PROBLEMA. - 1

Un transformador trifásico de 550 kVA; 9.000/600 V con conexión triángulo-estrella dió en los ensayos con carga reducida los siguientes valores:

Ensayo de vacío: Uo= 600 V, Io=16 A, Po=4.800 W.

Ensayo de cortocircuito: Ucc=500 V, Icc=20 A, Pcc=8.200 W.

1°.- Calcular todos los parámetros por fase referidos al primario.

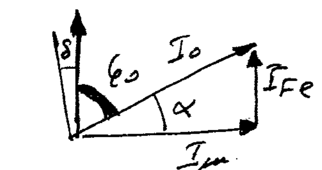
2°.- Representar el circuito equivalente aproximado referido al primario

3°.- Obtener las componentes de la corriente en el primario cuando el secundario está suministrando la corriente de plena carga con un f.d.p. 0,8 en retraso.

* $r_t = \dfrac{9000}{\dfrac{600}{\sqrt{3}}} = 25{,}98$

* $P_o = \sqrt{3}\, I_o\, U_o \cos\varphi_o \Rightarrow \cos\varphi_o = \dfrac{P_o}{\sqrt{3}\, U_o\, I_o} = \dfrac{4.800}{\sqrt{3}.600.16} = 0{,}2887 \Rightarrow \varphi_o = \underline{73{,}22°}$

$P_{of} = \dfrac{P_o}{3} = \dfrac{4.800}{3} = 1.600\ w. \qquad P_{of} = P_{Fe} = R_{Fe} * I_{Fe}^2$



δ ⇒ despreciable

$I_{Fef_{BT}} = I_{of_{BT}} \cos\varphi_o = 16 \times 0{,}2887 = \underline{4{,}62\ A}$

$I_{\mu f_{BT}} = I_{of_{BT}} \operatorname{sen}\varphi_o = 16 \times 0{,}9574 = \underline{15{,}32\ A}$

$\curlywedge \Rightarrow I_{of} = I_{oL} = 16\ A$

$R_{Fe_{BT}} = \dfrac{P_{of}}{I_{Fe}^2} = \dfrac{1600}{4{,}62^2} = \underline{74{,}96\ \Omega}$

$X_{\mu_{BT}} = \dfrac{U_f}{I_{\mu f}} = \dfrac{\frac{600}{\sqrt{3}}}{15{,}32} = \underline{22{,}61\ \Omega}$

$I_{of_{AT}} = \dfrac{I_{of_{BT}}}{r_t} = \dfrac{16}{25{,}98} = 0{,}616\ A$

$I_{Fef_{AT}} = \dfrac{I_{Fef_{BT}}}{r_t} = \dfrac{4{,}62}{25{,}98} = 0{,}1778\ A$

$I_{mf_{AT}} = \dfrac{I_{mf_{BT}}}{r_t} = \dfrac{15{,}32}{25{,}98} = 0{,}5897\ A$

$R_{Fe_{AT}} = R_{Fe_{BT}} \cdot r_t^2 = 74{,}96 . 25{,}98^2 = \underline{50.595\ \Omega}$

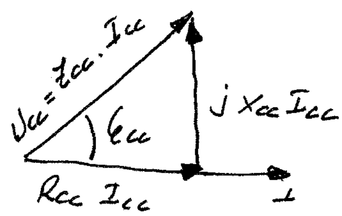
$X_{\mu AT} = X_{\mu_{BT}} \cdot r_t^2 = 22.61 \times 25.98^2 = 15.262\ \Omega$

$X_{\mu AT} = \dfrac{U_{AT}}{I_{m_{AT}}} = \dfrac{9000}{0{,}5897} = \underline{15.262\ \Omega}$

Ensayo cc:

$P_{cc} = \sqrt{3}\, U_{cc} . I_{cc} . \cos\varphi_{cc} \Rightarrow \cos\varphi_{cc} = \dfrac{P_{cc}}{\sqrt{3}\, U_{cc} I_{cc}} = \dfrac{8.200}{\sqrt{3}.500.20} = 0{,}4734 \Rightarrow \varphi_{cc} = 61{,}74°$

