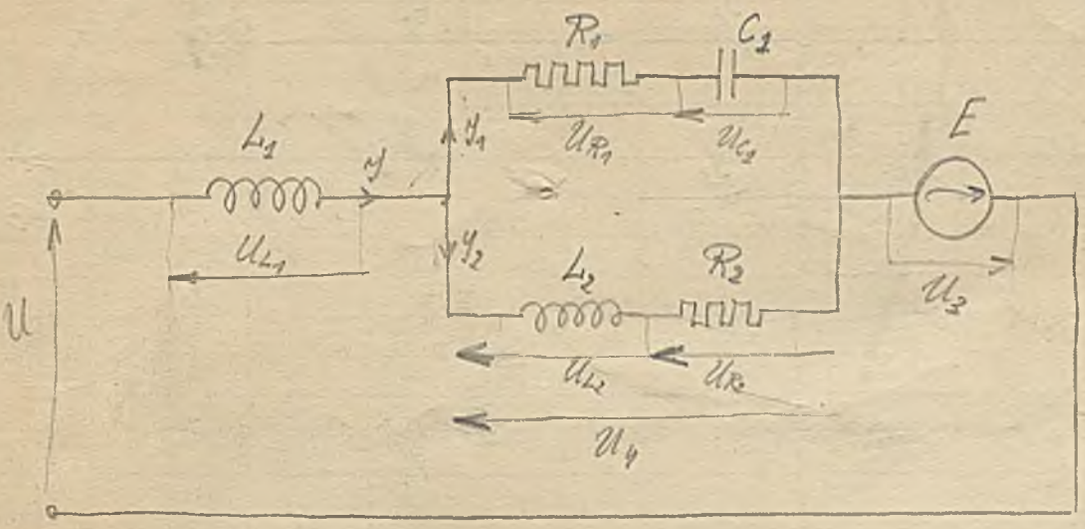
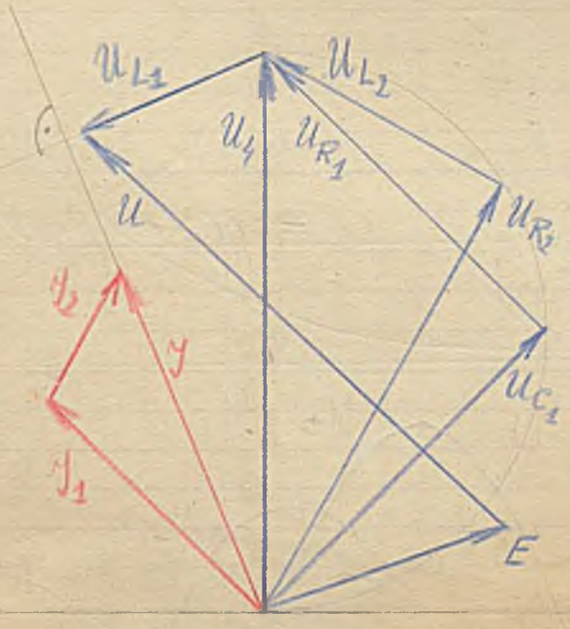
dnia 11. XII - 50 r.

Hrowski Antoni
Wydz. Elektryczny.

Egzamin z podstaw elektrotechniki

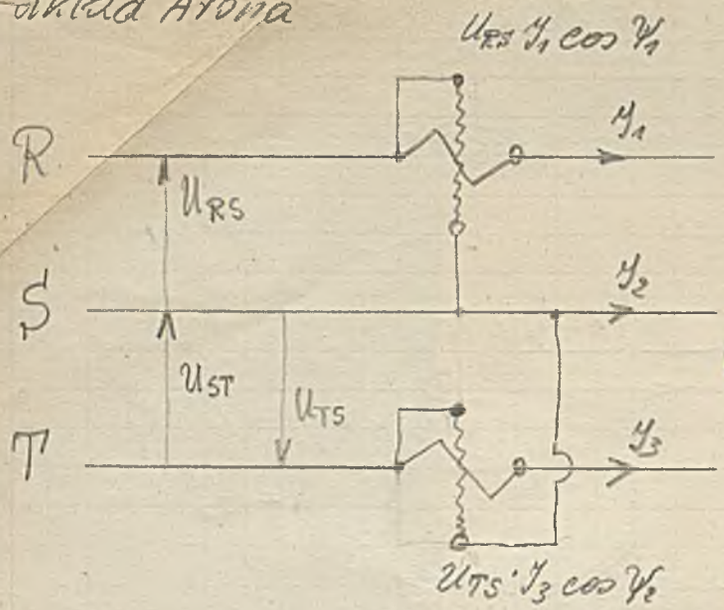
Narysować wykres fazowy.

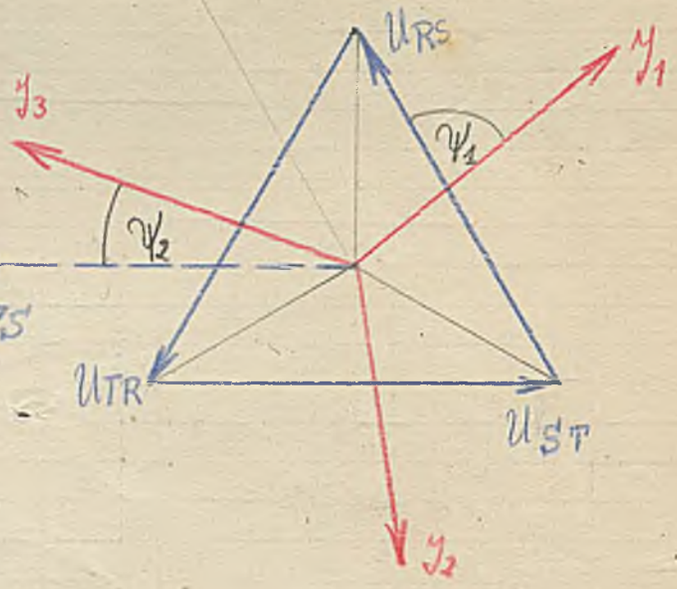




0,040 / 0,4

Układ Arona





$$P_u = P_{u1} + P_{u2}$$

$$P_u = U_{RS} I_1 \cos\psi_1 + U_{TS} \cdot I_3 \cos\psi_2$$

$$P_b = U_{RS} I_1 \sin\psi_1 + U_{TS} I_3 \sin\psi_2$$

$$\psi_1 = \varphi + 30^\circ$$

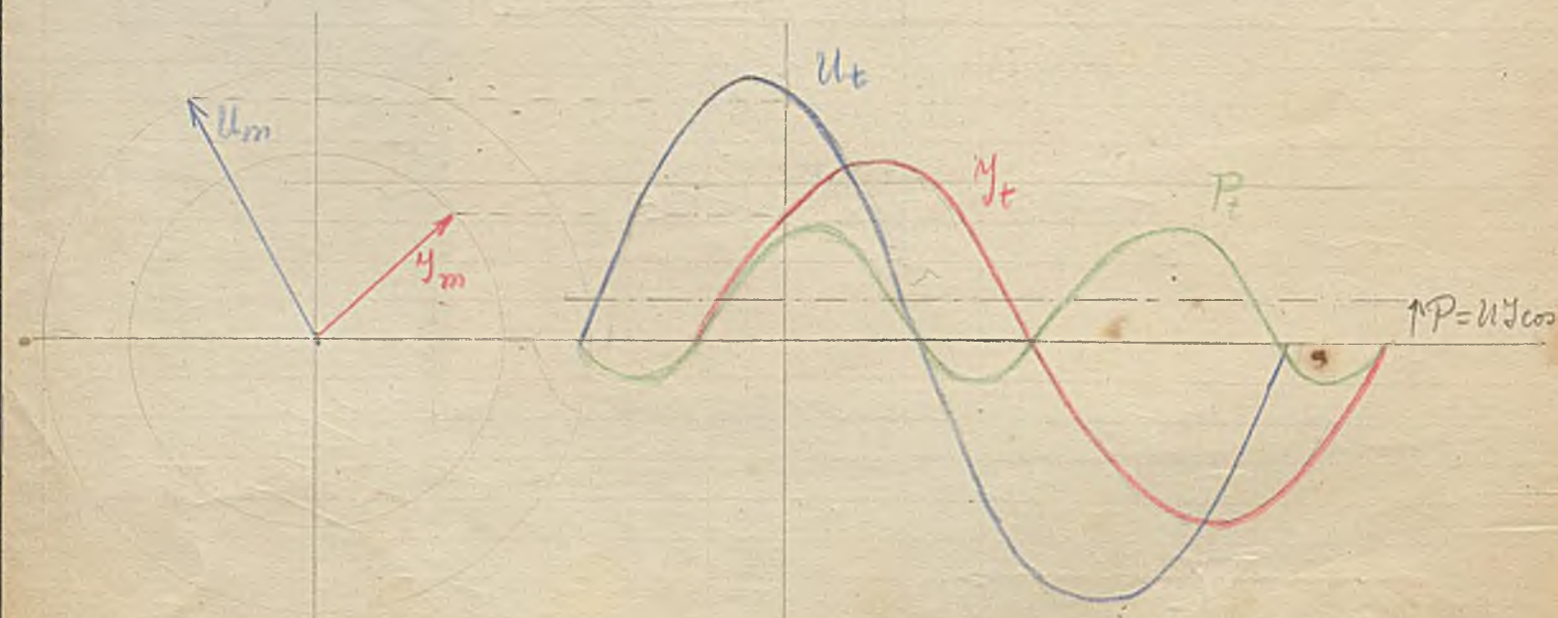
$$\psi_2 = \varphi - 30^\circ$$

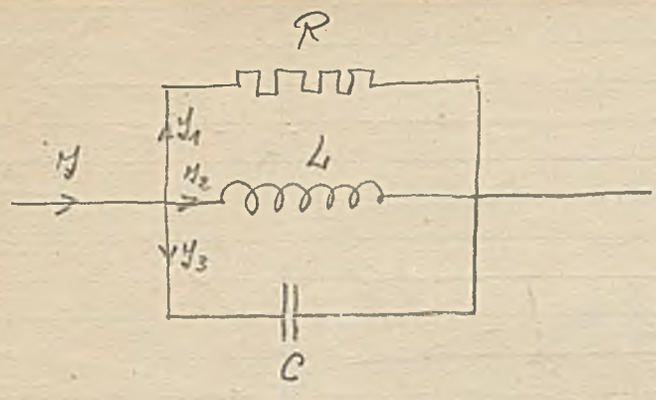
Symbolicznie $\hat{P} = \hat{U} \cdot \check{I}$

$$\hat{P}_u = \hat{U}_{RS} \cdot \check{I}_1 + \hat{U}_{TS} \cdot \check{I}_3$$

Obliczyć moc w wartości średniej:

$$P = \frac{1}{T}\int_0^T p_t\,dt = \frac{1}{T}\int_0^T u_t i_t\,dt = UI\cos\varphi + \underbrace{UI\sin\left(2\omega t + \alpha_u + \alpha_i - \frac{\pi}{2}\right)}_{=0}$$





$X_L = X_C$ rezonans

$$\omega L = \frac{1}{\omega C}$$

1) Narysować wykres prądowy

$U = I_2 L \omega$ $\quad I_2 = \frac{U}{L\omega}$

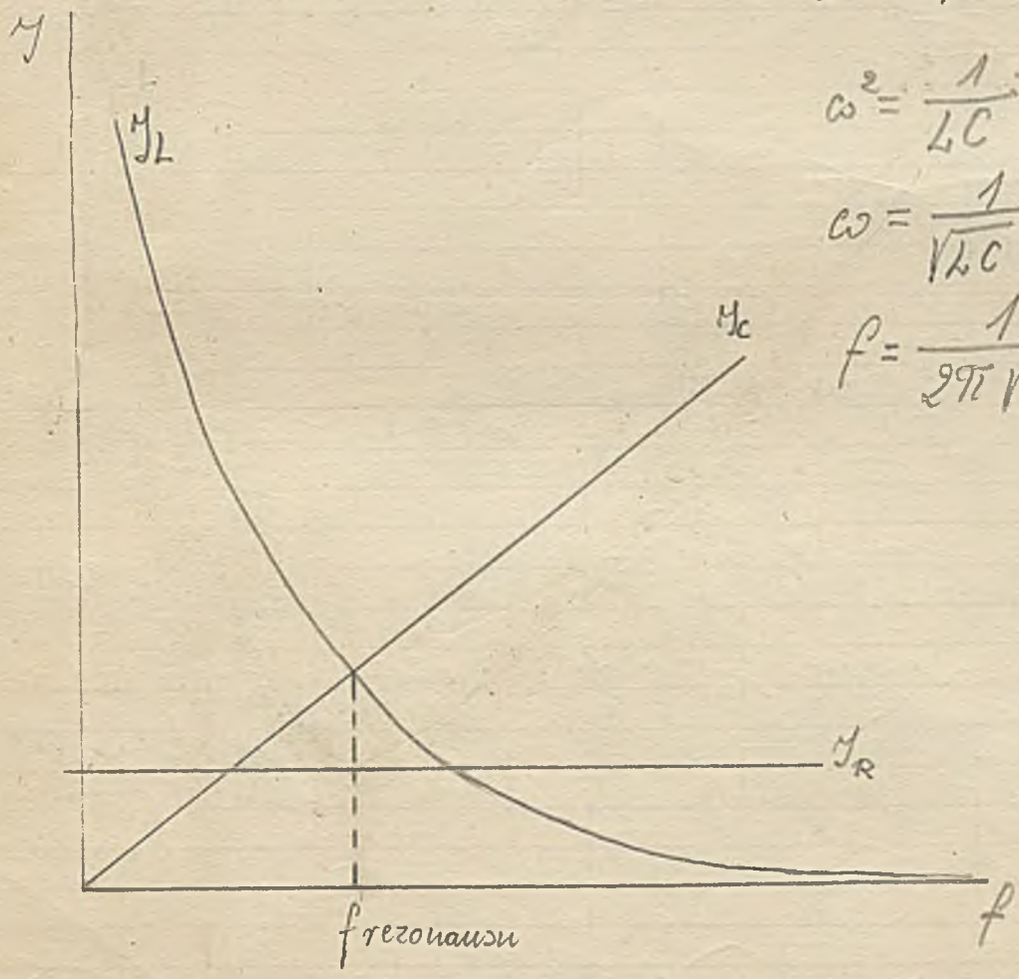
$U = I_3 \frac{1}{C\omega}$ $\quad I_3 = U C \omega$

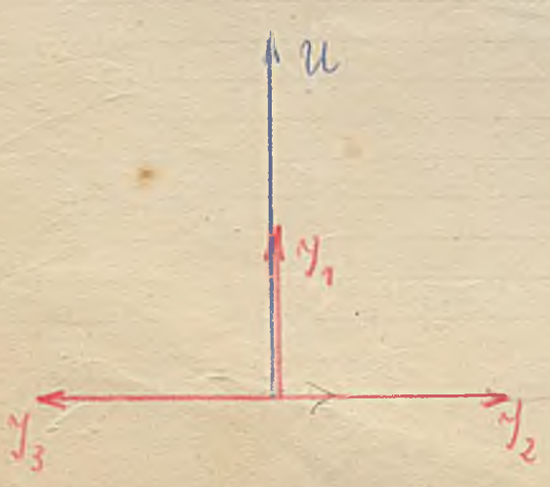
$U = I_1 R$ $\quad I_1 = \frac{U}{R}$

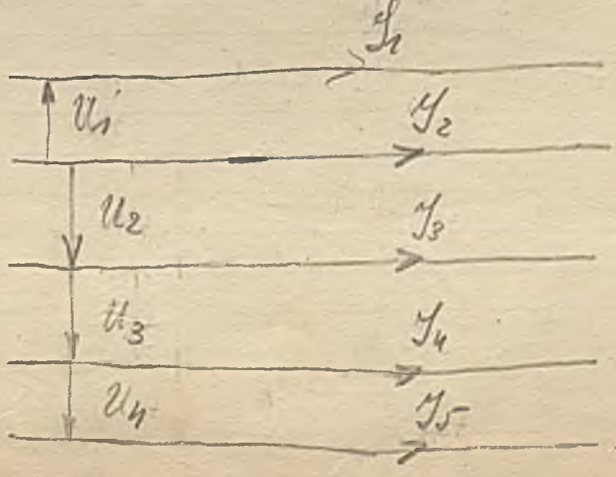
$$\omega^2 = \frac{1}{LC}$$

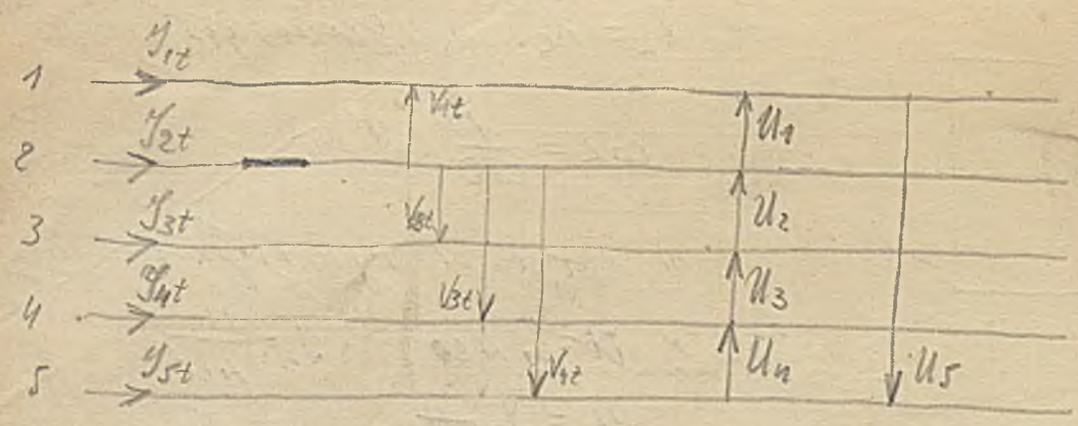
$$\omega = \frac{1}{\sqrt{LC}} \qquad \omega = 2\pi f$$

