2007.03.27. kedd

XII. Előadás (7. hét)

Viszonylagos egységek

javítás a VIII. Előadáshoz

a b c

$X_{a1} = (X_ö - X_k) + a\Delta X$

ΔZ_{a1} $\quad \Delta Z_{c1} = \Delta x \quad X_{c1} = (X_ö - X_k) + \underbrace{a^2 \Delta X}_{\Delta Z}$

$\Delta x \Rightarrow -\Delta x$

$\Delta Z_{a1} = ja\Delta x = j\Delta x(-0,5 + j0,86) = -0,86\Delta x - j0,5\Delta x$ (+ +)

$\Delta Z_{c1} = ja^2\Delta x = j\Delta x(-0,5 - j0,86) = +0,86\Delta x - j0,5\Delta x$ (− +)

—

Viszonylagos egységek

nem lényeg – trafó áttétel – vonali vagy fázis } előny

V.e. => per unit pu.

Független mennyiségek

$S (S_n) = S_{3f}$ (3 fázisú)

$S_{1f} = \frac{S}{3}$ (1 fázisú)

} teljesítmény

$U (U_n) = U_v$ (vonali)

$U_f = \frac{U}{\sqrt{3}}$ (fázis)

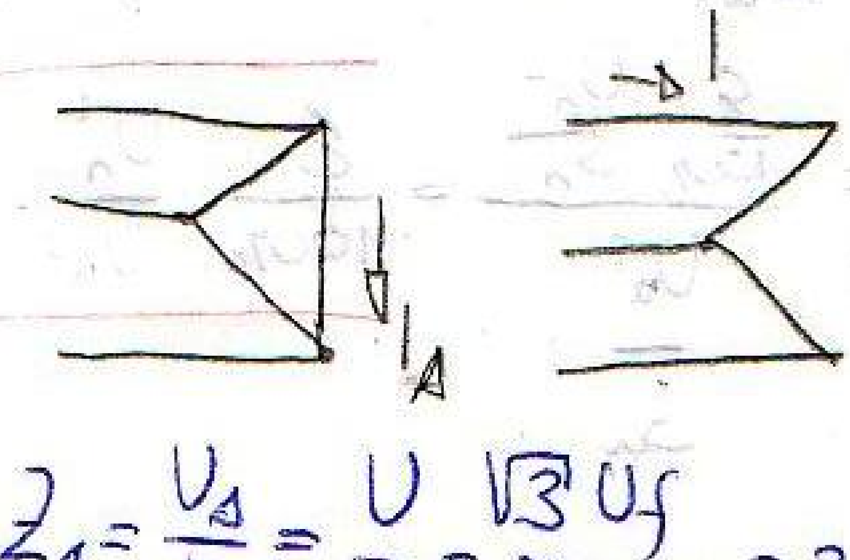
} feszültség

(NB: jegyezd meg)

Származtatott mennyiségek

$I \quad ((I_v = I_f)) \quad I = \frac{S}{\sqrt{3}U}$ } áramerősség

NB

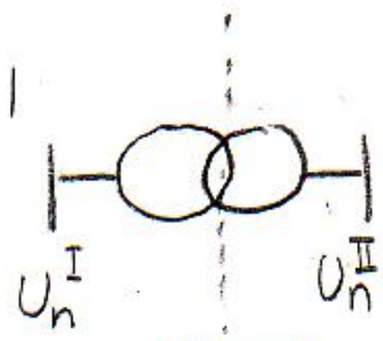


$I_\Delta = \frac{I}{\sqrt{3}}$

$Z \quad (Z = Z_f) \quad Z = \frac{U^2}{S}$ } impedancia

NB $Z_\Delta = \frac{U_\Delta}{I_\Delta} = \frac{U}{\frac{I}{\sqrt{3}}} = \frac{\sqrt{3}U_f}{\frac{I}{\sqrt{3}}} = 3\frac{U_f}{I_f} = 3Z_f = 3Z_Y$

V.e. (viszonylagos egység)



