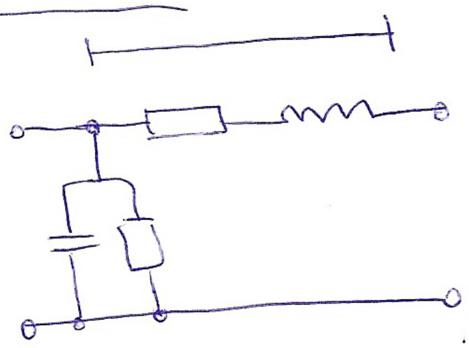
2009. 03. 17. Villenerg. gyak.



Jövő péntek: 2-4 h

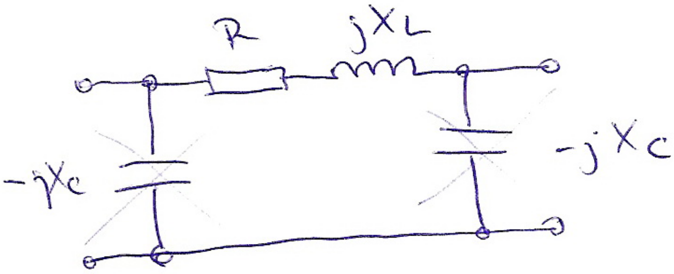
## Távvezeték:



- fesz. szint. → geometria
- vez. hossz
- (pontosság), (frekvencia)

→ $\frac{R}{X_L}$

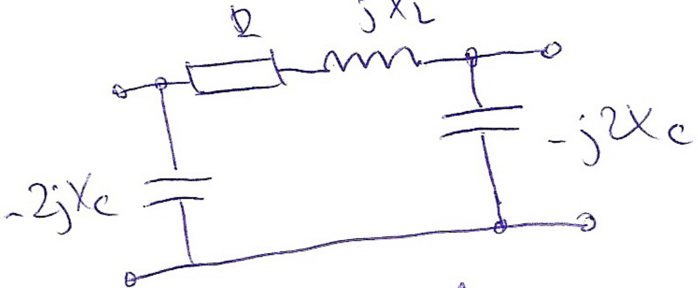
⇓




Névleges adatok:

$U_n$ [kV]
$l$ [km]
$r$ [Ω/km]
$x_L$ [Ω/km]
$x_C$ [MΩ·km]

Névleges π vázlat elemei:

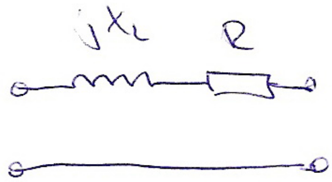



$R = r \cdot l$

$X_L = x_L l$

$X_C = \frac{x_C}{l}$

→ $l < 50$ km →



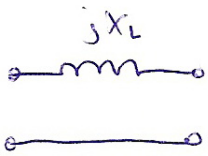

rövid vez.: $X_C \approx \infty$

hosszú vez.: $X_C$

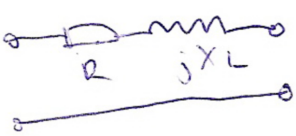
↳ $l > 150$ km

hosszú

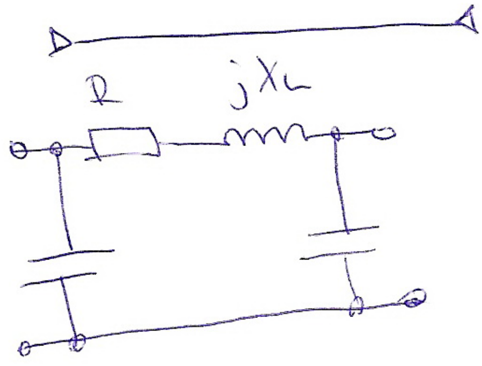
rövid:




| $R/X_L$ | $U_n$ |
|---|---|
| << 1 | Nagyfesz. |
| ≈ 1 | Közép → $l \le 50$ km |
| >> 1 | Kisfr. → $l \le 1$ km |



## Kábel




11kV
22kV

## Fogyasztó: – 3 fázisú

- csillag kapcs.

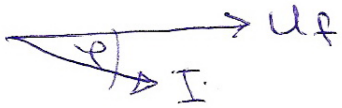
$U_n$ [kV] vonali

$S_n$ [MVA] 3f

$\cos\varphi$ < ind. / kap.