$S_n = \sqrt{3}.U_n.I_n \Rightarrow I_{1n} = \dfrac{S_n}{\sqrt{3}\,U_{1n}} = \dfrac{550 \times 10^3}{\sqrt{3}.9000} = 35{,}28\ A \Rightarrow I_{1nf} = \dfrac{I_{1nL}}{\sqrt{3}} = \underline{20{,}37\ A}$



$R_{cc} I_{ccf} = U_{ccf} \cos\varphi_{cc} \Rightarrow R_{ccf_{AT}} = \dfrac{U_{ccf} \cos\varphi_{cc}}{I_{ccf}} = \dfrac{500 . 0{,}4734}{\frac{20}{\sqrt{3}}} = \underline{20{,}50\ \Omega}$

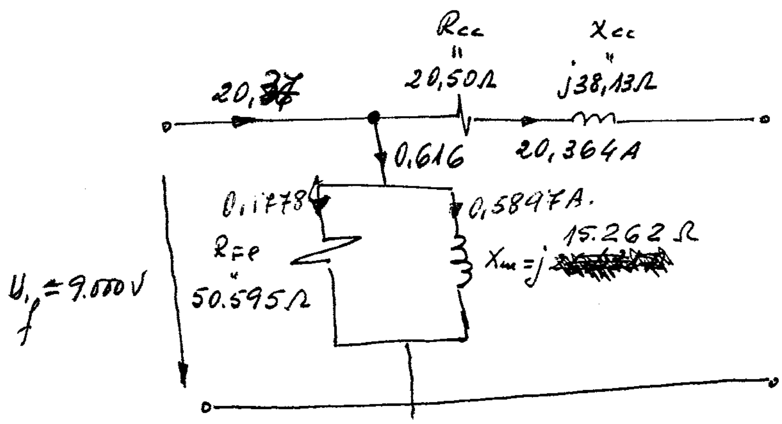
(I_{ccf} = 11,55)

$X_{ccf} . I_{ccf} = U_{ccf} . \operatorname{sen}\varphi_{cc} \Rightarrow X_{ccf_{AT}} = \dfrac{U_{ccf} . \operatorname{sen}\varphi_{cc}}{I_{ccf}} = \dfrac{500 \times 0{,}8808}{\frac{20}{\sqrt{3}}} = \underline{38{,}13\ \Omega}$

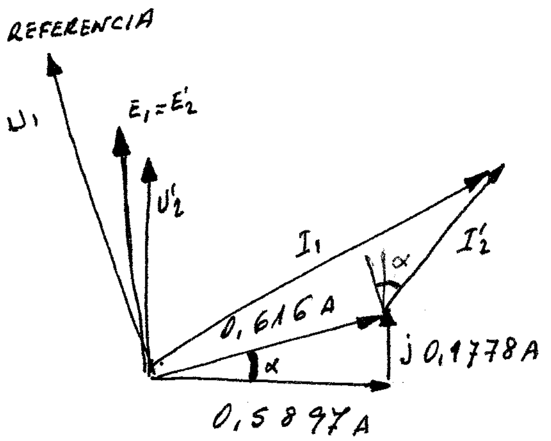
$I_{ccf_{AT}} = \dfrac{20}{\sqrt{3}} = 11{,}55\ A$

$I_{1nf_{AT}} = 20{,}37\ A$

2º



3º



Si se desprecia el pequeño desfase que existe entre las tensiones en bornes y las f.e.m., se tiene:

$$I'_2 = 20{,}37\,(0{,}8 + j0{,}6) = 16{,}296 + j\,12{,}222 =$$

$$= 20{,}364 \angle 36{,}876°$$

$$I_0 = 0{,}1778 + j0{,}5897 = 0{,}616 \angle 73{,}22°$$

$$I_1 = I'_2 + I_0 = (16{,}29 + 0{,}1778) + j\,(12{,}22 + 0{,}5897) = 16{,}4678 + j\,12{,}81 = \underline{\underline{20{,}86}} \angle 37{,}88°$$