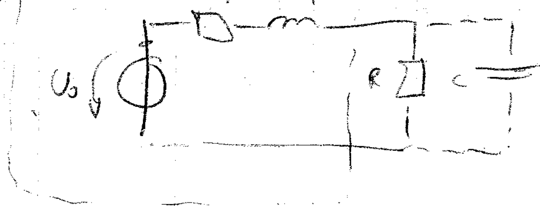
ET2 vom 29.09.2004

(1)

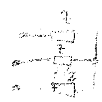


Quelle mit R_i u. L_i speist R

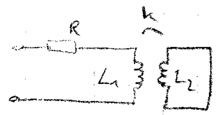
ges: C parallel damit

P an R maximal, bestimme C

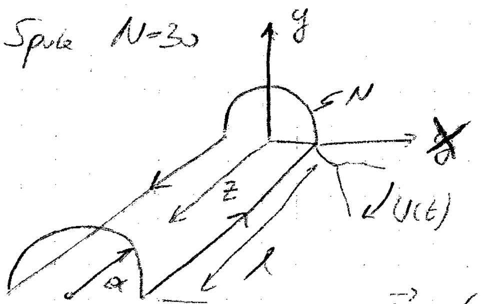
(2) Fet-Sammlung Bsp 47



(3) Fet-Sammlung Bsp 97



(4) Spule $N=30$



$a = 10\,mm$

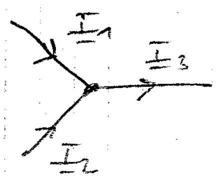
$l = 40\,mm$

$f = 60\,Hz$

$$\vec{B} = (2{,}1 \cdot \vec{e}_x + 1{,}8 \cdot \vec{e}_y - 1{,}5 \cdot \vec{e}_z)\cos(\omega t)\ mT$$

ges: $u(t)$

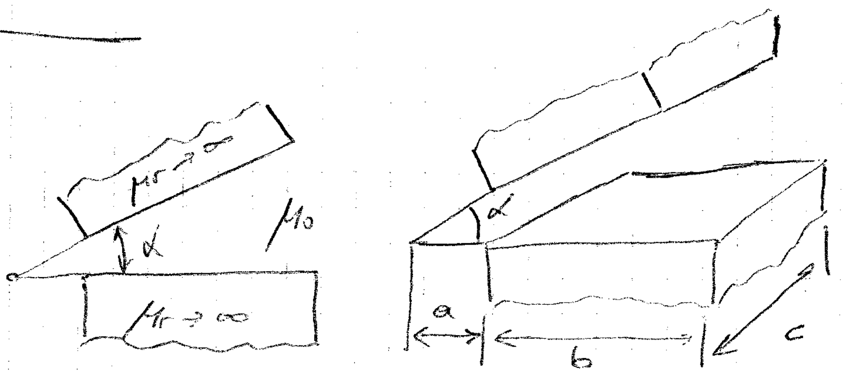
(5)



$\underline{I}_1 = (3{,}6 - j\,9{,}2)\,A \qquad \underline{I}_2 = (4{,}1 - j\,2{,}6)\,A$

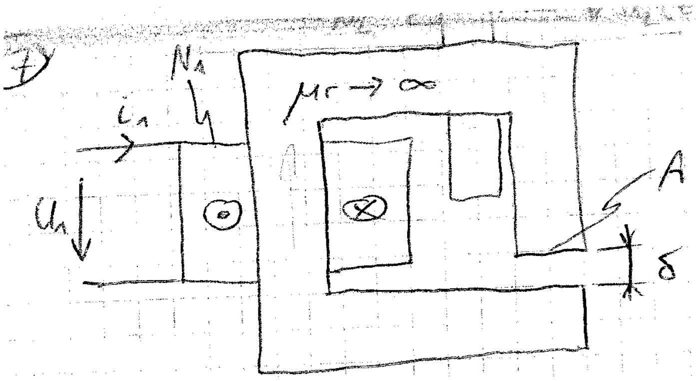
ges: reelle Standardform von i_3

(6)



ges: Permeanz der Luftspalts in einem magn. Kreis

7)