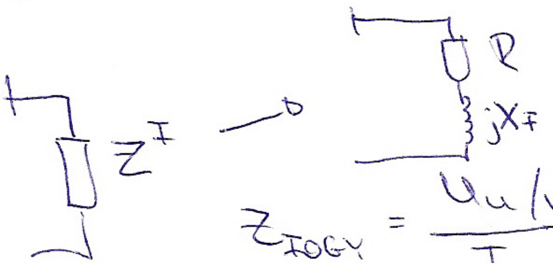
$$S_n = \sqrt{3}\, U_n I_n$$

Fazorábra: fázismennyiségek




$$I = I_n(\cos\varphi \mp j\sin\varphi)$$ (ind / kap)

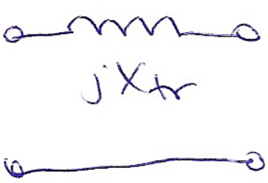
- $Z_F$ = áll




$$Z_{FOGY} = \frac{U_n/\sqrt{3}}{I} = \frac{U_n/\sqrt{3}}{\frac{S_n}{\sqrt{3}U_n}(\cos\varphi \mp \sin\varphi)} =$$

$$= \frac{U_n^2}{S_n}(\cos\varphi \pm \sin\varphi) = R_F \pm j X_F$$

## Transzformátor:



… állandó tartó fogy.

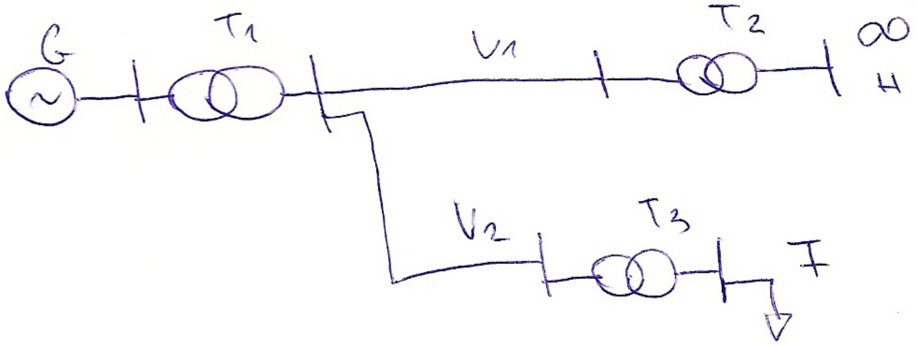
- $I_F = \text{áll}$

- $S_F = \text{áll}$

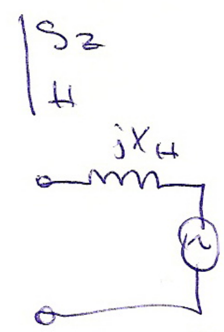
$$I_F = \frac{S_n}{\sqrt{3}\,U_n}(\cos\varphi \mp \sin\varphi)$$

$$W = P\,t$$

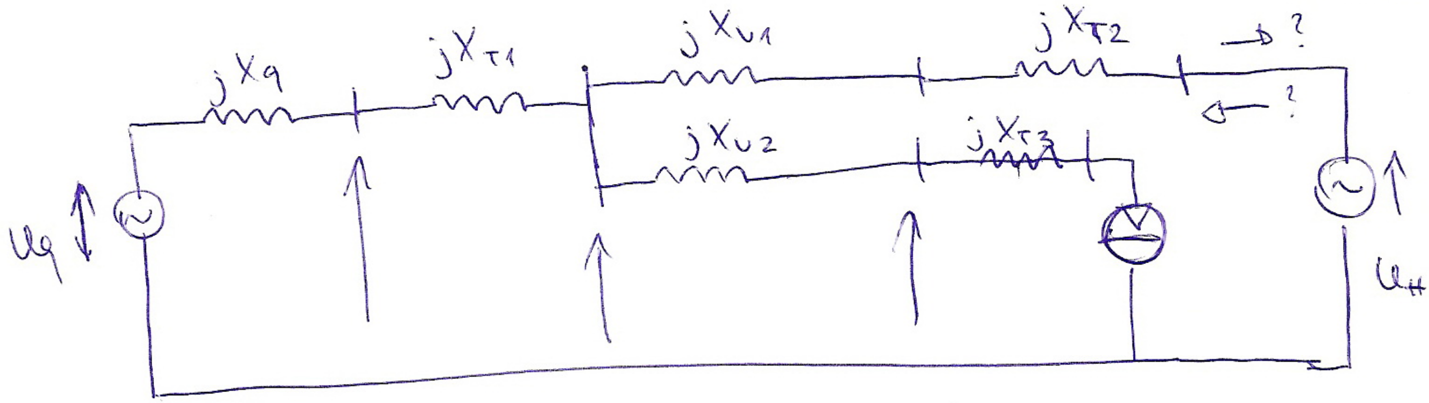
F




végtelennel $S_n = \infty$ ⇓ $X_H = 0$




$$X_H = \frac{U_n^2}{S_Z}$$




$U_g$, $U_n$ fázisfesz.