$$f = \frac{1}{2\pi\sqrt{LC}}$$





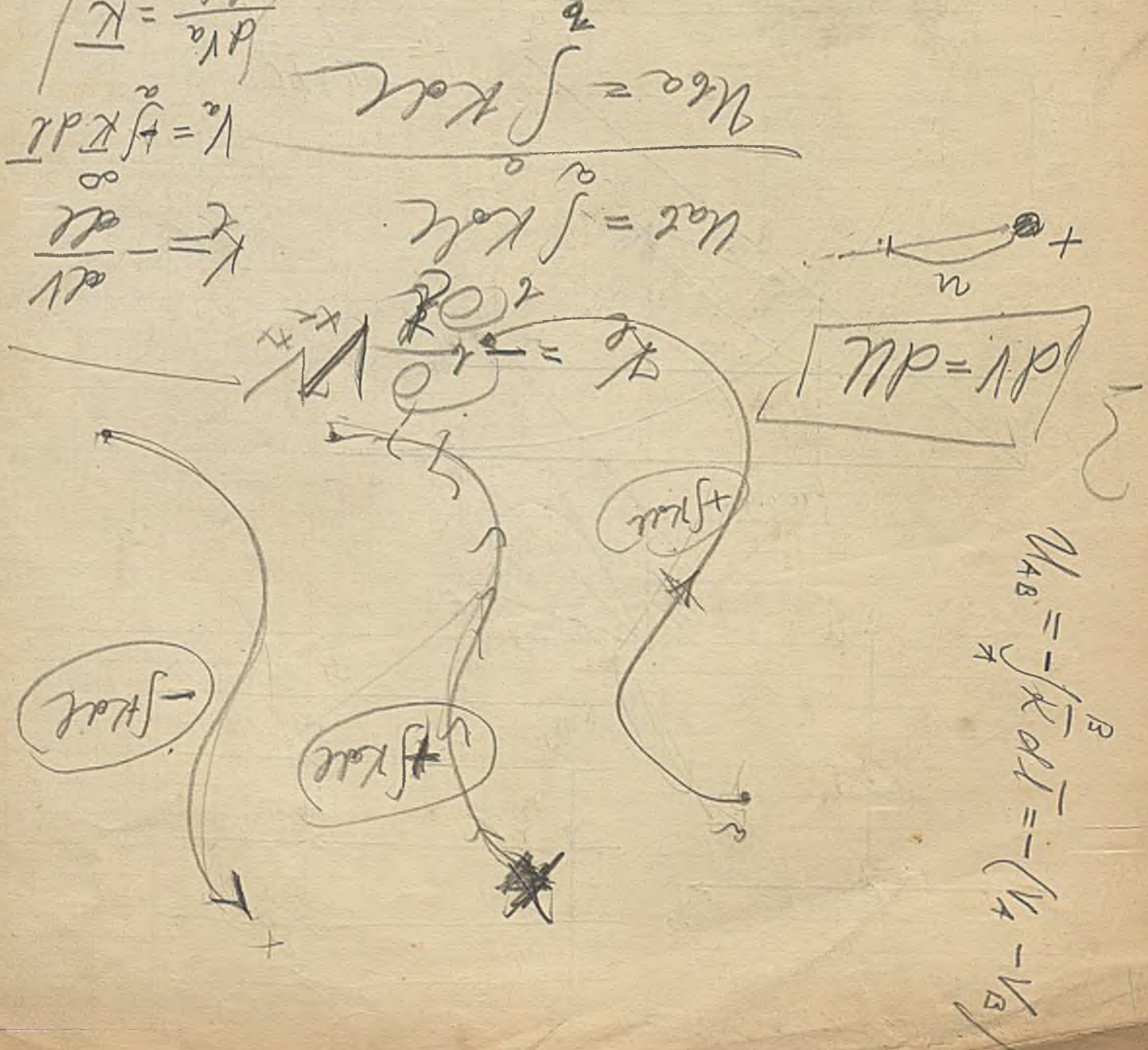




$$P = \frac{1}{T}\int_0^T P_t\,dt = \frac{1}{T}\int_0^T V_t y_t\,dt + \frac{1}{T}\int_0^T V_{2t} y_{3t}\,dt + \frac{1}{T}\int_0^T V_{3t} y_{4t}\,dt + \frac{1}{T}\int_0^T V_{4t} y_{5t}\,dt$$

$$P_t = V_{1t} y_{1t} + V_{2t} y_{3t} + V_{3t} y_{4t} + V_{4t} y_{5t} = P_{1t} + P_{2t} + P_{3t} + P_{4t}$$

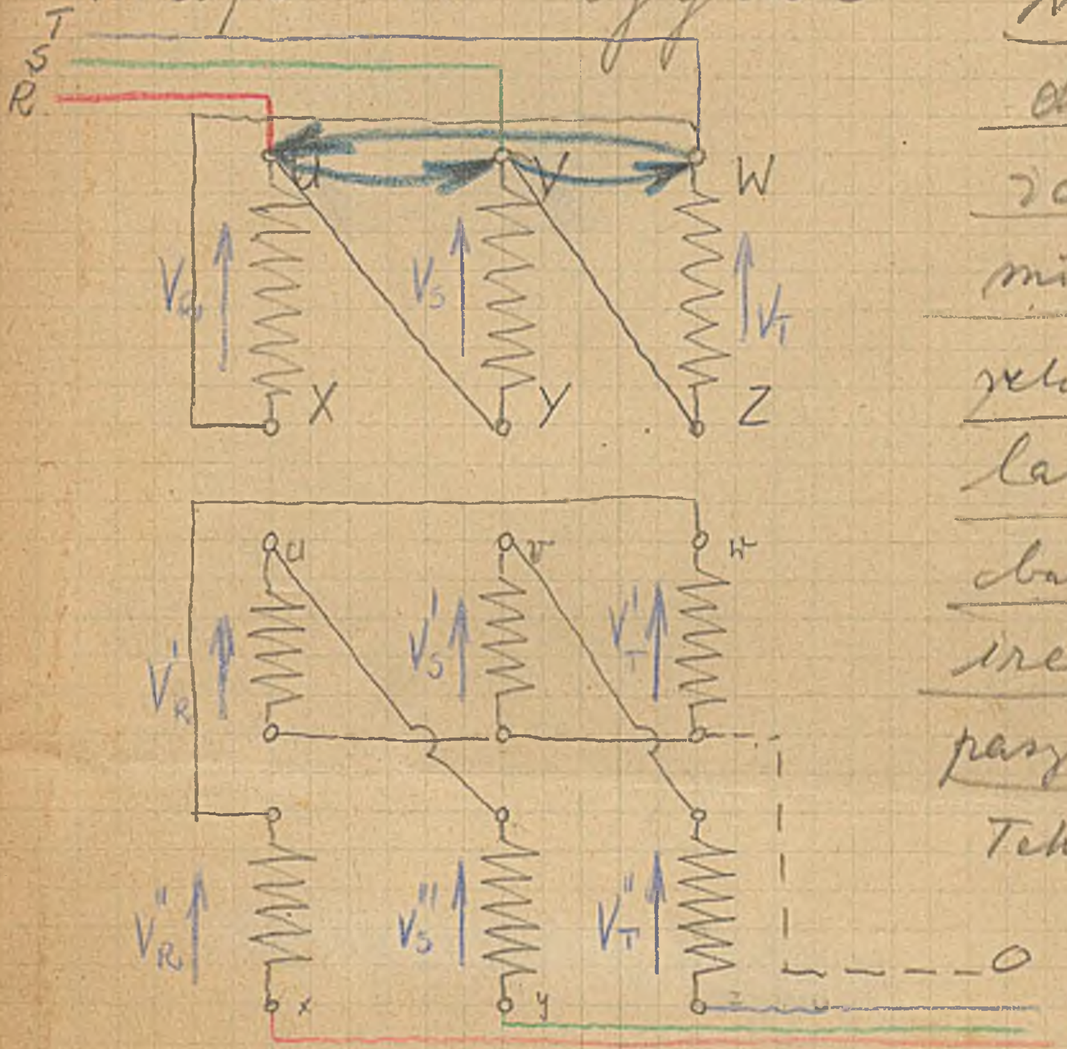
$$K = \frac{\partial P}{\partial \alpha}$$



Egzamin ustny z Podstaw Elektrotechniki

Piątkowski Ryszard.

Trafo w zygzak



Na cały rok

drewno

żelazo

metale nierdzewne

szkło

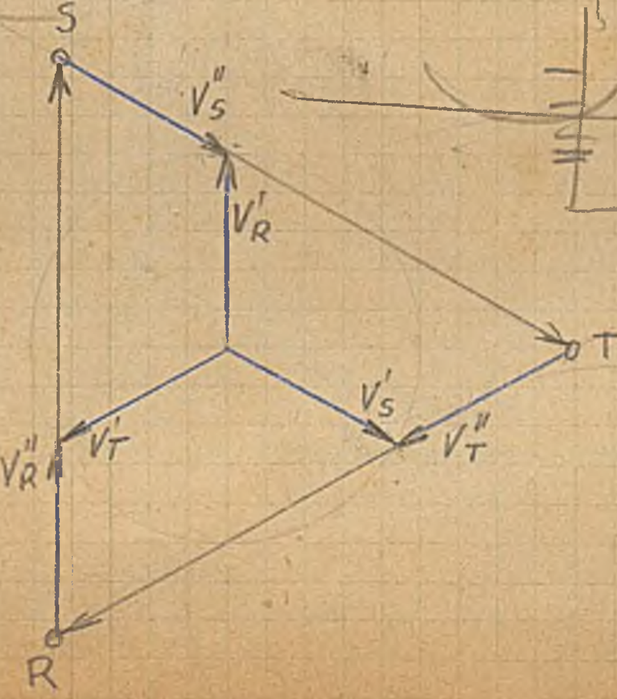
kabiny

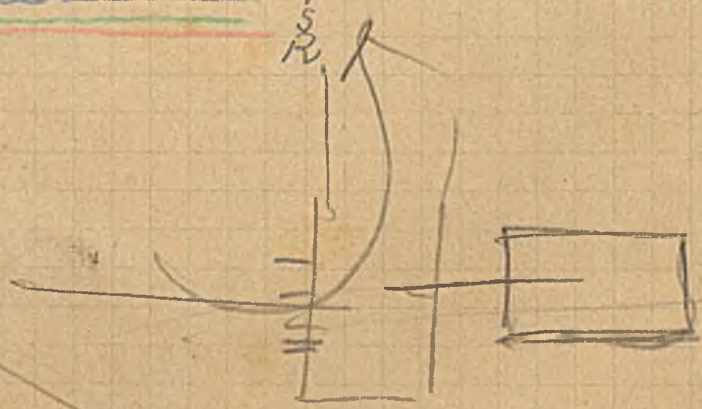
bakelit

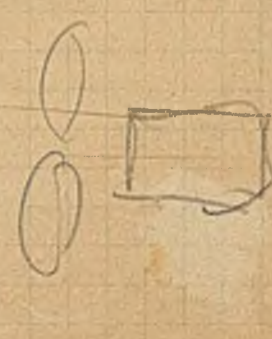
ircha

pasy skórzane

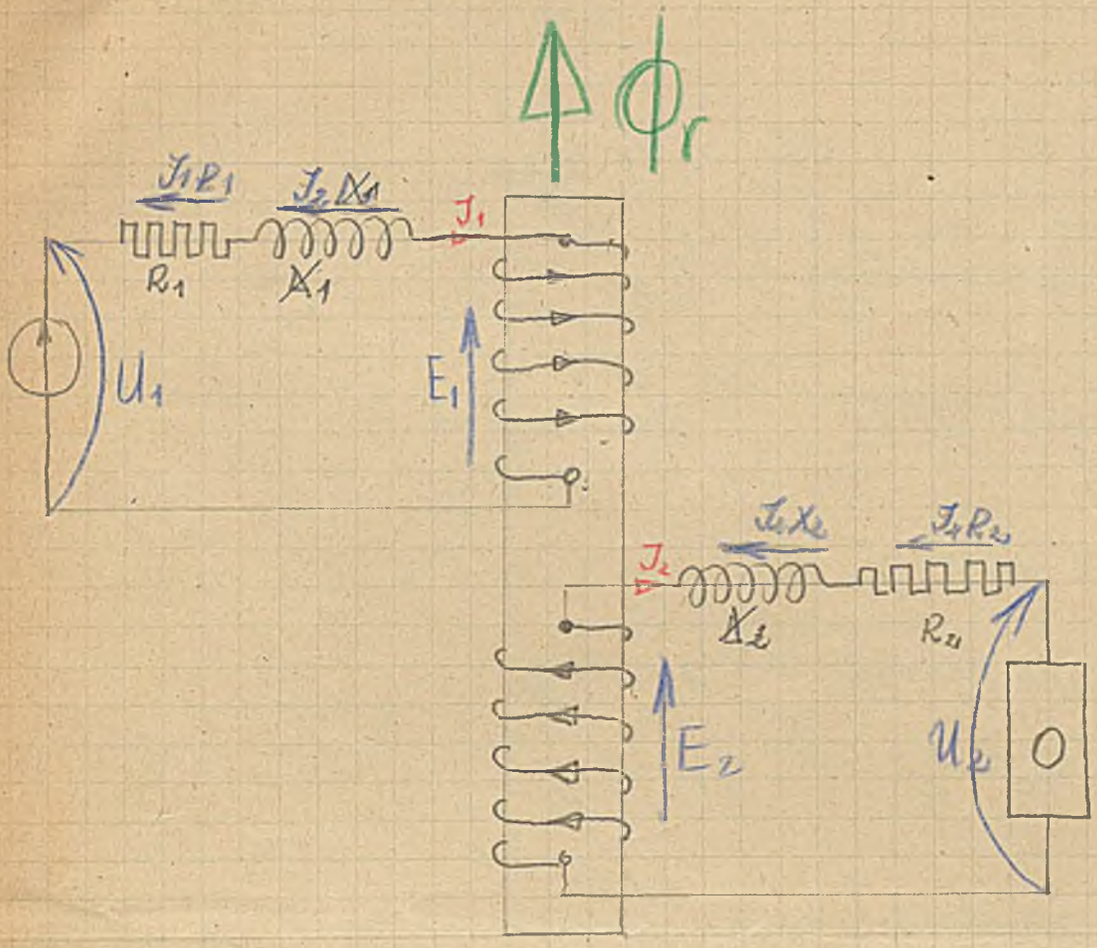
Tekstylia (płócienne i bawełniane)



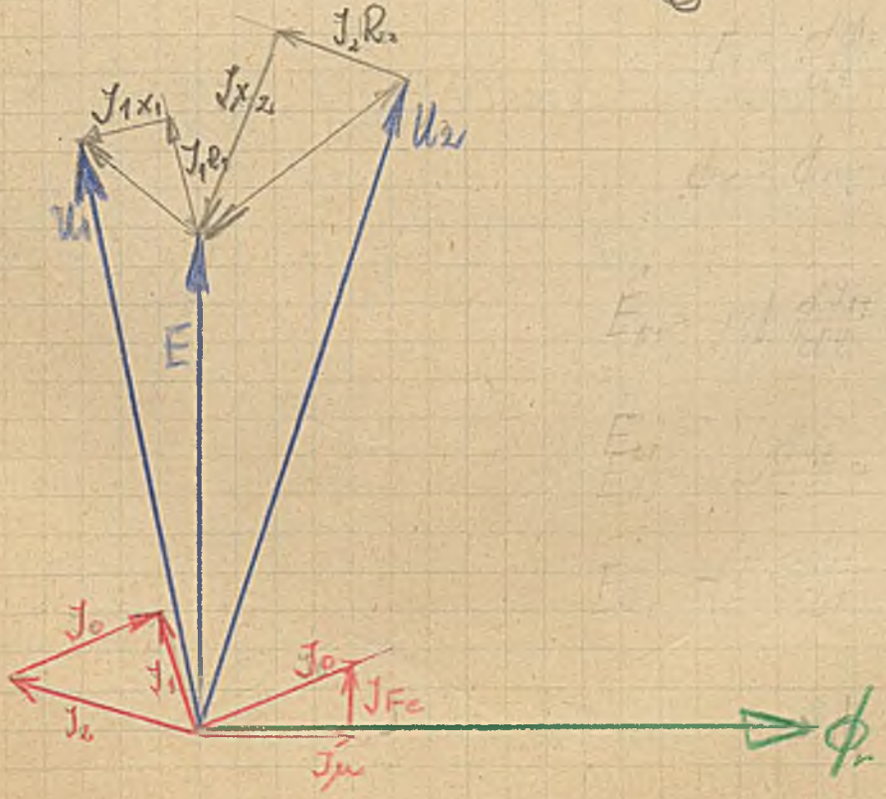




Transformator



6



$$\hat{U}_1 = \hat{J}_1 R_1 + \hat{J}_1 \hat{X}_1 + \hat{E}_1 \qquad \hat{E}_1 = +\left[L_1 \frac{d\hat{J}_1}{dt} - M \frac{d\hat{J}_2}{dt}\right]$$

$$\hat{U}_2 = \hat{E}_2 - \hat{J}_1 \hat{X}_2 - \hat{J}_2 R_2 \qquad \hat{E}_2 = -\left[L_2 \frac{d\hat{J}_2}{dt} - M \frac{d\hat{J}_1}{dt}\right]$$

$$\hat{U}_1 = \hat{J}_1 R_1 + \hat{J}_1 \hat{X}_1 + L_1 \frac{d\hat{J}_1}{dt} - M \frac{d\hat{J}_2}{dt}$$

$$\hat{U}_2 = -\left[L_2 \frac{d\hat{J}_2}{dt} - M \frac{d\hat{J}_1}{dt}\right] - \hat{J}_2 \hat{X}_2 - \hat{J}_2 R_2$$

$$E_t = \frac{d\phi_t}{dt} \cdot z \cdot 10^{-8} V \quad ; \quad \phi_t = \phi_m e^{j\omega t}$$

$$\hat{E}_t = \hat{\phi}_t \, j\omega z \cdot 10^{-8} V = \hat{\phi}_m \, j\omega z \cdot 10^{-8} e^{j\omega t}$$

$$\hat{E}_t = \hat{\phi}_m \, j\omega z \cdot e^{j\omega t} \, 10^{-8} V$$

$$\hat{E}_m = \hat{\phi}_m \frac{j\omega z}{\sqrt{2}} e^{j\omega t} \, 10^{-8} V$$

$p = \frac{z_1}{z_2}$ przekładnia trafo

Dla wartości chwilowych

$$U_{1t} = J_{1t} R_1 + J_{1t} X_1 + \left[L \frac{dJ_{1t}}{dt} - M \frac{dJ_{2t}}{dt}\right]$$

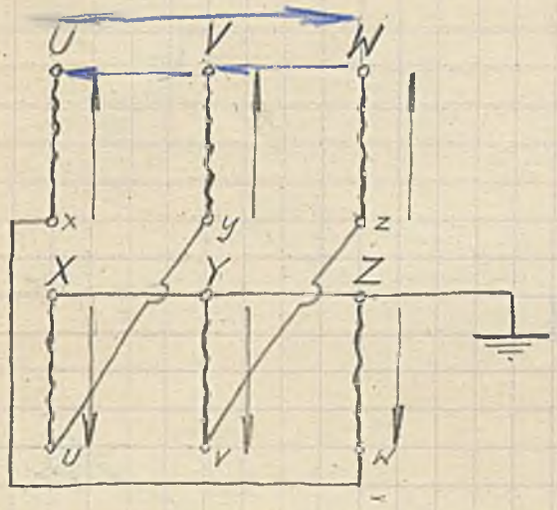
$$U_{2t} = -\left[L_2 \frac{dJ_{2t}}{dt} - M \frac{dJ_{1t}}{dt}\right] - J_{2t} X_2 - J_{2t} R_2$$

9.12.1949 r.