„a" index: alap

S_{alap}

$U^I_{alap} \Rightarrow U_a^I \left(\frac{U_n^{II}}{U_n^I} \right) = U^{II}_{alap}$

áttétel

$$I_a^I = \frac{S_a}{\sqrt{3}\, U_a^I} \qquad I_a^{II} = \frac{S_a}{\sqrt{3}\, U_a^{II}} \quad \left(NB \;\; I_a^{II} = I_a^I \frac{U_n^I}{U_n^{II}} \right)$$

$$Z_a^I = \frac{(U_a^I)^2}{S_a} \qquad Z_a^{II} = \frac{(U_a^{II})^2}{S_a} \quad \left(NB \;\; Z_a^{II} = Z_a^I \left(\frac{U_a^{II}}{U_a^I} \right)^2 \right)$$

Átszámítás (transzformáció)

dimenzionális egység ⇒ viszonylagos egység (lényeljük a mértékegységet)

$$S^{[v.e]} = \frac{S^{MVA}}{S_a} = \frac{S_{1f}}{S_{a\,1f}}$$

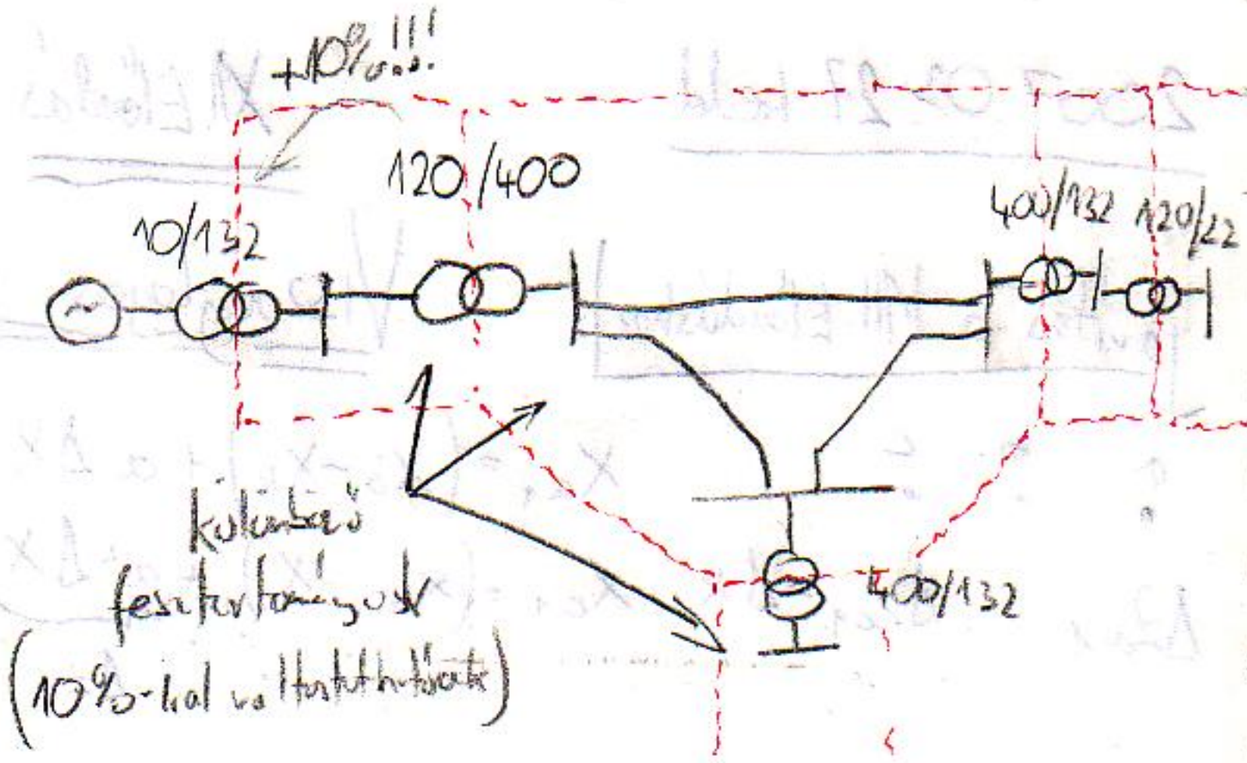
$$U^{[v.e]} = \frac{U}{U_a^I} = \frac{U_f}{U_{af}}$$