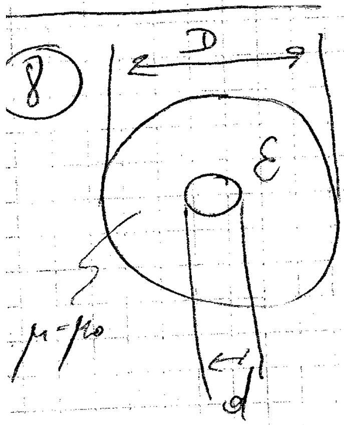


geg: sinförmige Spg. liegt an ($u_1(t)$).

ges: - i_1 wenn Wirkleitungswiderstand der Spule gegenüber dem Blindleistungswid. vernachlässigbar?

- u_2 wenn i_1 fließt?

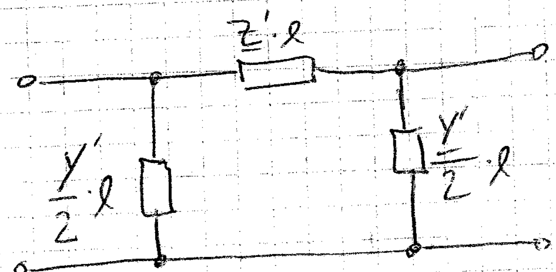
8)



geg: $L' = \frac{\mu_0}{2\pi} \cdot \ln\left(\frac{D}{d}\right)$; $\varepsilon = 2{,}3 \cdot \varepsilon_0$

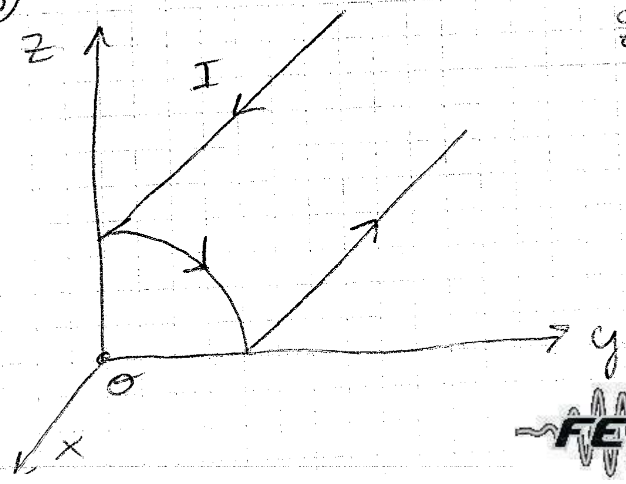
ges: $\underline{Z}_W$

9)



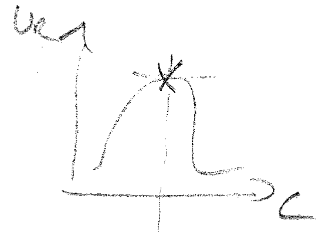
ges: $\underline{Z}_W$ des 2-Tors

10)



ges: $\vec{B}(0)$ nach Betrag u. Richtung

(1) $U_R = \underbrace{\frac{Z_{RC}}{Z_{RL} + Z_{RC}}}_{max} \cdot U_0$ $\qquad P_R = \frac{U_R^2}{R}$



$\downarrow$

$|U_R| = \frac{R_C}{\sqrt{R_C^2 + Im^2}} \rightarrow \frac{dU_R}{dC} = 0$

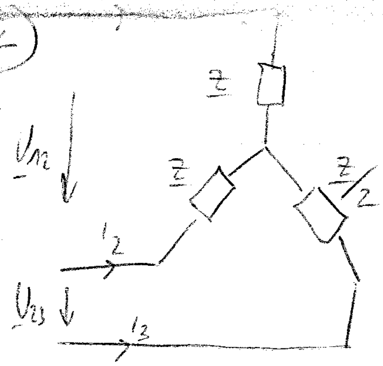
händisch $-\frac{1}{2} \frac{\text{innere Ableitung}}{\sqrt{\;}} = 0$ $\qquad x^{-\frac{1}{2}} \quad -\frac{1}{2} \cdot x^{-\frac{3}{2}}$