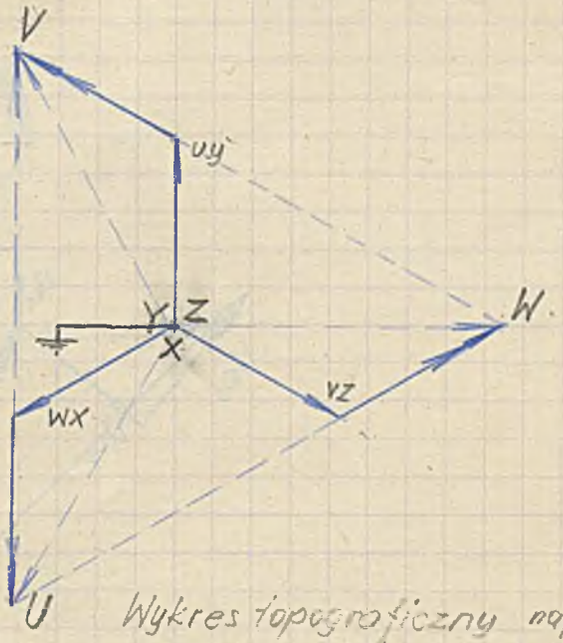
Brauner Jan
sem. V. dole

Egzamin ustny z Podstaw elektrotechniki

1.)

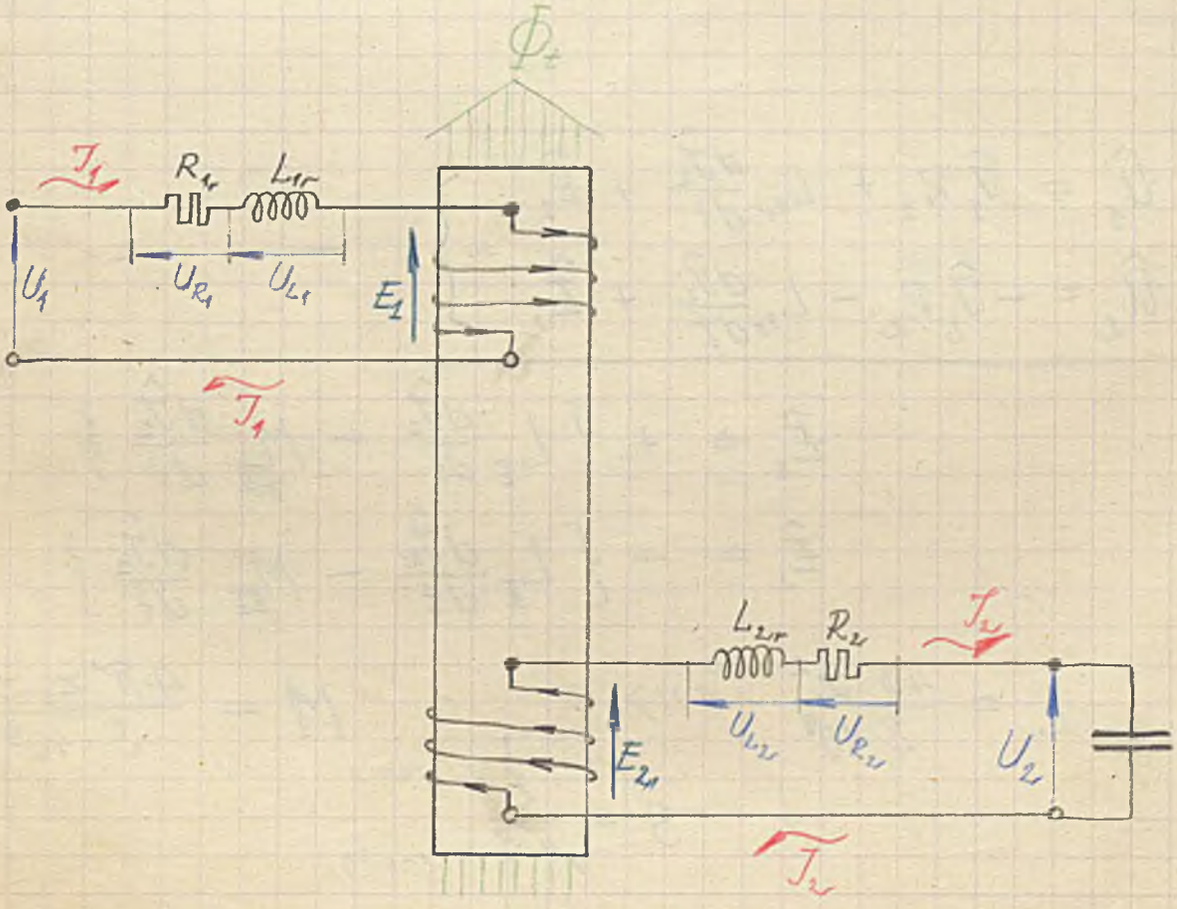


Schemat połączeń uzwojenia wtórnego transformatora 3-faz. pot. w zygzak



Wykres topograficzny napięć w uzwojeniu wt. Tr pot. w zygzak (dla układu symetrycznego).

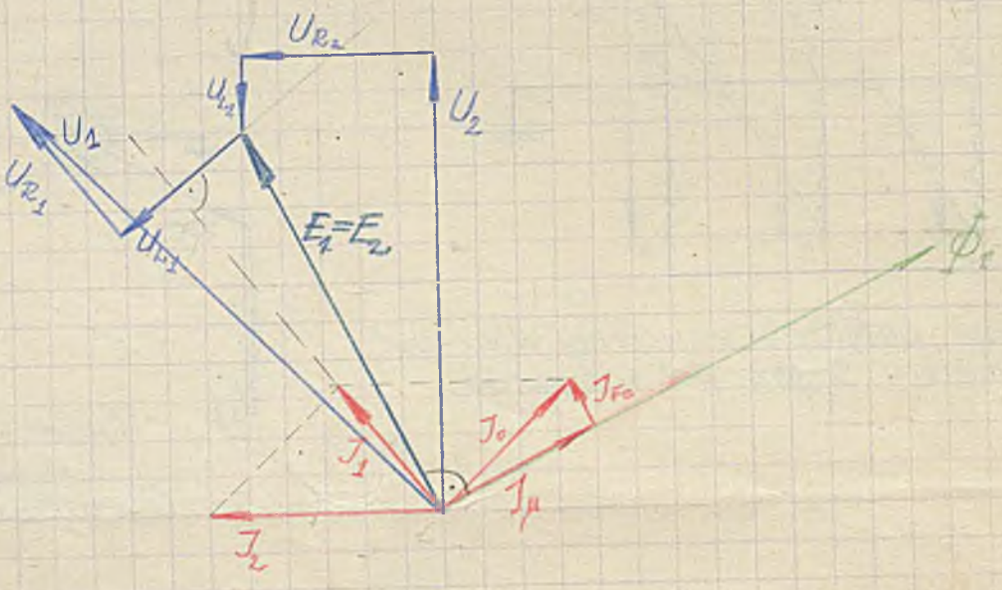
2.)



Schemat połączeń transformatora jednofazowego obciąż. pojemnością.

dobre

Wykres transformatora obc. pojemnością



$$\left.\begin{aligned} \hat{U}_1 &= \hat{J}_1 R_1 + L_{1r}\frac{d\hat{J}_1}{dt} + \hat{E}_1 \\ \hat{U}_2 &= -\hat{J}_2 R_2 - L_{2r}\frac{d\hat{J}_2}{dt} + \hat{E}_2 \end{aligned}\right\}$$

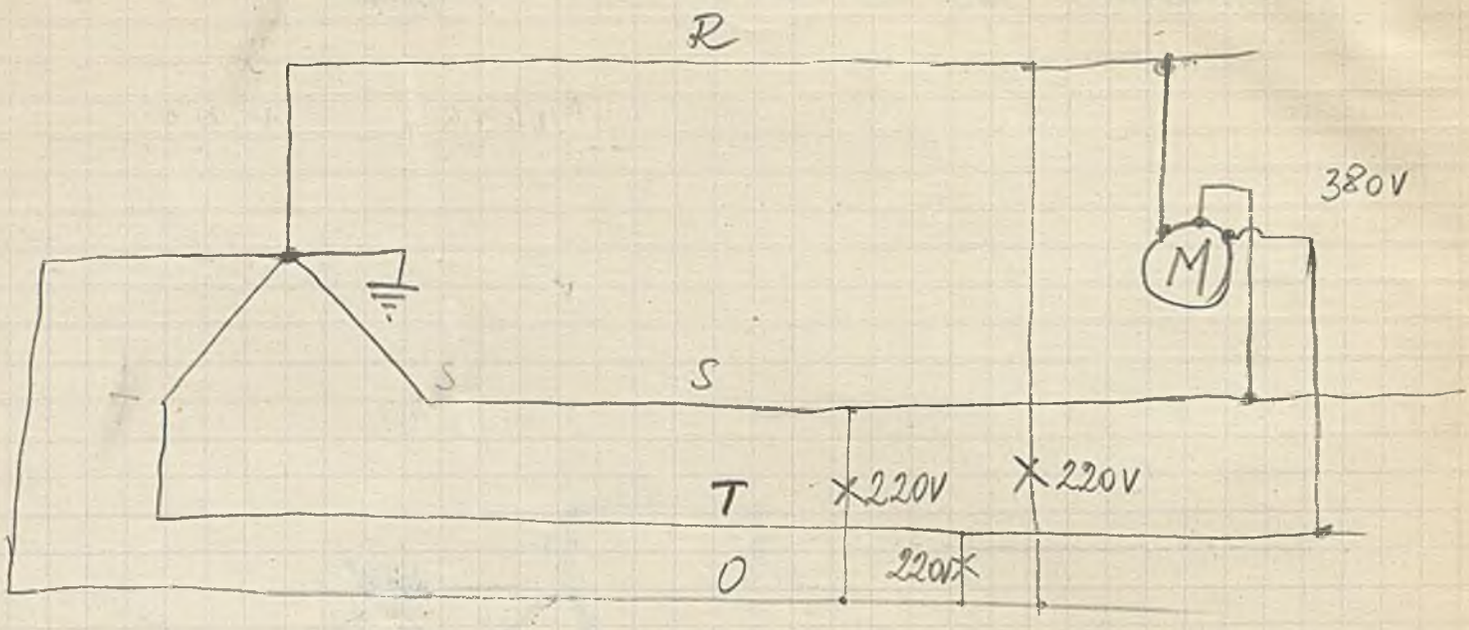
$$\hat{E}_1 = +\left\{ L_I \frac{d\hat{J}_1}{dt} - M_{II}\frac{d\hat{J}_2}{dt} \right\}$$

$$\hat{E}_2 = -\left\{ L_{II}\frac{d\hat{J}_2}{dt} - M_{II}\frac{d\hat{J}_1}{dt} \right\}$$

$$L = \frac{4\pi z_1^2}{S\,10^9} \ \langle H \rangle \qquad ; \qquad M = \frac{4\pi z_1 z_2}{S\cdot 10^9} \ \langle H \rangle$$

$$S = \frac{l}{\mu J} \quad \begin{matrix} \langle cm \rangle \\ \langle cm^2 \rangle \end{matrix}$$

$$L_I = L_{II} = L \ ; \qquad M_{II} = M_{II} = M \ ; \qquad z_1 = z_2$$

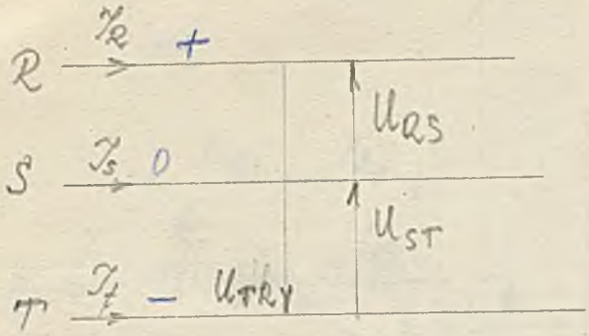


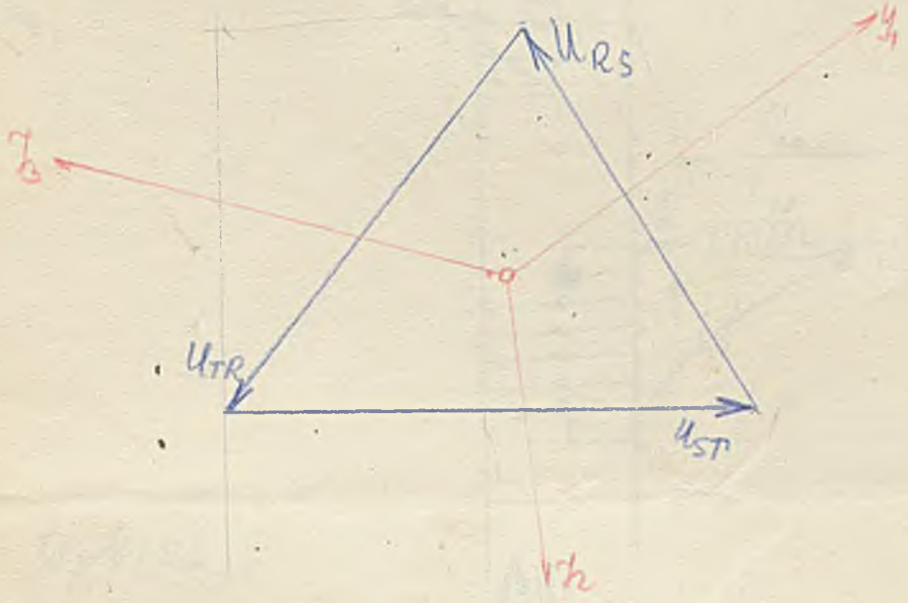
λ 380 V
Δ 220 V

Δ 380 V
λ 660 V

0,1 A

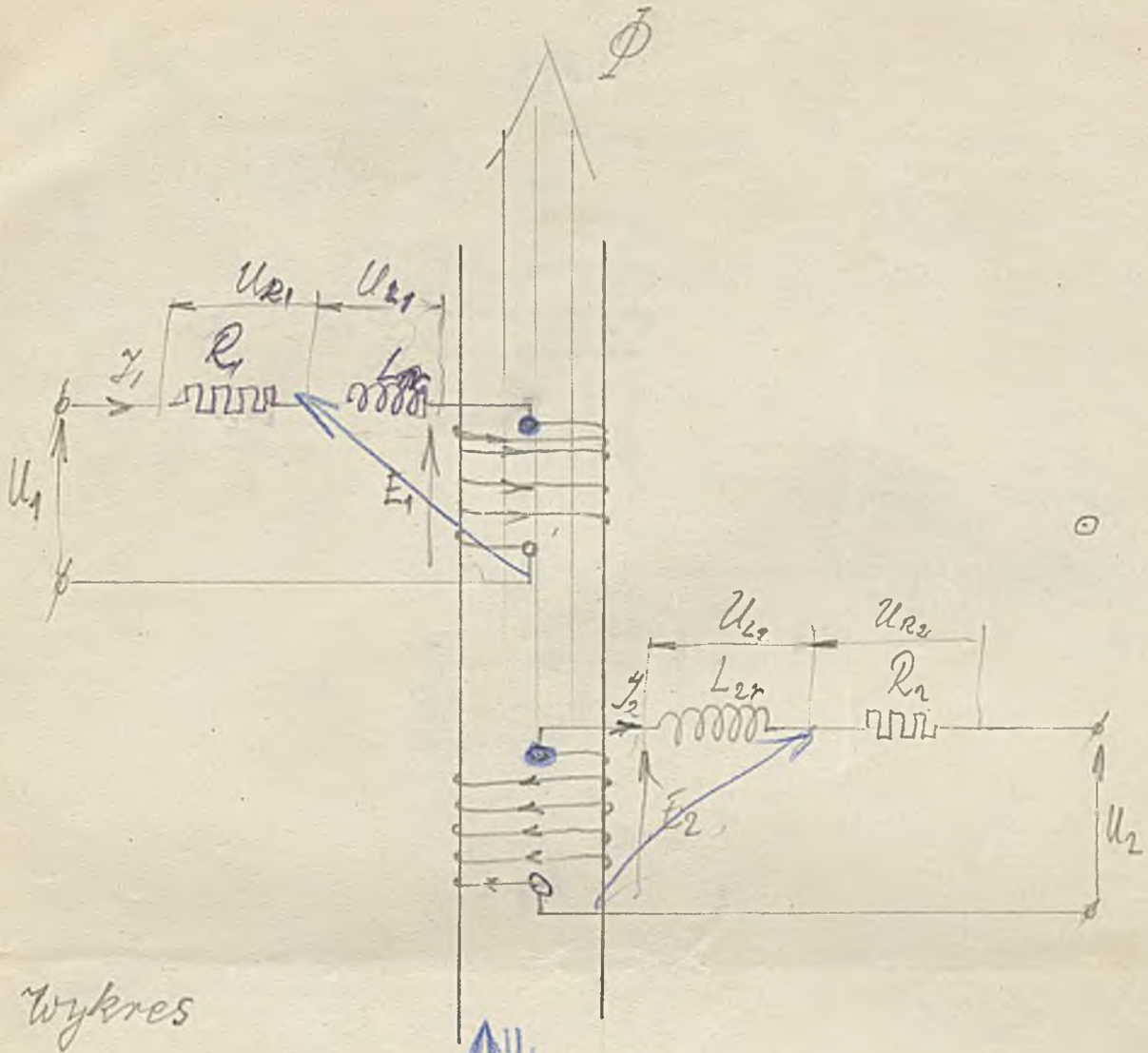
Stakibsa Jan
Semestr IV



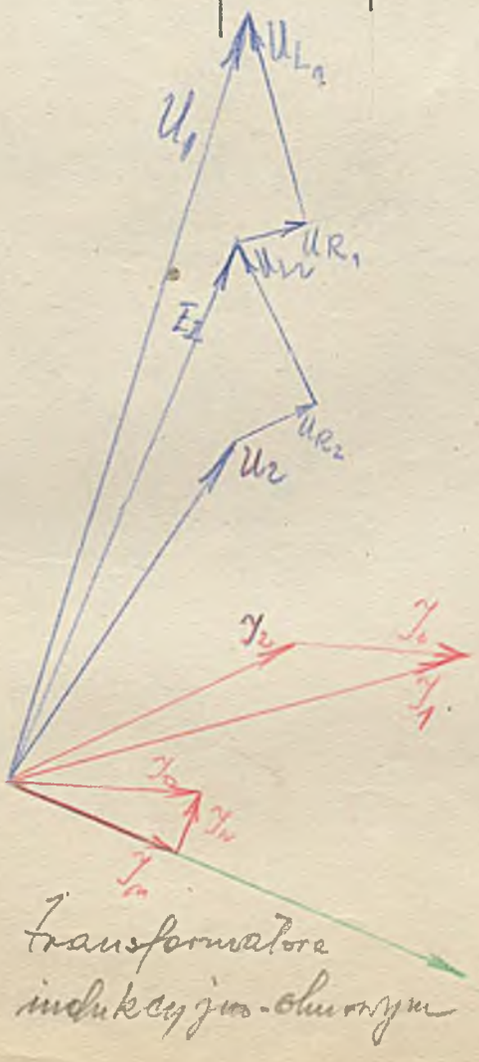


$$u_1 = E_1 + \gamma_1 R \qquad \hat{u}_1 = \hat{E}_1 + \hat{\gamma}_1 \hat{Z}_1$$