(mindegyik hogy viszonyítjuk a fázist osztom le)

$$I^{[v.e]} = \frac{I}{I_a^I}$$

$$Z^{[v.e]} = \frac{Z^{\Omega}}{Z_a^I} =$$

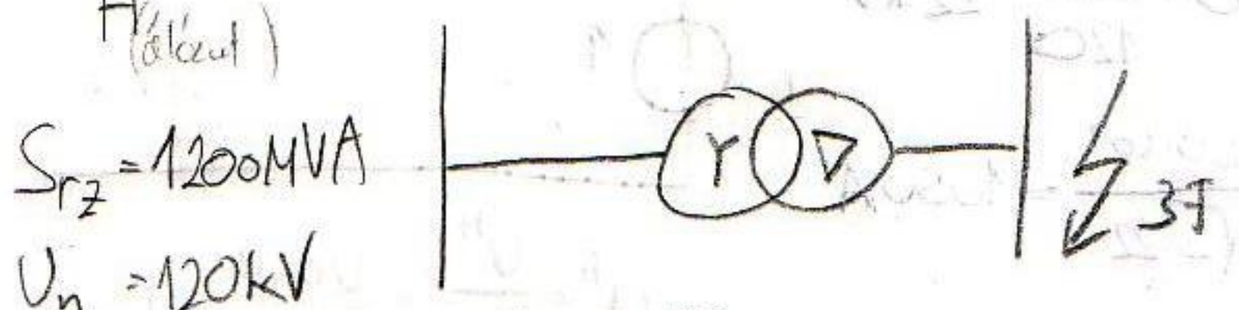
drop esetén $Z^{[v.e]} = \frac{\frac{\varepsilon}{100\%} \cdot \frac{U_n^2}{S_n}}{\frac{U_a^2}{S_a}} = \frac{\varepsilon}{100\%} \cdot \frac{U_n^2}{U_a^2} \cdot \frac{S_a}{S_n}$



3F rövidzárlat

Ω – v.e.

(ε_{rz}=100%)



S_n=40MVA
U_n=120/22 kV
ε=10%
(Yd5)

120kV

jX^H=j12Ω $jX^{tr.}$=j36Ω

$$X^H_{120} = \frac{\varepsilon}{100\%} \cdot \frac{U_n^2}{S} = \frac{100\%}{100\%} \cdot \frac{(120kV)^2}{1200MVA} = 12\Omega$$

$$x^{tr} = \frac{10\%}{100\%} \cdot \frac{(120kV)^2}{40MVA} = 36\Omega$$

$$|I_{rz}|_{120kV} = \frac{\frac{120kV}{\sqrt{3}}}{j(12+36)\Omega} = -j\,1443A$$

$1443\angle -90°$ A

22kV

jX^H jX^{tr}

$$x^H = \frac{(22kV)^2}{\times 1200MVA} = 0,403\Omega$$

$$x^{tr} = \frac{10\%}{100\%} \cdot \frac{(22kV)^2}{40MVA} = 1,21\Omega$$

$$|I_{rz}|_{22kV} = \frac{\frac{22kV}{\sqrt{3}}}{j(0,403+1,21)\Omega} = -j\,7875A$$

$7875\angle -90°$ A

$S_{rz} = \sqrt{3} \cdot 120kV\ 1,443kA$ $= \sqrt{3}\ 22kV \cdot 7,875kA = 300MVA$

