43{,}21 \text{ A}$

$Z_{bobina} = 30 \angle 78^\circ$

$\dot{V}_1 = 118{,}79 \angle 34{,}79$

$\dot{V}_2 = 98{,}99 \angle -43{,}21$

$V_S = 169{,}70 \angle 0^\circ$