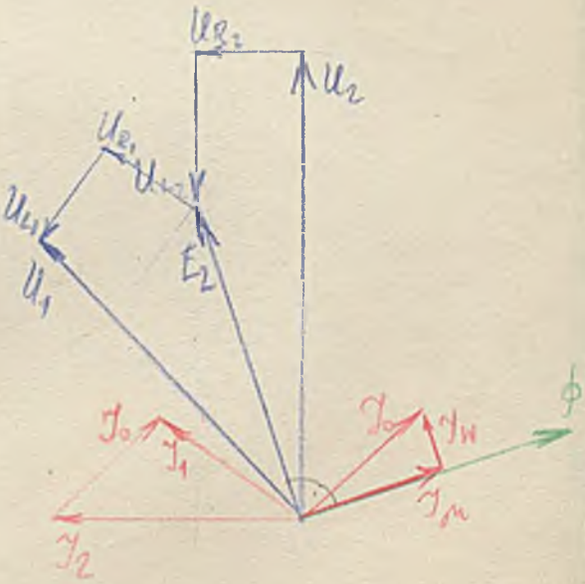
$$u_2 = E_2 - \gamma_2 R_2 \qquad \hat{u}_2 = \hat{E}_2 - \hat{\gamma}_2 \hat{Z}_2$$



Wykres

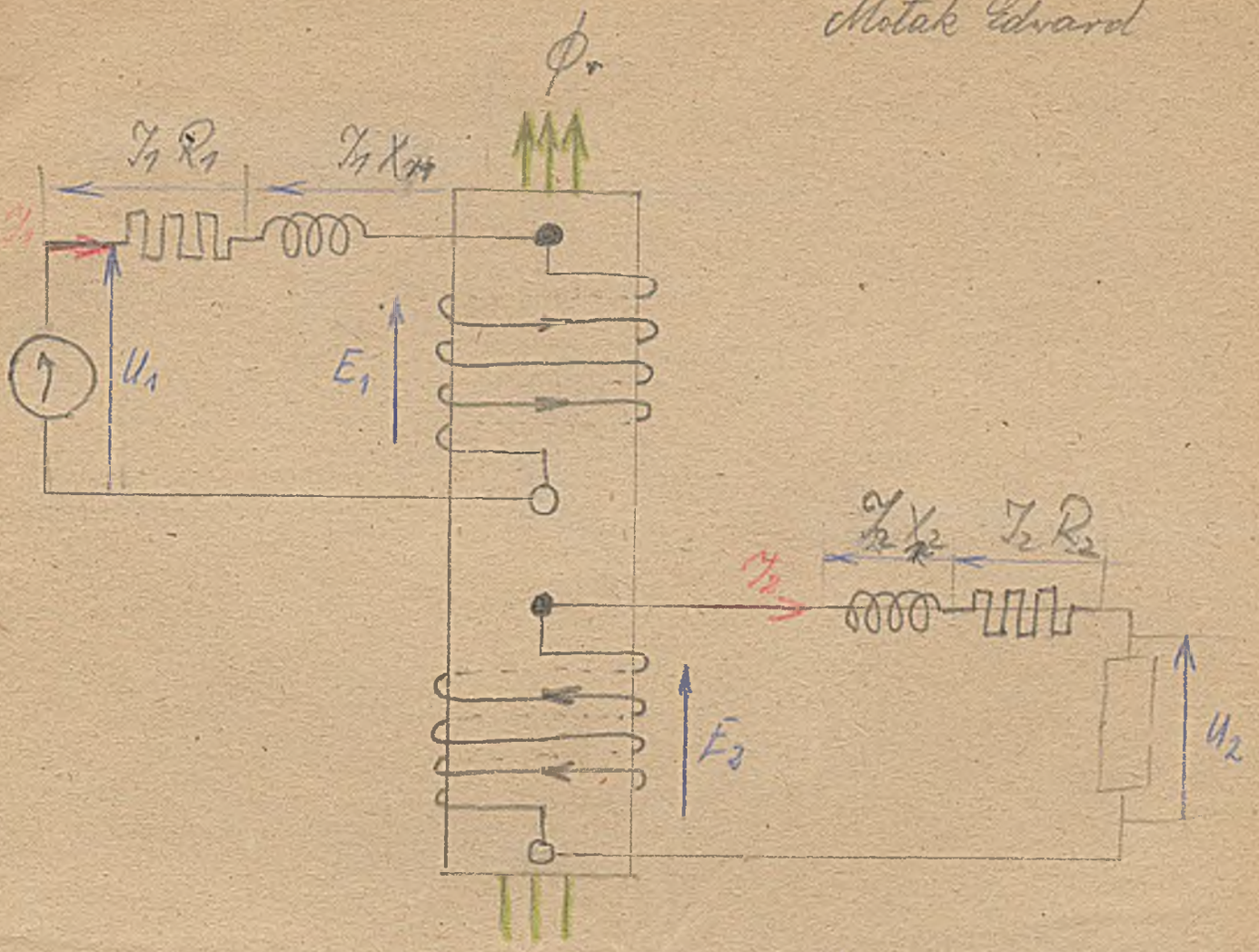


Wykres dla transformatora o obciążeniu indukcyjno-ohmowym



Wykres transformatora dla obciążenia czysto pojemnościowego

Motak Edvard



$$U_{1t} - I_{1r} R - L_{1r} \frac{dI_t}{dt} - E_{1t} = 0$$

$$U_{2t} + I_{2t} R + L_{2r} \frac{dI_{2t}}{dt} - E_{2t} = 0$$

$$\hat{U}_1 - \hat{I}_1 R_1 - \hat{I}_1 \hat{X}_{1r} - \hat{E}_1 = 0$$

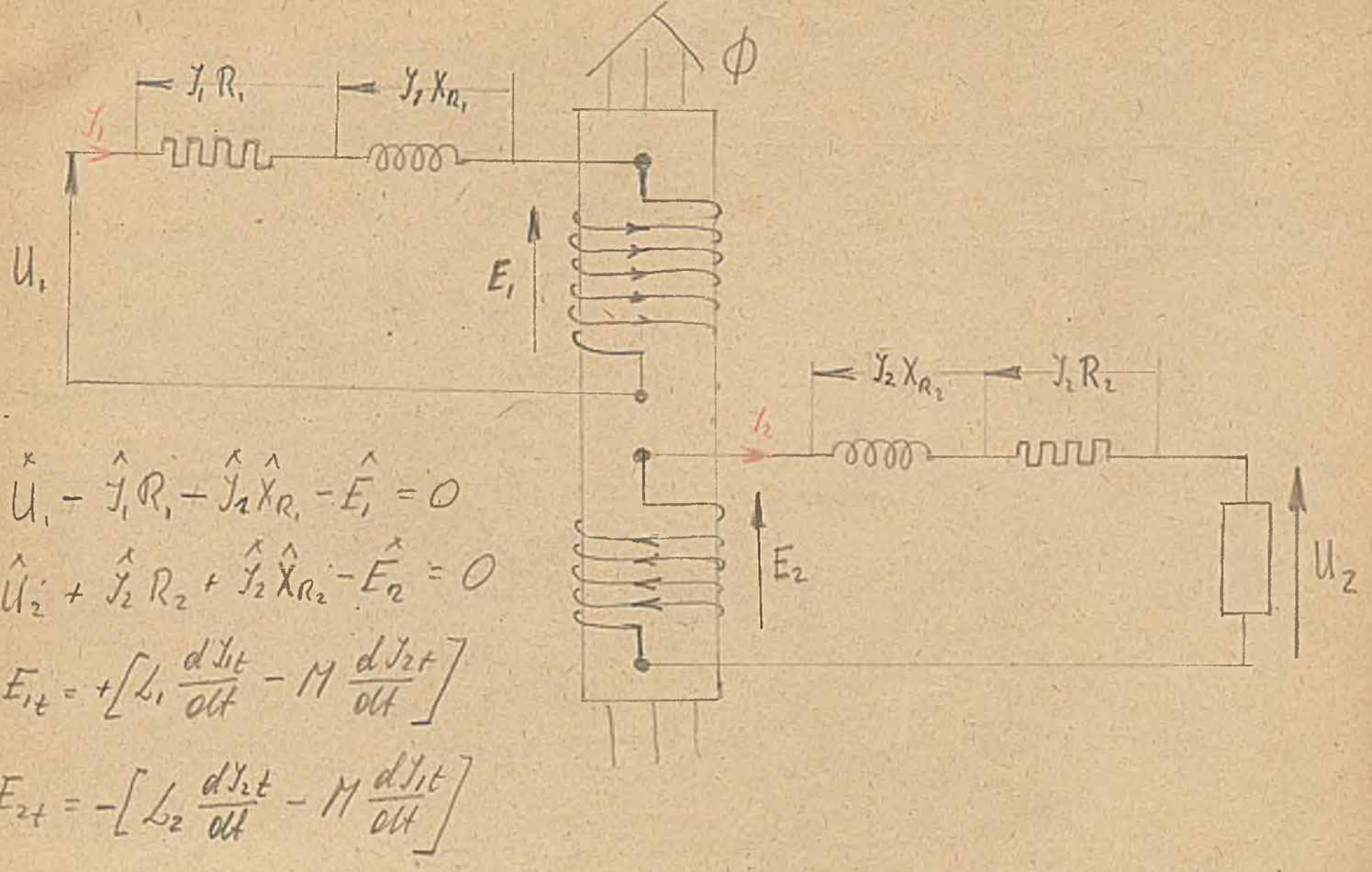
$$\hat{U}_2 + \hat{I}_2 R_2 + \hat{I}_2 \hat{X}_{2r} - \hat{E}_2 = 0$$

$$\hat{I}_1 \hat{X}_1 = j\omega L_{1r} \hat{I}_1$$

$$\hat{Z}_1 = R_1 + j L_{r1} \omega$$

$$\hat{Z}_2 = R_2 + j L_{r2} \omega$$

$$\underline{\mathcal{B}} = \frac{0{,}4\mathcal{I}}{S}\left(\mathcal{I}_1 z_1 - \mathcal{I}_2 z_2\right)$$



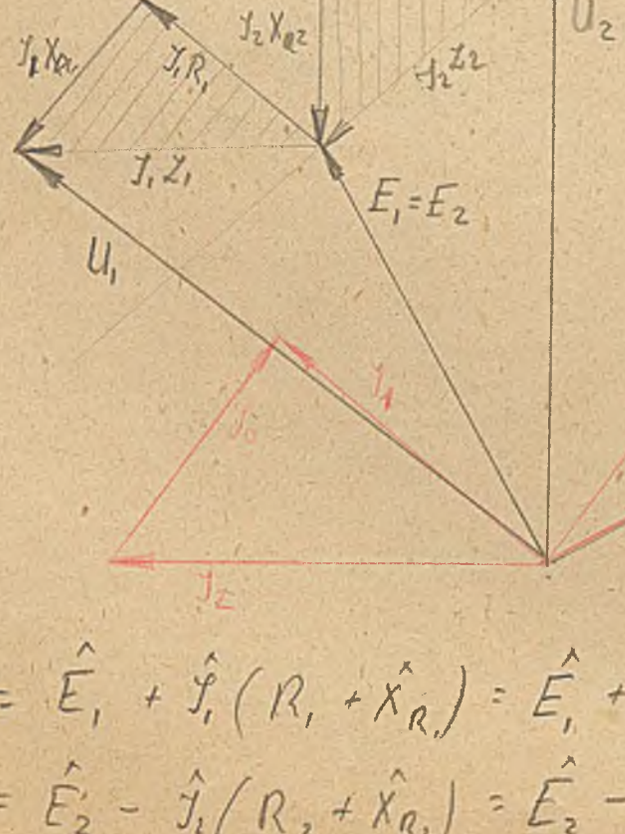
$$\hat{U}_1 - \hat{I}_1 R_1 - \hat{I}_1 \hat{X}_{R_1} - \hat{E}_1 = 0$$

$$\hat{U}_2 + \hat{I}_2 R_2 + \hat{I}_2 \hat{X}_{R_2} - \hat{E}_2 = 0$$

$$E_{1t} = +\left[L_1 \frac{dI_{1t}}{dt} - M \frac{dI_{2t}}{dt}\right]$$

$$E_{2t} = -\left[L_2 \frac{dI_{2t}}{dt} - M \frac{dI_{1t}}{dt}\right]$$

$$E = 4{,}44\, \Phi_m f \cdot z \cdot 10^{-8}\ V$$



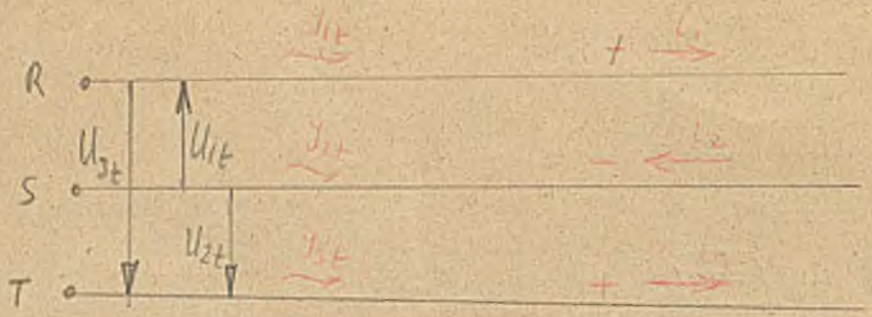
$$X_R = L_R \omega$$

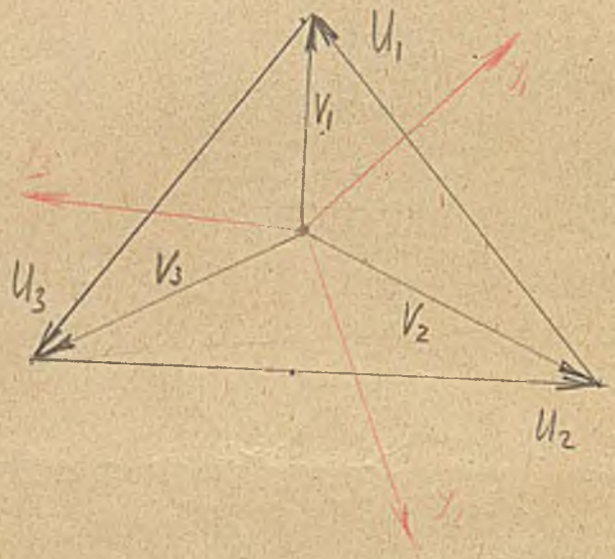
$$\hat{\Phi} = \frac{0{,}4\pi}{S}\left(\hat{I}_1 z_1 - \hat{I}_2 z_2\right)$$

$$\hat{U}_1 = \hat{E}_1 + \hat{I}_1\left(R_1 + \hat{X}_{R_1}\right) = \hat{E}_1 + \hat{I}_1 \hat{Z}_1 \qquad \hat{Z}_1 = R_1 + j L_{R_1} \omega$$

$$\hat{U}_2 = \hat{E}_2 - \hat{I}_2\left(R_2 + \hat{X}_{R_2}\right) = \hat{E}_2 - \hat{I}_2 \hat{Z}_2 \qquad \hat{Z}_2 = R_2 + j L_{R_2} \omega$$

$$\boxed{\hat{U}_1 = \hat{E}_1 + \hat{I}_1 \hat{Z}_1} \qquad \boxed{\hat{U}_2 = \hat{E}_2 - \hat{I}_2 \hat{Z}_2}$$