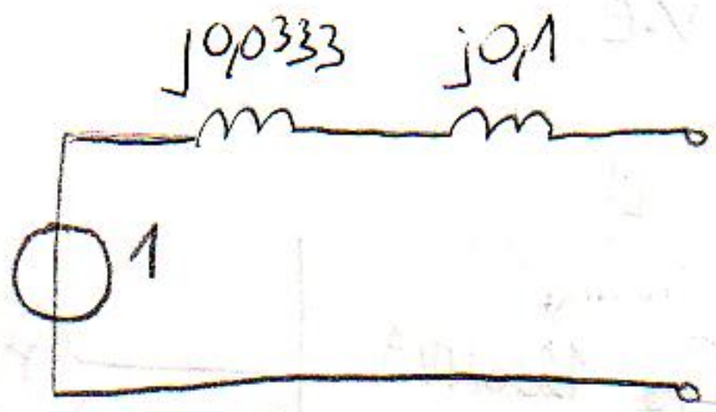
v.e. => folyt köv oldal

folyt ⇒ v.e. (viszonylagos egység)

$$S_a = 40\,MVA$$

$$U_a^{I\,120} = 120kV \Rightarrow U_a^{II\,22} = 120 \cdot \frac{22}{120} = 22\,kV$$

$$I_a^{120} = \frac{S_a}{\sqrt{3}\,U_a^{120}} = 192,5A \Rightarrow I_a^{22} = \frac{40\cdot 10^3}{\sqrt{3}\,22} = 1050A$$



$$U^H = \frac{U^H}{U_a^{120}} = \frac{120kV}{120kV} = 1$$

$$X^H = \frac{\varepsilon^{rz}}{100\%} \cdot \frac{U_n^2}{U_a^2} \cdot \frac{S_a}{S_n} = \frac{100\%}{100\%} \cdot \frac{(120kV)}{(120kV)^2} \cdot \frac{40MVA}{1200MVA} = 0,0333 \quad (v.e)$$

$$X^{tr} = \frac{10\%}{100\%} \frac{(120kV)^2}{(120kV)^2} \cdot \frac{40MVA}{40MVA} = 0,1\ (v.e)$$

$$\Rightarrow I_{rz}^{(v.e)} = \frac{1}{j(0,0333+0,1)} = -j\,7,51\ (v.e.)$$

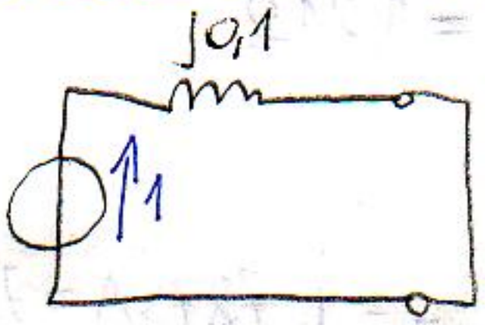
$$I_{rz}\Big|_{22kV} = I_{rz}^{v.e} \cdot I_a\Big|_{22kV} = -j\,7,51 \cdot 1050A = \underline{-j\,7875A}$$

$$I_{rz}\Big|_{120kV} = I_{rz}^{v.e}\ I_a\Big|_{120kV} = -j\,7,51\ 192,5A = \underline{-j\,1443A}$$

$$S_{rz} : \left|S_{rz}^{v.e}\right| = U^{v.e} \cdot I_{rz}^{v.e} = 1 \cdot 7,51 = 7,51\ (v.e)$$

$$\Rightarrow S_{rz} = S_{rz}^{v.e} \cdot S_a = 7,51 \cdot 40 = 300MVA$$

Transzformator saját rövidzár teljesítménye:



$$i_{rz} = \frac{U^{v.e}}{Z^{v.e}} = \frac{1}{j0,1} = -j\,10\ v.e.$$

$$\left|S_{rz}^{v.e}\right| = \left|U^{v.e} \cdot I^{v.e}\right| = 1 \cdot 10 = 10 v.e.$$

$$S_{rz}\Big|_{Sajat} = \frac{S_n}{\frac{\varepsilon}{100\%}} = \frac{40MVA}{0,1}$$

$$S_{rz}^{MVA} = S_{rz} \cdot S_a = 10 \cdot 40MVA = 400MVA$$