## Viszonylagos egységek módszere

$U_{n1} / U_{n2}$

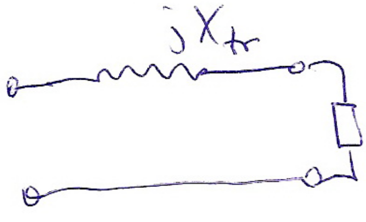
$S_n$

$\varepsilon$

$$X_{tr}^{(1)} = \frac{\varepsilon}{100}\,\frac{U_{n1}^2}{S_n} \qquad S_1 = S_2$$

$$X_{tr}^{(2)} = \frac{\varepsilon}{100}\,\frac{U_{n2}^2}{S_n}$$

$$\frac{X_{tr}^{(1)}}{X_{tr}^{(2)}} = \left(\frac{U_{n1}}{U_{n2}}\right)^2$$




$$Z_2 = \frac{U_2}{I_2}$$

$$\left.\begin{aligned} U_2 &= U_1 \cdot a \\ I_2 &= \frac{I_1}{a} \end{aligned}\right\} \; Z_2 = \frac{U_2}{I_2} = \frac{U_1}{I_1} a^2$$

($\frac{U_1}{I_1} = Z_1$)

# Alapmennyiségek

$U_a$
$I_a$
$Z_a$
$S_a$

} absz. értékek (dimenziójuk van)

- 2 oldalasított
- szimmetrizált

$\frac{U_{af}}{I_{af}} = Z_a$

$S_{a3f} = \sqrt{3}\, U_{av} I_a = 3 S_{a1f} = 3 U_{af} I_a$

ohm

$U_f = Z I$ komplex

$U_{af} = Z_a I_a$ absz.

viszonylagos forgó komplex

$\frac{U_f}{U_{af}} = \frac{Z}{Z_a} \frac{I}{I_a}$

$u = z \cdot i$

$U_v = \sqrt{3}\, U_f$

$U_{va} = \sqrt{3}\, U_{fa}$

$\frac{U_v}{U_{va}} = \frac{U_f}{U_{fa}}$ $u$

$S_{1f} = U_f I^*$

$S_{a1f} = U_{af} I_a$

$\frac{S_{1f}}{S_{a1f}} = \frac{U_f}{U_{af}} \frac{I^*}{I_a}$

$s = u \cdot i^*$

$S_{3f} = 3 S_{1f}$

$S_{3fa} = 3 S_{1fa}$

$s = \frac{S_{3f}}{S_{3fa}} = \frac{S_{1f}}{S_{1fa}}$ $s$

$$X_{tr}^{(1)} = \frac{\varepsilon}{100}\,\frac{U_{n1}^2}{S_n}$$

$$X_{tr}^{(2)} = \frac{\varepsilon}{100}\,\frac{U_{n2}^2}{S_n}$$

$$Z_a = \frac{U_{fa}}{I_a} = \frac{\frac{U_{av}}{\sqrt{3}}}{\frac{S_{a3f}}{\sqrt{3}\,U_{av}}} = \frac{U_{av}^2}{S_{a3f}}$$

$U_a : U_{av}$

$S_a : S_{a3f}$


$U_a^{I}$ ; $U_a^{II} = U_a^{I}\,\frac{U_{n2}}{U_{n1}}$

$S_a^{I}$ $\quad S_a^{II} = S_a^{I}$

$I_a^{I}$ $\quad I_a^{II} = I_a^{I}\,\frac{U_{n1}}{U_{n2}}$

$Z_a^{I}$ $\quad Z_a^{II} = Z_a^{I}\left(\frac{U_{n2}}{U_{n1}}\right)^2$

trafó áttéte megszűnik!

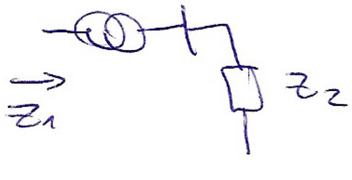
$$x_{tr}^{(1)} = \frac{X_{tr}}{Z_a^{I}} \qquad x_{tr}^{(2)} = \frac{X_{tr}}{Z_a^{II}}$$

$$x_{tr}^{(1)} = \frac{\frac{\varepsilon}{100}\frac{U_n^2}{S_n}}{\frac{(U_a^{I})^2}{S_a}} = \frac{\varepsilon}{100}\,\frac{\left(\frac{U_{n1}}{U_a^{I}}\right)^2}{\frac{S_n}{S_a}}$$

$$x_{tr}^{(2)} = \frac{\frac{\varepsilon}{100}\frac{U_{n2}^2}{S_n}}{\frac{(U_a^{II})^2}{S_a}} = \frac{\varepsilon}{100}\,\frac{\left(\frac{U_{n2}}{U_a^{II}}\right)^2}{\frac{S_n}{S_a}}$$

$$\left(\frac{U_{n1}}{U_a^{I}}\right)^2 = \left(\frac{U_{n2}}{U_a^{II}}\right)^2 \quad \Rightarrow \quad x_{tr}^{(1)} = x_{tr}^{(2)}$$

$$\left(\frac{U_{n1}}{U_{n2}}\right)^2 = \left(\frac{U_a^{I}}{U_a^{II}}\right)^2$$




$Z_1 = Z_2$