R
S
T
U_{3t}
U_{1t}
U_{2t}

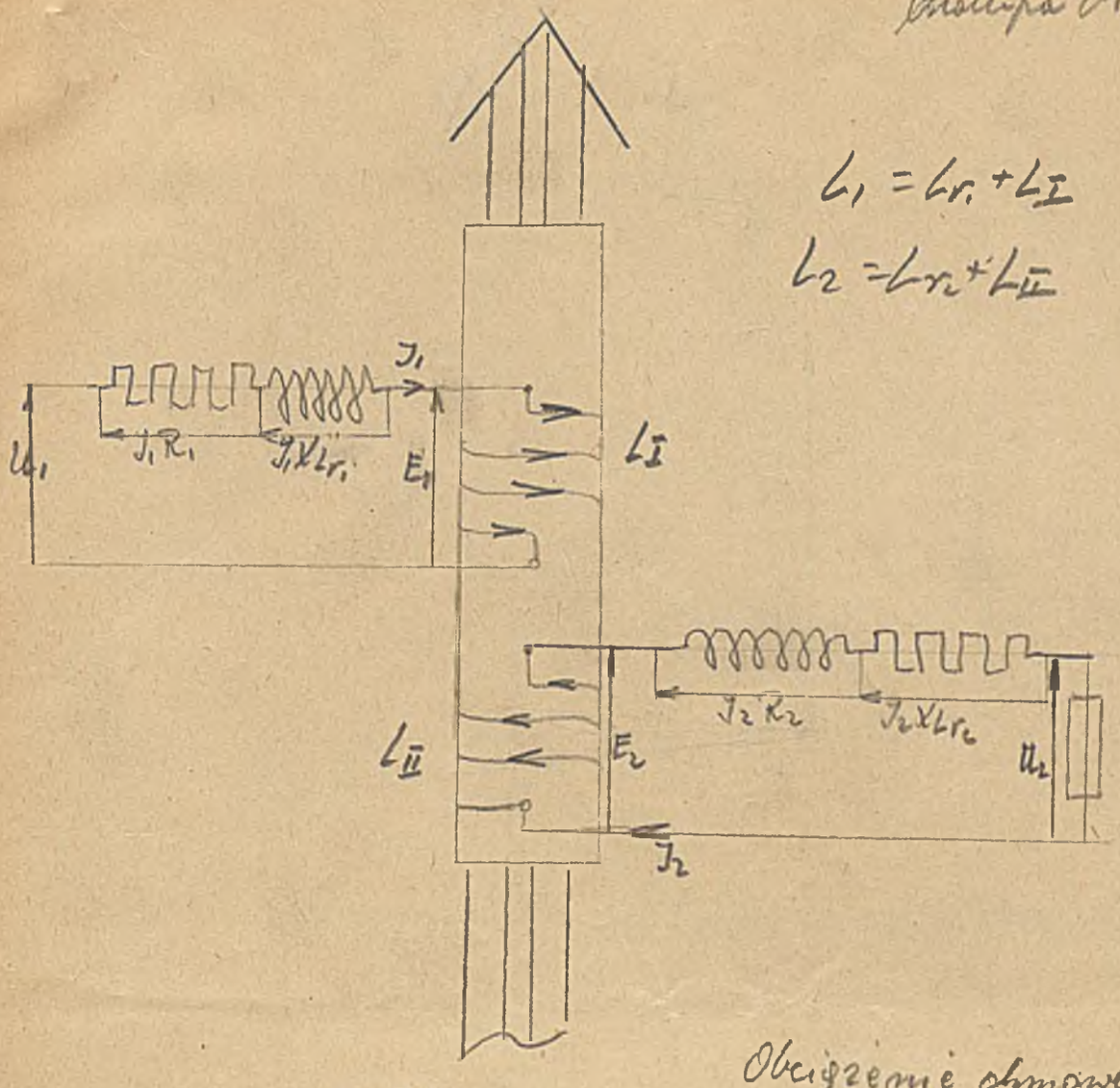

U_1
V_1
U_3
V_3
V_2
U_2

Andrzej Grabowski

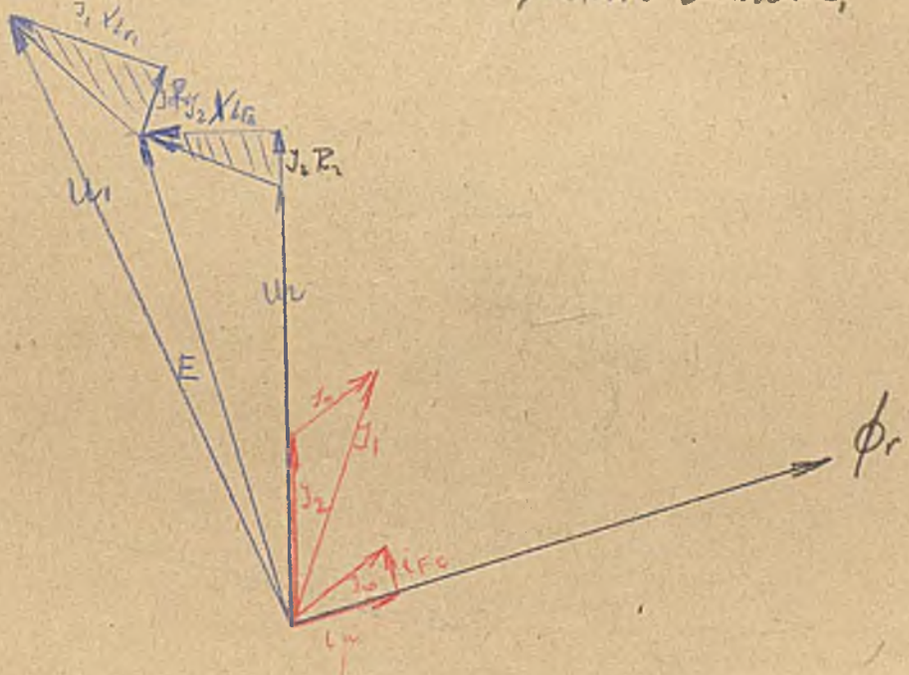
Strona 11. 7.

$L_1 = L_{r_1} + L_{II}$

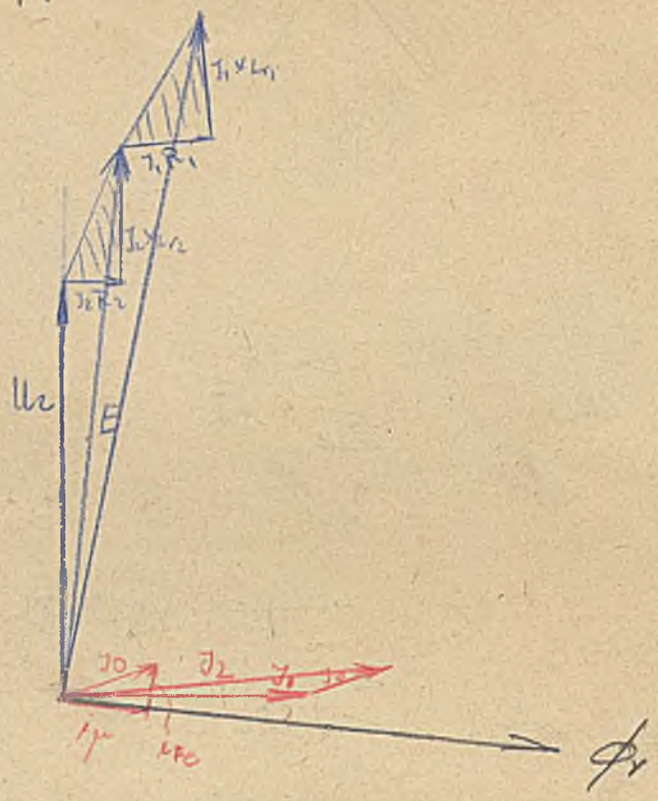
$L_2 = L_{r_2} + L_{II}$



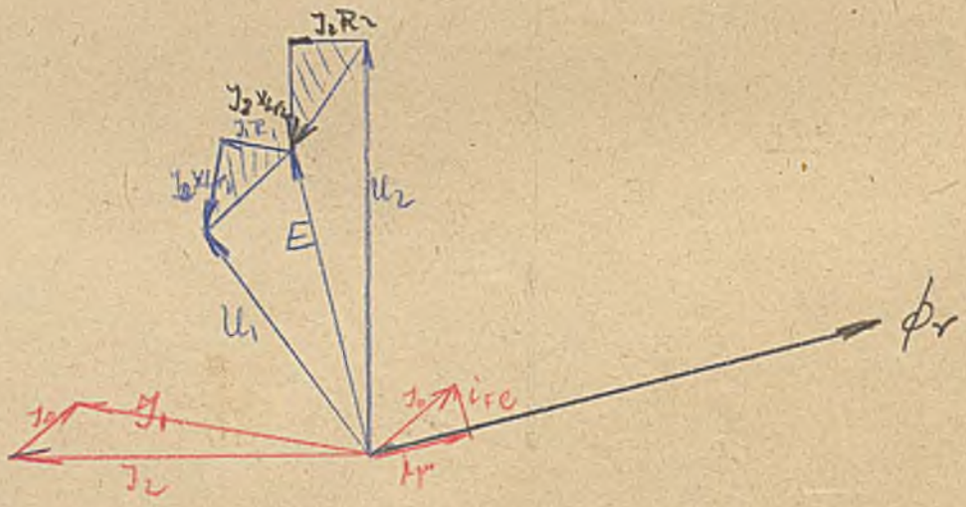
Obciążenie ohmowe.



Obciążenie indukcyjne.

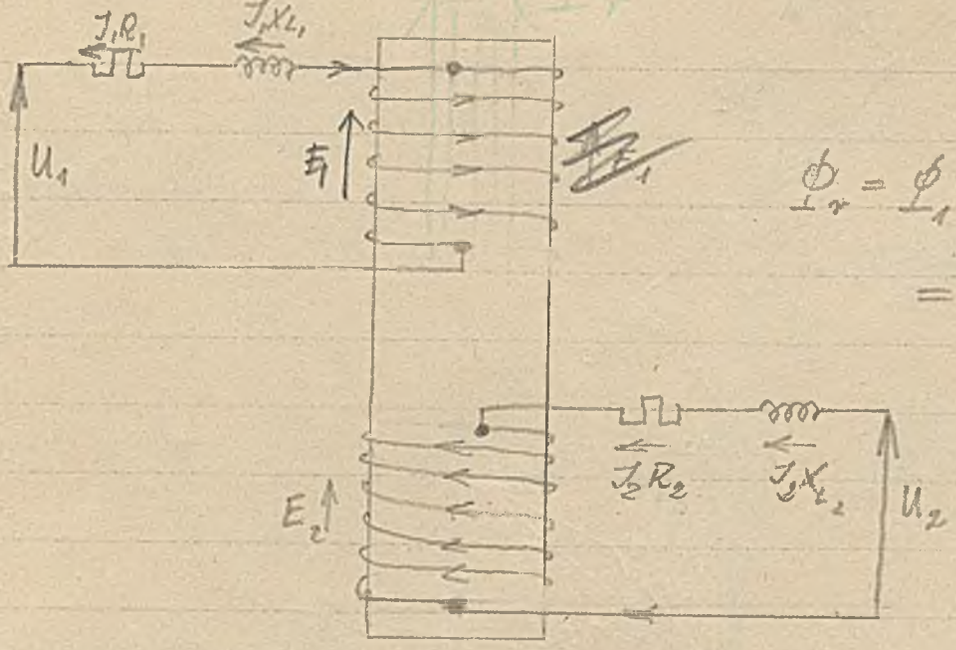


Obciążenie pojemnościowe.



(3)

Andrzej Grabowski



$$\Phi_r = \Phi_1 - \Phi_2 = \frac{0{,}4\pi I_1 z}{s} - \frac{0{,}4\pi I_2 z}{s}$$

$$= \frac{0{,}4\pi z}{s}(I_1 - I_2)$$

I_0 – prąd biegu jałowego

$$U_{1t} = E_1 + I_1 R_1 + L_{r1}\frac{dI_1}{dt}$$

$$U_{2t} = E_2 - I_2 R_2 - L_{r2}\frac{dI_2}{dt}$$

$$E_1 = \left[L_1 \frac{dI_1}{dt} - M\frac{dI_2}{dt}\right]$$

$$E_2 = -\left[L_2\frac{dI_2}{dt} - M\frac{dI_1}{dt}\right]$$

$$U_1 = I_1 R_1 + \left[L_1\frac{dI_1}{dt} - M\frac{dI_2}{dt}\right] + L_{r1}\frac{dI_1}{dt}$$

$$\hat{U}_1 = \hat{I}_1 R_1 + L_{r1}\frac{d\hat{I}_1}{dt} + \left[L_1\frac{d\hat{I}_1}{dt} - M\frac{d\hat{I}_2}{dt}\right]$$

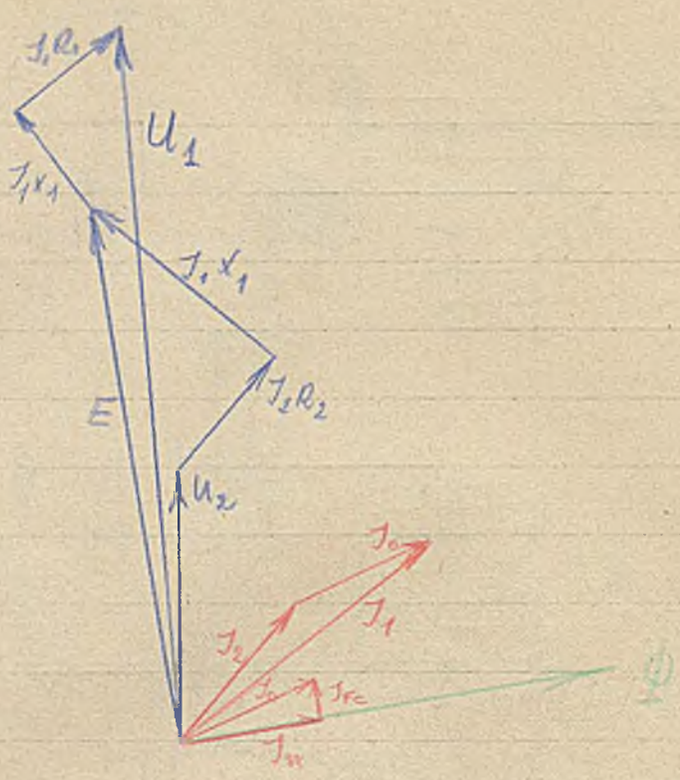
$$\hat{U}_1 = \hat{I}_1 R_1 + j\omega L_{r1}\hat{I}_1 + \left[j\omega L_1 \hat{I}_1 - j\omega M \hat{I}_2\right]$$

$$\hat{U}_1 = \hat{I}_1 R_1 + j\omega L_{r1}\hat{I}_1 + j\omega\left[L_1 I_1 - M\hat{I}_2\right] \quad \text{I}$$

$$\hat{U}_2 = -\hat{I}_2 R_2 - L_{r2}\frac{d\hat{I}_2}{dt} - \left[L_2\frac{d\hat{I}_2}{dt} - M\frac{d\hat{I}_1}{dt}\right]$$

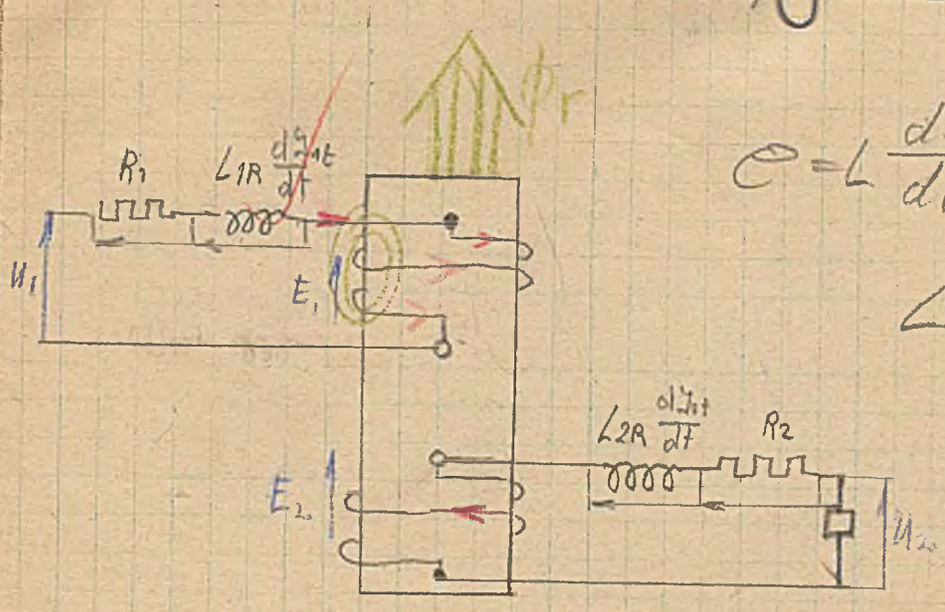
$$\hat{U}_2 = -\hat{I}_2 R_2 - j\omega L_{r2}\hat{I}_2 - j\omega\left[L_2\hat{I}_2 - M\hat{I}_1\right] \quad \text{II}$$

$$\hat{E}_m = \hat{E}_1 = \hat{E}_2 = 4{,}44 j \hat{\Phi}_m f z \cdot 10^{-8}$$



U_2
I_2
I_2R_2
I_2X_2
E
Φ
I_m
I_{fc}
I_0
I_1
I_{X_1}
I_1R_1
U_1

Równanie różniczkowe transformatora



$$e = L\frac{dJ}{dt}$$

$$L = \frac{\Phi N}{J} = \frac{\Phi_m \sin\omega t \cdot N}{J_m \sin\omega t} = \frac{\Phi_m N}{J_m}$$

$$L = \frac{\mu S N^2}{l}$$

$$u_{1t} - J_{1t}R_1 - L_{1R}\frac{dJ_{1t}}{dt} - E_{1t} = 0$$

$$u_{2t} + J_{2t}R_2 + L_{2R}\frac{dJ_{2t}}{dt} - E_{2t} = 0$$

$$u_{1t} = E_{1t} + J_{1t}R_1 + L_{1R}\frac{dJ_{1t}}{dt}$$

$$u_{2t} = E_{2t} - J_{2t}R_2 - L_{2R}\frac{dJ_{2t}}{dt}$$

$$J_t = J_m \sin(\omega t + \varphi)$$

Zespolone:

$$\hat{U}_1 = \hat{E}_1 + \hat{J}_{1R1} + \hat{J}_1 \hat{X}_{1R}$$

$$\hat{U}_2 = \hat{E}_2 - \hat{J}_2 R_2 - \hat{J}_2 \hat{X}_{2R}$$

$$\hat{U}_1 = \hat{E}_1 + \hat{J}_1 R_1 + j\omega L_{1R}\hat{J}_1$$

$$\hat{U}_2 = \hat{E}_2 - \hat{J}_2 R_2 - j\omega L_{2R}\hat{J}_2$$

$$E_t = N\frac{d\Phi_t}{dt}\cdot 10^{-8}\,V$$

$$\Phi_t = \Phi_m \sin\omega t$$

$$E_t = \omega N \Phi_m \cos\omega t \cdot 10^{-8}$$

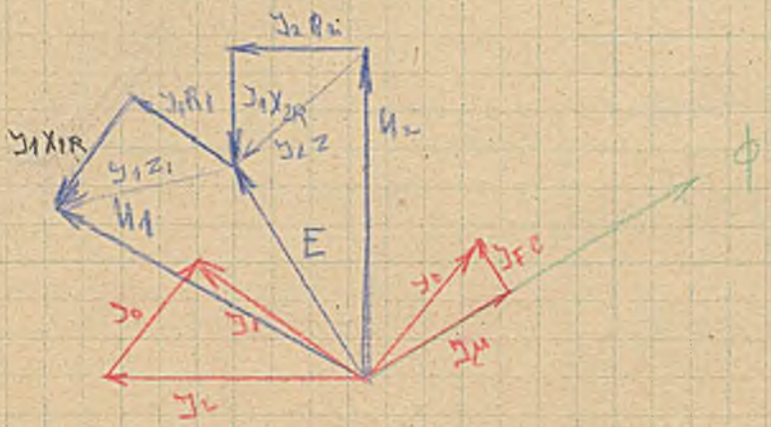
$$E_m = 2\pi f \Phi_m N \cdot 10^{-8}$$

$$E = \frac{2\pi}{\sqrt{2}} f \Phi_m N \cdot 10^{-8} = 4{,}44 \Phi_m f N \cdot 10^{-8}$$

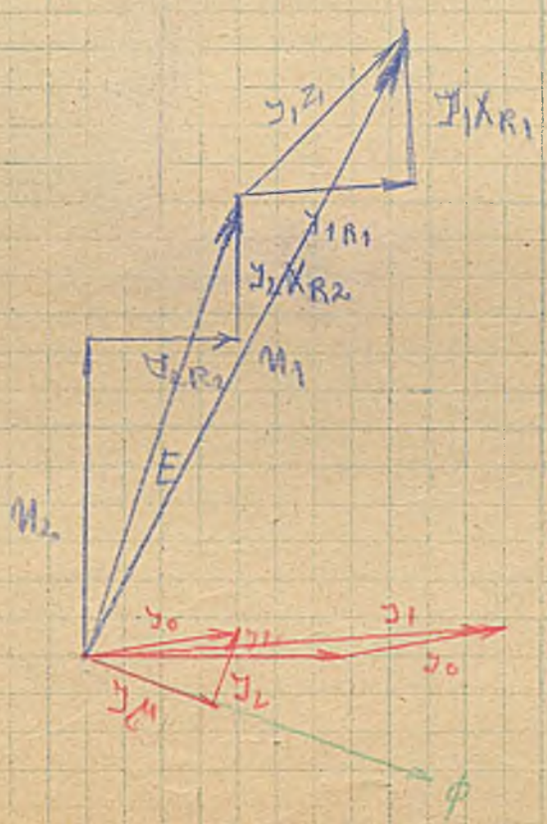
$$\hat{E} = j\,4{,}44\,\Phi_m f N$$

Wykres do ćw. pojęcia.

Ćw. pojemnościowe



Obciążenie indukcyjne



$E_1 = j4{,}44\, \Phi_{1m}\, z_1\, 10^{-8}$

$E_2 = j4{,}44\, \Phi_{2m}\, z_2\, 10^{-8}$

$\hat{Z} = R + jX$

$Z = \sqrt{R^2 + (L\omega)^2}$

$\hat{U}_1 = \hat{E}_1 + \hat{I}_1 \hat{Z}_1 + j\omega L_{1R} \hat{I}_1$

$U_2 = \hat{E}_2 - \hat{I}_2 \hat{Z}_2 + j\omega L_{1R} \hat{I}_2$

$\hat{U}_1 = \hat{E}_1 + \hat{I}_1 (\hat{Z}_2 + j\omega L_{1R})$

$U_2 = \hat{E}_2 - \hat{I}_2 (\hat{Z}_2 - j\omega L_{1R})$

$\hat{E}_1$

$\hat{E}_2$

Kańtoch Karol

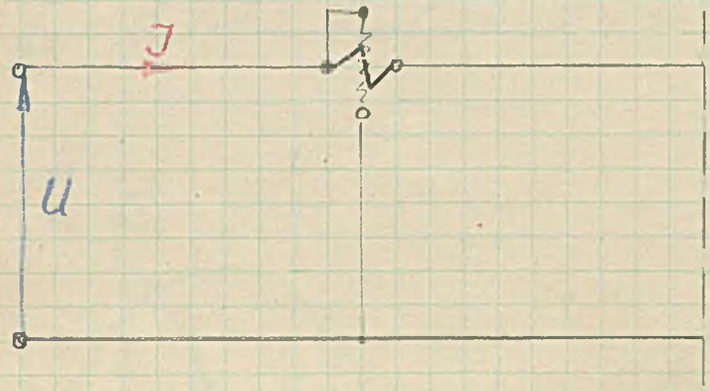
Gliwice. dn. 4. XI. 1949r.

dobrze

Egzamin ustny z Podstaw elektr.

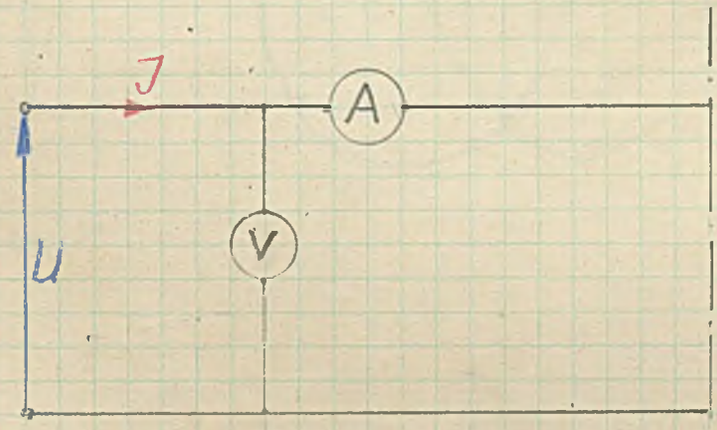
Pomiar mocy:

Pomiar mocy prądu stałego.



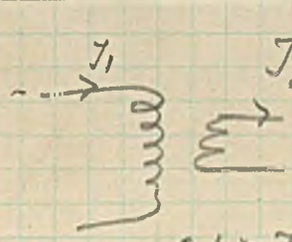
Przy pomocy watomierza

$P = U \cdot J;$



Przy pomocy Woltomierza i Amperomierza

$P = UJ;$



$$J_2 = J_{2r} \frac{Z_1}{Z_2} Z_2$$

$$\phi = \phi_1 - \phi_2 = \frac{0{,}4\pi J_1 z_1}{S} - \frac{0{,}4\pi J_2 z_2}{S} =$$

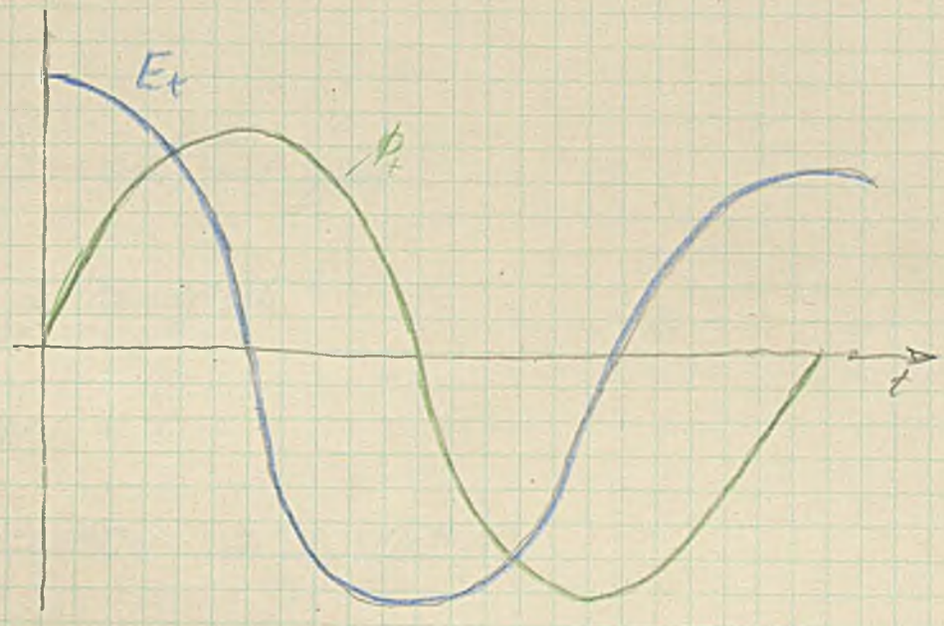
$$J_2 = J_{2r} \frac{Z_1}{Z_2} Z_2$$

$$E_t = z \frac{d\Phi_t}{dt} 10^{-8} \; V$$

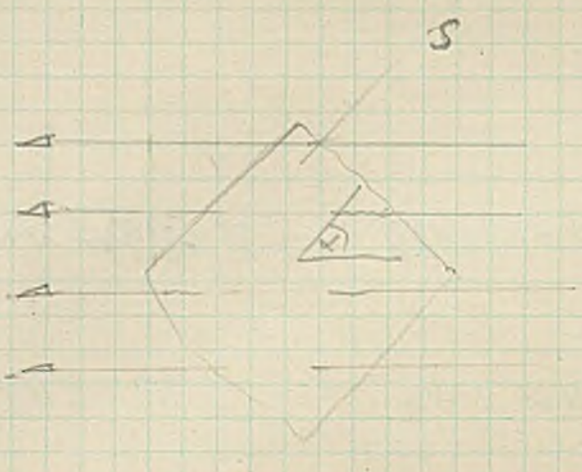
$$\Phi_t = \Phi_m \sin(\omega t + \alpha)$$

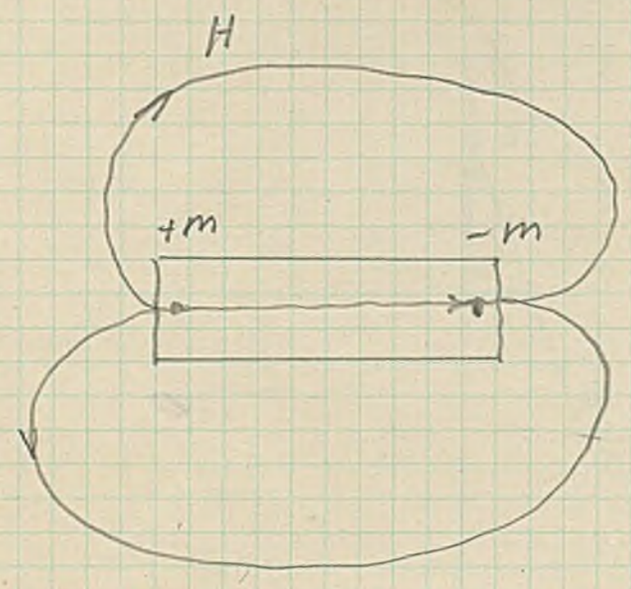
$$E_t = z \frac{d}{dt} \Phi_m \sin(\omega t + \alpha) 10^{-8} = z \omega \Phi_m \sin(\omega t + \alpha + \frac{\pi}{2}) 10^{-8}$$

$$E_t = z 2\pi f z \Phi_m (\omega t + \alpha + \frac{\pi}{2}) \qquad \omega = 2\pi f$$



$$\Phi = \int_S \bar{B}\, d\bar{S} =$$





$$H = \frac{F}{m} = \sum \frac{m_i}{\mu l_i^2}$$

$$\dim F = L M T^{-2}$$

$\langle F \rangle$ = cal fmt gsch^{-2}

$\langle F \rangle_{CGS}$ = cm g sek^{-2}

$F = 100$

$F = 100$ cm g sek^{-2}

$F = 100$ dyn

$$H = \frac{0.4\pi J_z}{l_{cm}} \quad \overset{A}{\overset{''}{O}}$$

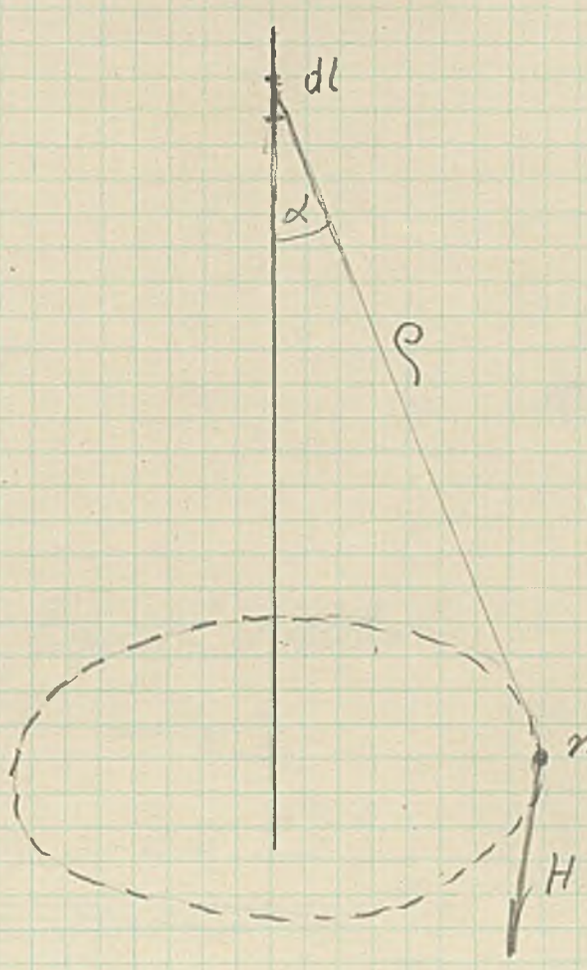
$$H_k = \frac{J^A}{l_m} \quad \overset{nO''}{}$$

$$nO'' = \frac{4\pi}{10} O''$$

$K = 3000$ V/cm

$K_k = 300000$ V/m

Kanfoch Karol



$$dF = m \frac{J_A dl \sin\alpha}{\rho^2}$$
dyn

$$dF = m \frac{J_A dl \sin\alpha}{10\,\rho^2}$$
dyn

$$MA = 10A. = 3 \cdot 10^9 EA$$

$$dF = \frac{m\, J_{EA} dl \sin\alpha}{3 \cdot 10^9 \rho^2}$$

$$dF = \frac{m\, J^{mA} dl \sin\alpha}{10 \cdot 10^3 \rho^2}$$

$$1A = 10^{-3} mA$$

$$1kA = 10^3 A.$$

$$dF = \frac{m\, J^{kA} dl \sin\alpha\, 10^3}{10\,\rho^2}$$

Kanfoch Karol. $R_W = 1\Omega$

$z = 20$

μA

$5 \cdot 10^{-6} A$

$50 mA$

$5 \cdot 10^{-2}$

$50 \mu A.$

J

$J_z = 0{,}8 Hl$

$5 \cdot 10^{-2} 20 = 0{,}8 Hl$

$5 \cdot 10^{-6} x = 0{,}8 Hl$

$\frac{5 \cdot 10^{-6} x}{5 \cdot 10^{-2} 20} = 1$

$\frac{10^{-4} x}{20} = 1$

$x =$

Ilość zwojów / rolkę wicy. →

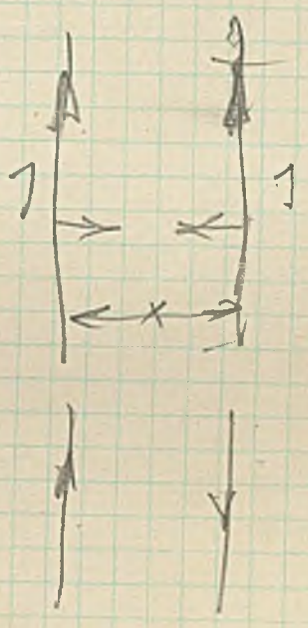
$\frac{x}{20 \cdot 10^4} = 1$

$x = 20 \cdot 10^4$

$x = 20 \cdot 10^4 = 2 \cdot 10^5$ zwoji

$F = \mu \, 2\pi_1 \, \pi_2 \frac{l}{x} \, dn$

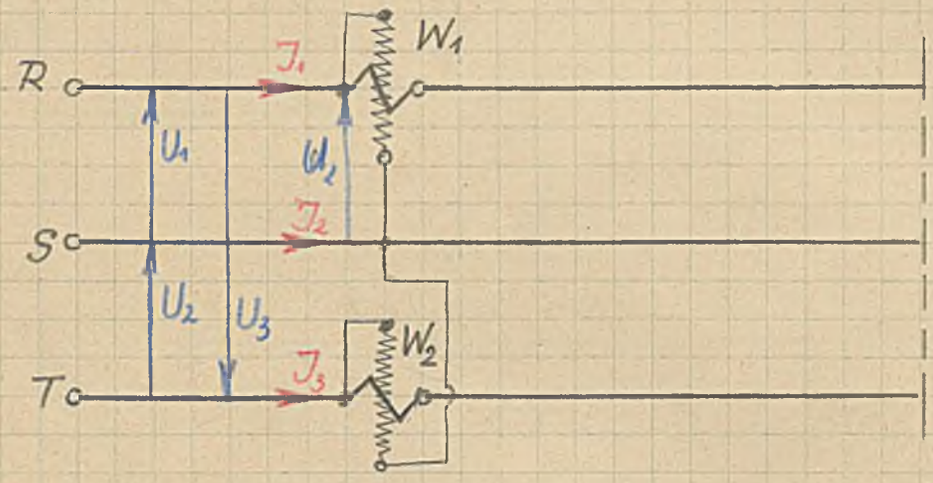
dn



Kantoch Karol

dobre

Pomiar mocy trójfazowej nierównomiernie obciążonego



$$\hat{P}_1 = \hat{U}_1 \cdot \check{J}_1$$

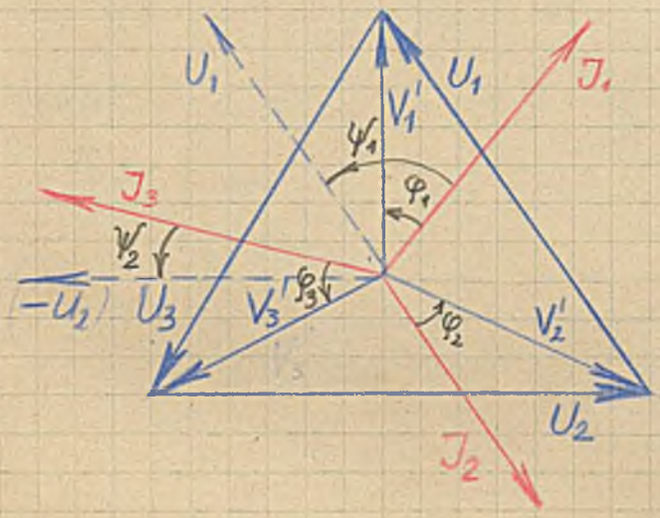
$$\hat{P}_2 = (-\hat{U}_2) \cdot \check{J}_3$$

$$\hat{P} = \hat{P}_1 + \hat{P}_2 = \hat{U}_1 \cdot \check{J}_1 + (-\hat{U}_2) \cdot \check{J}_3 \;;$$

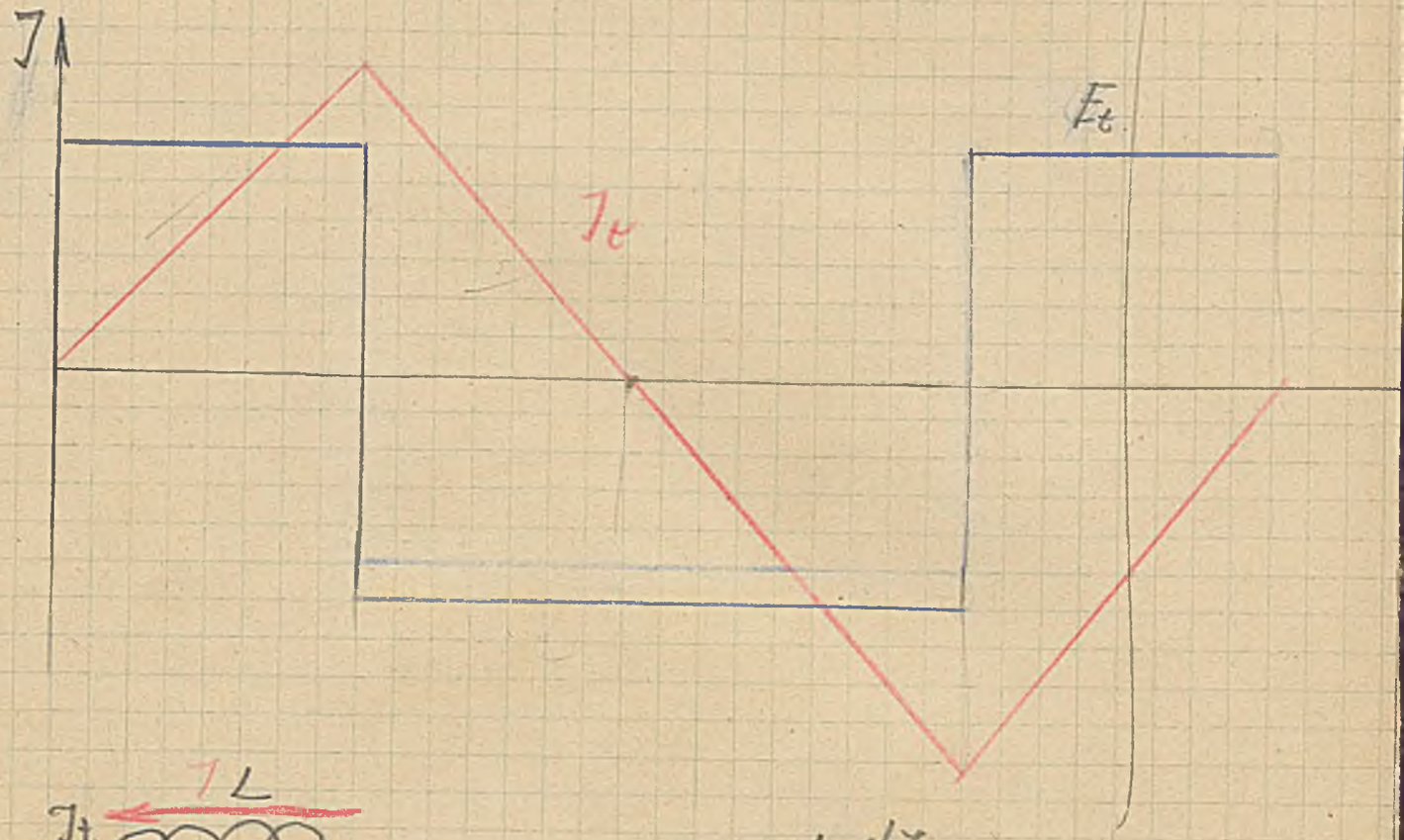
$$P_{1w} = U_1 \cdot J_1 \cdot \cos\Psi_1 = U_1 J_1 \cos(\varphi_1 + 30^\circ)$$

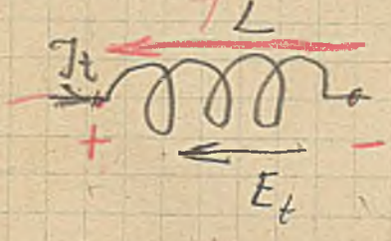
$$P_{2w} = U_2 \cdot J_3 \cdot \cos\Psi_2 = U_2 J_3 \cos(\varphi_3 - 30^\circ)$$

$$P = P_{1w} + P_{2w} = U_1 J_1 \cdot \cos(\varphi_1 + 30^\circ) + U_2 J_3 \cos(\varphi_3 - 30^\circ)$$



Kańtoch Karol

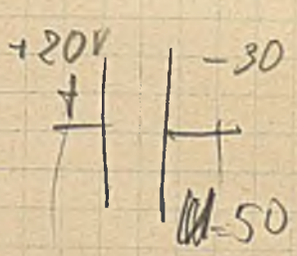




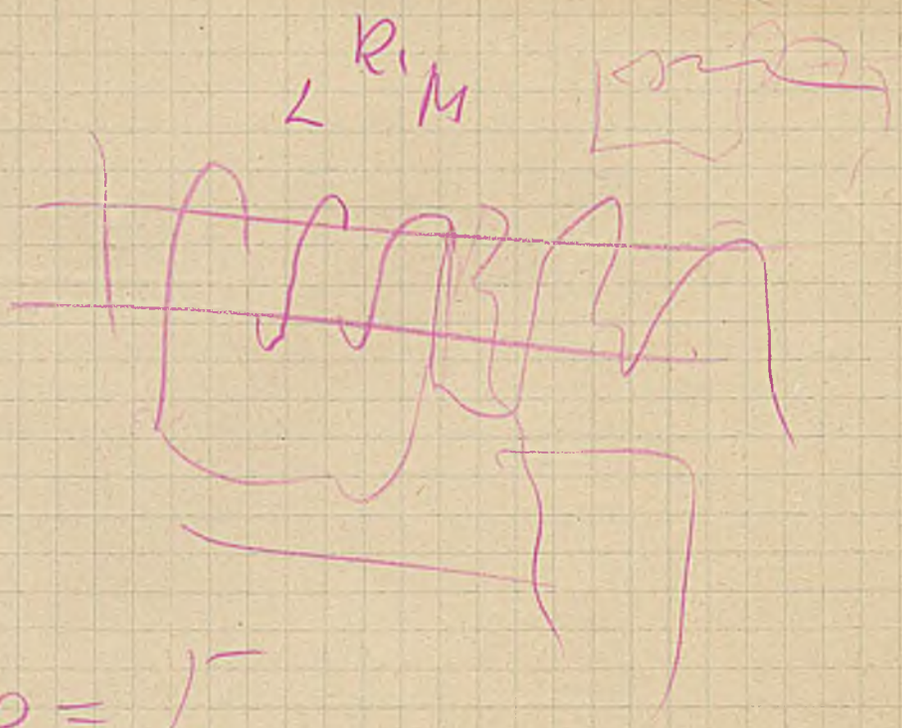
$$E_t = L \frac{dJ_t}{dt}$$

$$W = \frac{1}{2} L J^2$$

$$W = \frac{1}{2} C U^2$$

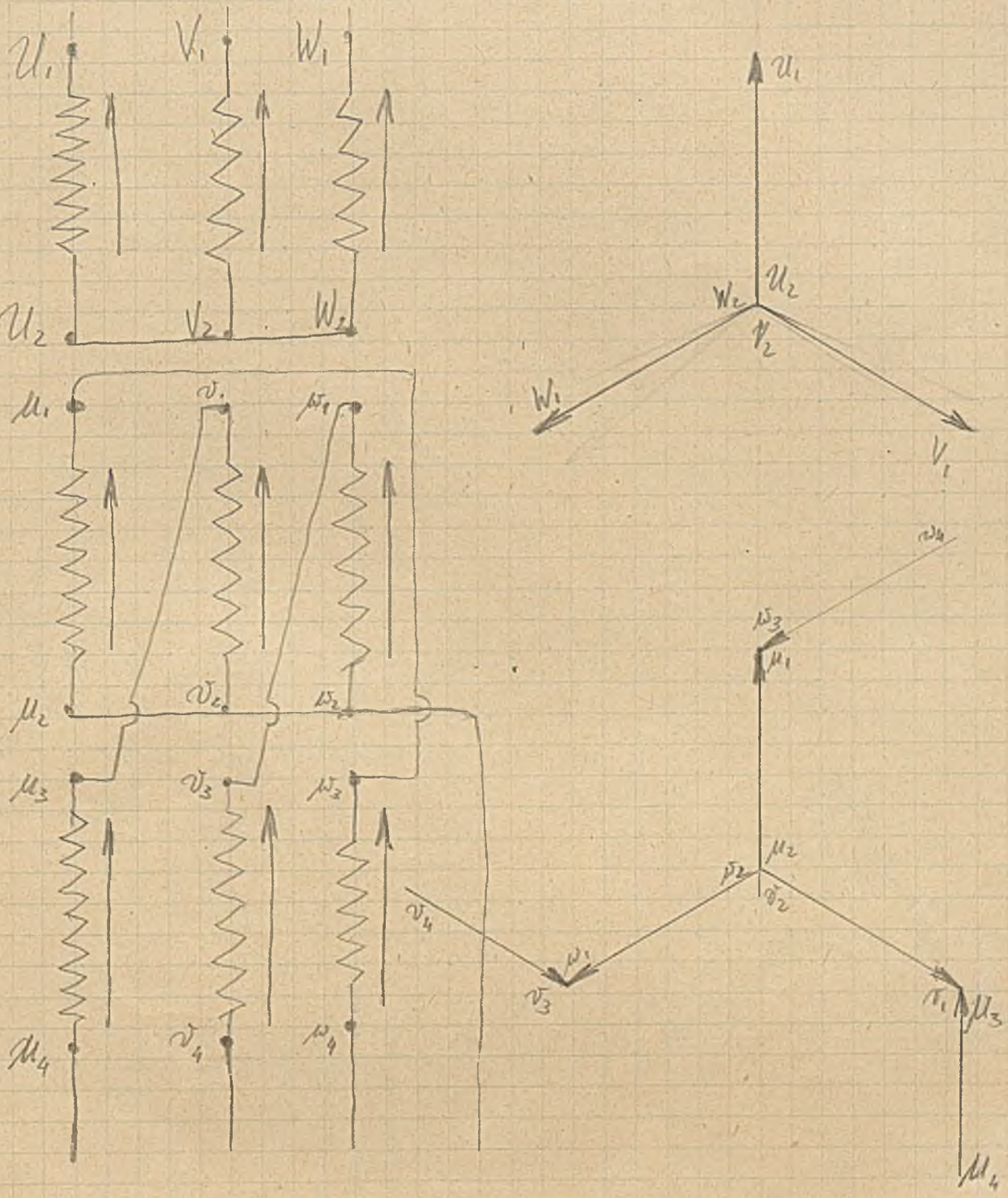


$$U = V_6 - V_6$$

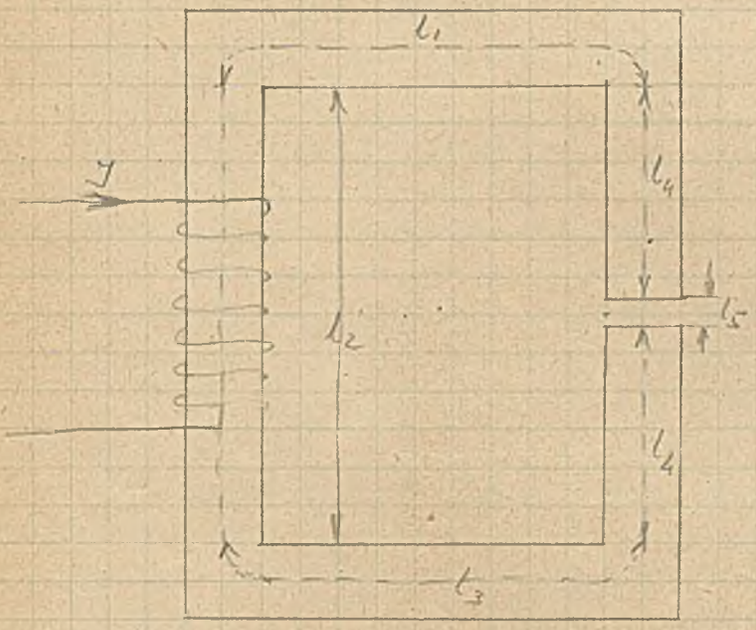

R1
M

Bobusia Adolf 23.IX.49

Egzamin ustny z
Podstaw Elektrotechniki



Magnetyczne prawo Ohma



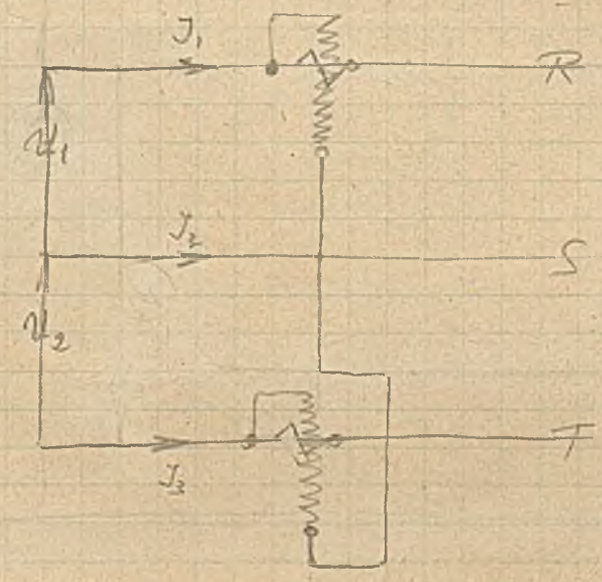
$$\Phi = \frac{N}{S} \qquad S = \frac{l}{\mu \rho}$$

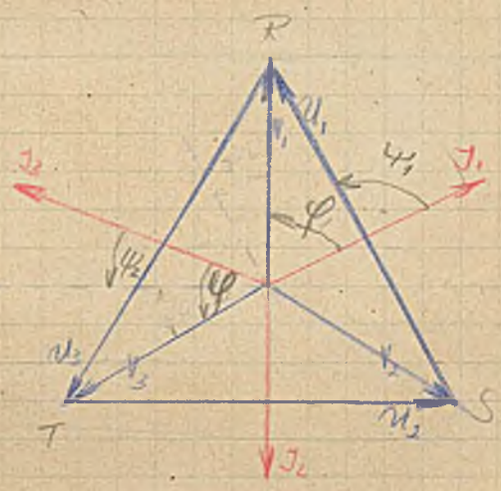
$$\sum N = \sum (\Phi S)$$

$$0{,}4\pi I_{(z)} z = \sum \left(B \frac{l_i}{\mu} \right)$$

$$0{,}4\pi I_{(n)} z = \sum (H l_i)$$

Pomiar mocy w układzie trójfazowym obciążonym nierównomiernie.





$$\Psi_1 = \varphi + 30^\circ$$

$$\Psi_2 = \varphi - 30^\circ$$

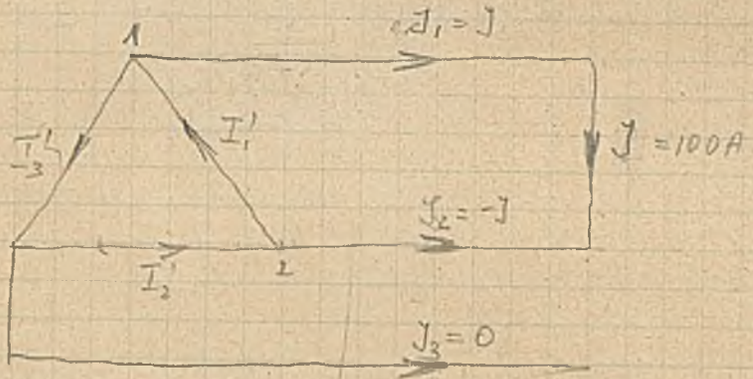
$$P_H = P_1 + P_2$$

$$P_1 = U_1 I_1 \cos \Psi_1$$

$$P_2 = -U_2 I_3 \cos \Psi_2$$

$$P_W = U_1 I_1 \cos \Psi_1 - U_2 I_3 \cos \Psi_2$$

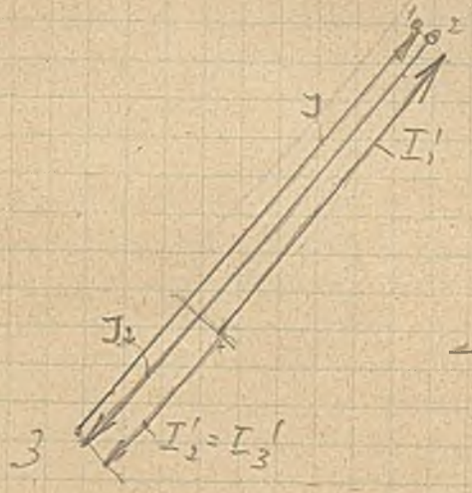
Dla równomiernego obciążenia $P = \sqrt{3}\, U I \cos \varphi$

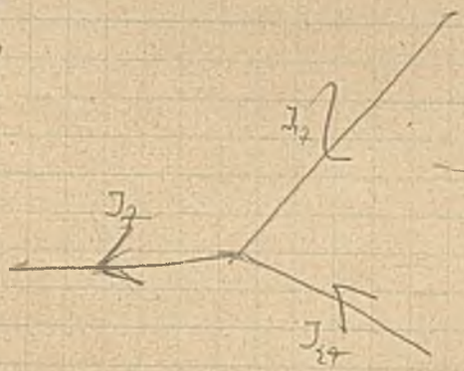


$$\hat{\underline{I}}_1' = \hat{\underline{J}}_1 + \frac{1}{3}\hat{\underline{J}}_2 + \frac{2}{3}\hat{\underline{J}}_3 = \hat{\underline{J}} - \frac{1}{3}\hat{\underline{J}} = \frac{2}{3}\hat{\underline{J}}$$

$$\hat{\underline{I}}_2' = \hat{\underline{J}}_2 + \frac{1}{3}\hat{\underline{J}}_3 + \frac{2}{3}\hat{\underline{J}}_1 = -\hat{\underline{J}} + \frac{2}{3}\hat{\underline{J}}_1 = -\frac{1}{3}\hat{\underline{J}}$$

$$\hat{\underline{I}}_3' = \hat{\underline{J}}_3 + \frac{1}{3}\hat{\underline{J}}_1 + \frac{2}{3}\hat{\underline{J}}_2 = \frac{1}{3}\hat{\underline{J}} - \frac{2}{3}\hat{\underline{J}} = -\frac{1}{3}\hat{\underline{J}}$$





$$J_{12} = J_{m_1} \sin(\omega t + \alpha)$$

$$J_{12} = J_{m_2} \sin(\omega t + \beta)$$

$$J_{12m} = J_{1m_1} \sin(\omega t + \alpha) + J_{12m_2} \sin(\omega t + \beta) =$$

$$= J_{1m}(\sin\omega t \cos\alpha + \cos\omega t \sin\alpha) + J_{12m}(\sin\omega t \cos\beta + \cos\omega t \sin\beta) =$$

$$= (J_{m_1}\cos\alpha + J_{m_2}\cos\beta)\sin\omega t + (J_{m_2}\sin\alpha + J_{m_2}\sin\beta)\cos\omega t =$$

$$= J_m \cos\varphi \sin\omega t + J_m \sin\varphi \cos\omega t = J_m \sin(\omega t + \varphi)$$

$$I_m = \sqrt{(I_{1m}\cos\alpha + I_{2m}\cos\beta)^2 + (I_{1m}\sin\alpha + I_{2m}\sin\beta)^2}$$

$$\operatorname{tg}\varphi = \frac{I_{1m}\sin\alpha + I_{2m}\sin\beta}{I_{1m}\cos\alpha + I_{2m}\cos\beta}$$

$$\hat{I}_{1t} = \hat{I}_{1m} e^{j\omega t}$$

$$\hat{I}_{2t} = \hat{I}_{2m} e^{j\omega t}$$

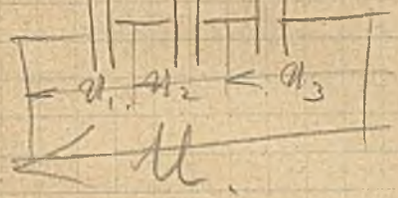
$$\hat{I}_{1m} = I_{1m} e^{j\alpha}$$

$$\hat{I}_{2m} = I_{2m} e^{j\beta}$$

$$\hat{I}_t = \hat{I}_{1t} + \hat{I}_{2t} = \left(\hat{I}_{1m} + \hat{I}_{2m}\right) e^{j\omega t} = \hat{I}_m e^{j\omega t} = I_m e^{j\varphi} e^{j\omega t}$$

$$\hat{I}_m =$$

C_1 C_2 C_3



$C_2 = 2C_1$, $C_3 = 3C_1$

$U_1 + U_2 + U_3 = U$

$$C_1 = \frac{Q}{U_1}$$

$$C_2 = \frac{Q}{U_2}$$

$$C_3 = \frac{Q}{U_3}$$

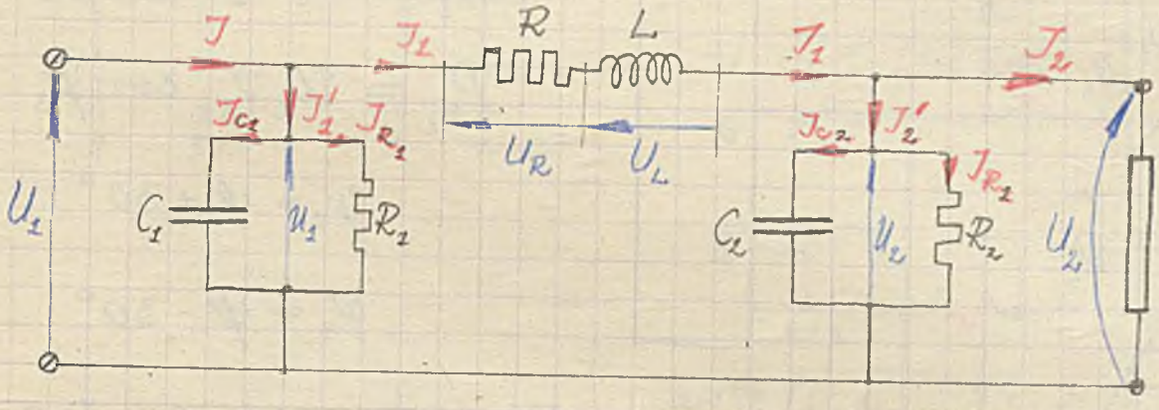
$$U_3 = \frac{Q}{3C_1}$$

$$U_2 = \frac{Q}{2C_1}$$

Prawer Jan
sem V

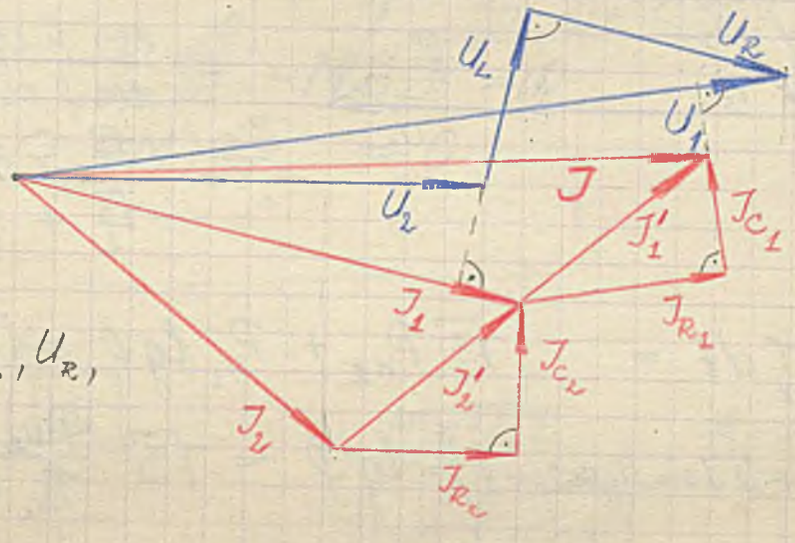
17.12.49 r.
dobre

Egzamin ustny z Podstaw elektrotechniki



$\hat{U}_2 = U_2 e^{j0°}$; $\hat{J}_2 = J_2 e^{-j40°}$

Znaleźć U_1 i J metodą topograficznych wykresów napięć i prądów

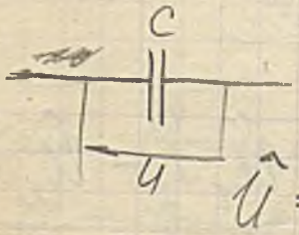


Kolejność kreślenia:

$U_2, J_2, J_{R_2}, J_{C_2}, J_2', J_1, U_L, U_R,$
$U_1, J_{R_1}, J_{C_1}, J_1', J.$

$A = \frac{1}{2} CU$ $\quad Q = C$ $\quad W = \frac{1}{2} CU^2$

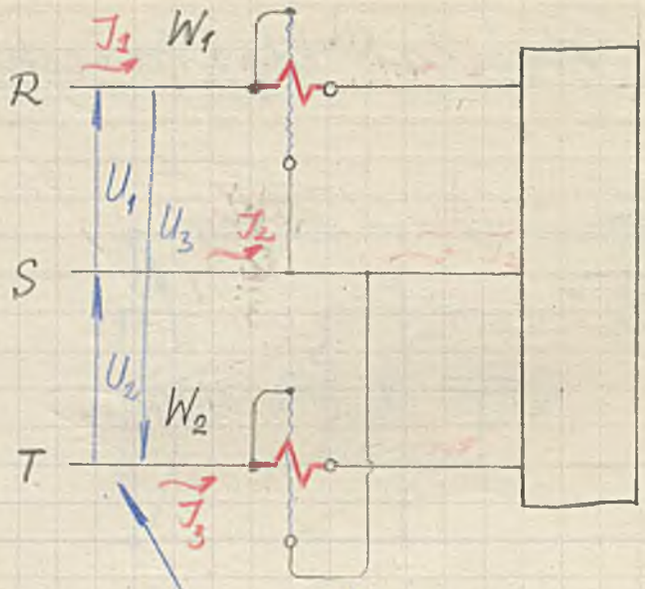
$Q = \int J\,dt$ $\quad W = \frac{1}{2} L J^2$

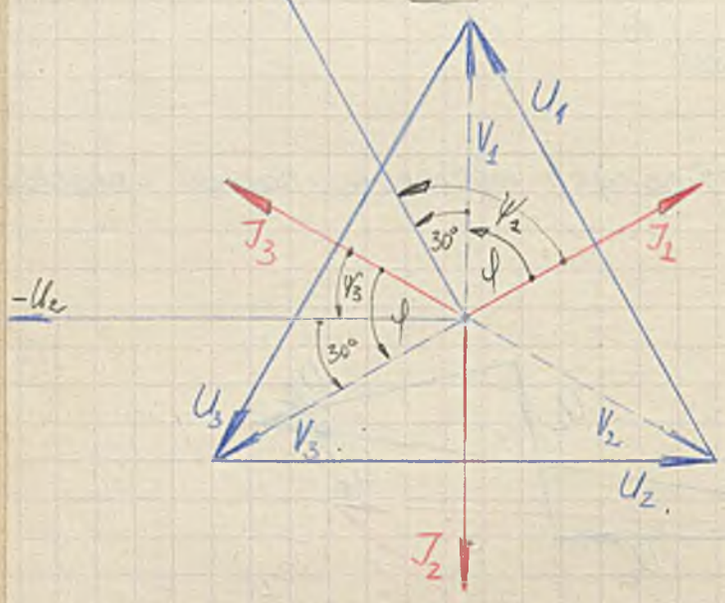


$U_t = \frac{1}{C} \int J_t\,dt$

$\hat{U} = \frac{1}{C\omega} \hat{J}$

Pomiar mocy w układzie Arona.





$$P_{całk.} = P_{W_1} + P_{W_2}$$

$$P_{W_1} = U_1 J_1 \cos\psi_1$$

$$P_{W_2} = U_2 J_3 \cos\psi_3$$

$$\psi_1 = \varphi + 30^\circ$$

$$\psi_3 = \varphi - 30^\circ$$

$$P_{całk.} = U_1 J_1 \cos(\varphi+30^\circ) + U_2 J_3 \cos(\varphi-30^\circ)$$

$$P_b = P \operatorname{tg}\varphi$$

$$\operatorname{tg}\varphi = \frac{P_{W_1}}{P_{W_2}} = \frac{\cos(\varphi+30^\circ)}{\cos(\varphi-30^\circ)} =$$

$$= \frac{\cos\varphi\cos 30^\circ - \sin\varphi\sin 30^\circ}{\cos\varphi\cos 30^\circ + \sin\varphi\sin 30^\circ} =$$

$$= \frac{\frac{\sqrt{3}}{2} - \frac{1}{2}\operatorname{tg}\varphi}{\frac{\sqrt{3}}{2} + \frac{1}{2}\operatorname{tg}\varphi} = \frac{\sqrt{3} - \operatorname{tg}\varphi}{\sqrt{3} + \operatorname{tg}\varphi}$$

$$Q = \frac{1}{T}\int_0^T u_t J_t \, dt =$$

$$= UJ\cos\varphi + UJ\sin(2\omega t + 2\varphi - \tfrac{\pi}{2})\Big|_0^T =$$

$$= UJ\cos\varphi;$$

$$\sqrt{3}\,P_{W_1} + P_{W_1}\operatorname{tg}\varphi = \sqrt{3}\,P_{W_2} - P_{W_2}\operatorname{tg}\varphi$$

$$\operatorname{tg}\varphi = \sqrt{3}\,\frac{P_{W_2} - P_{W_1}}{P_{W_2} + P_{W_1}} = \sqrt{3}\,\frac{P_{W_2} - P_{W_1}}{P}$$

$$P_b = \sqrt{3}\,(P_{W_2} - P_{W_1});$$

$$P_p = \sqrt{P_n^2 + P_b^2};$$

Symbolicznie:

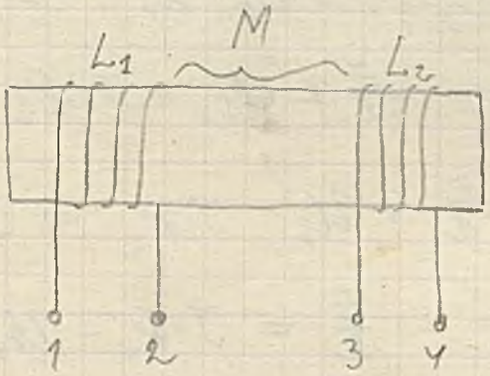
$$\hat{P} = \hat{P}_1 + \hat{P}_2$$

$$\hat{P}_1 = \hat{U}_1 \check{J}_1 \quad ; \quad \hat{P}_2 = -\hat{U}_2 \check{J}_3 \quad ;$$

$$\boxed{\hat{P} = \hat{U}_1 \check{J}_1 - \hat{U}_2 \check{J}_3}$$

Przemysław 17.12.49 r.

1)



I / 1-3 , 2-4

$L = ?$

a) $M = \sqrt{L_1 L_2}$

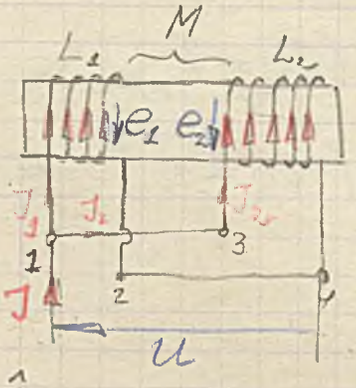
b) $M = 0$

II 2-3

$L_1 = ?$

a) $M = \sqrt{L_1 L_2}$ b) $M = 0$

ad I



a) $M = \sqrt{L_1 L_2}$ b) $M = 0$

$$\hat{u} = L_1 \frac{d\hat{J}_1}{dt} + M \frac{d\hat{J}_2}{dt}$$

$$\hat{u} = L_2 \frac{d\hat{J}_2}{dt} + M \frac{d\hat{J}_1}{dt}$$

$$L_1 \frac{d\hat{J}_1}{dt} + M \frac{d\hat{J}_2}{dt} - L_2 \frac{d\hat{J}_2}{dt} - M \frac{d\hat{J}_1}{dt} = 0$$

$$(L_1 - M)\frac{d\hat{J}_1}{dt} - (L_2 - M)\frac{d\hat{J}_2}{dt} = 0$$

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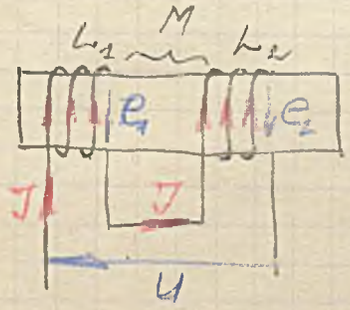
ad II



a) $M = \sqrt{L_1 L_2}$ b) $M = 0$

$$\hat{u} = \hat{E}_1 + \hat{E}_2$$

$$\hat{E}_1 = (L_1 + M)\frac{d\hat{J}}{dt}$$

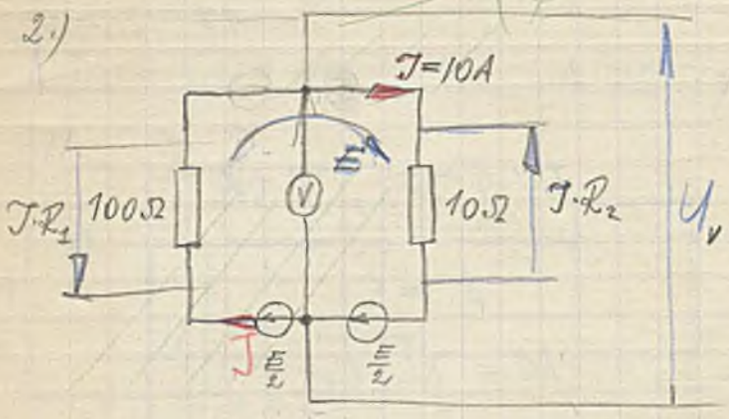
$$\hat{E}_2 = (L_2 + M)\frac{d\hat{J}}{dt}$$

$$\hat{u} = \underbrace{(L_1 + L_2 + 2M)}_{L}\frac{d\hat{J}}{dt}$$

a) dla $M = \sqrt{L_1 L_2}$, $L = L_1 + L_2 + 2\sqrt{L_1 L_2}$

b) dla $M = 0$, $L = L_1 + L_2$

2.)



$$\frac{E}{2} - I \cdot R_1 - U_v = 0$$

$$\frac{E}{2} = U_v + I \cdot R_1$$

$$\frac{E}{2} + U_v - I \cdot R_2 = 0$$

$$\frac{E}{2} = I \cdot R_2 - U_v$$

$$I \cdot R_2 - U_v = U_v + I \cdot R_1$$

$$2U_v = I(R_1 - R_2)$$

$$U_v = \frac{I}{2}(R_1 - R_2)$$

$$\underline{U_v} = 5(100 - 10) = \underline{450\,V}$$