$\rightarrow$ innere Ableitung

ET 2 Lösungsansätze vom 29.09.2004

(2)

$I_1 + I_2 + I_3$



$$\underline{U}_{12} = \underline{I}_1 \cdot \underline{Z} - \underline{I}_2 \cdot \underline{Z}$$

$$\underline{U}_{23} = \underline{U}_{12} \cdot a^2 = \underline{I}_2 \cdot \underline{Z} - \underline{I}_3 \cdot \frac{\underline{Z}}{2}$$

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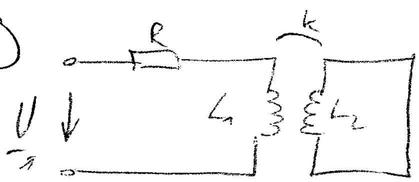
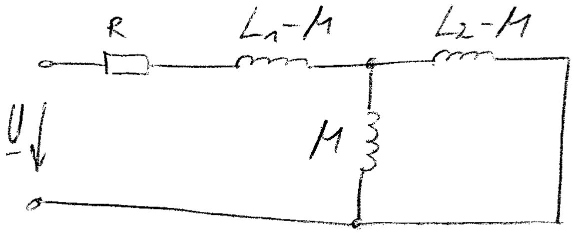
(3)



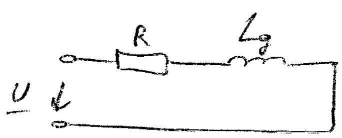
$\Rightarrow$



$$k = \frac{M}{\sqrt{L_1 L_2}}$$

$$L_g = (L_1 - M) + \frac{M(L_2 - M)}{L_2}$$

$$\tau = \frac{L_g}{R}$$



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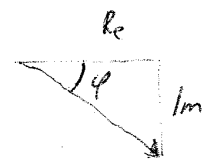
(5)

$$\underline{I}_3 = \underline{I}_1 + \underline{I}_2 = (7{,}7 - 11{,}8j)\ A$$



$$\varphi_{i_3} = \arctan\left(\frac{Im}{Re}\right)$$

$$|\underline{I}_3| = \sqrt{Re^2 + Im^2} \qquad \hat{i}_3 = I_3 \cdot \sqrt{2}$$

$$\underline{I}_3 = I_3 \cdot e^{j\varphi_{i_3}} \qquad i_3 = \hat{i}_3 \cdot \cos(\omega t + \varphi_{i_3})$$

---

(8)

$$\underline{Z}_W = \sqrt{\frac{L'}{C'}} \qquad c = \frac{1}{\sqrt{L' \cdot C'}} \qquad c = \frac{1}{\sqrt{\mu \cdot \varepsilon}}$$

$$C' = \frac{1}{c^2 \cdot L'}$$

$$\underline{Z}_W = \sqrt{c^2 \cdot L'^2} = c \cdot L'$$

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FET

7)

(i) $L = \mu_0 \cdot N_1^2 \cdot \frac{A}{\delta}$

$u_1 = j\omega L \cdot i$

$Q_L = \omega \cdot L \cdot I^2$

$S = Q_L = u_1 \cdot i_1 = \omega \cdot L \cdot i_1^2 = \omega \cdot \mu_0 \cdot N_1^2 \cdot \frac{A}{\delta} \cdot i_1^2$

$u_1 = \omega \cdot \mu_0 \cdot N_1^2 \cdot \frac{A}{\delta} \cdot i_1 \rightarrow i_1 = \frac{u_1 \cdot \delta}{\omega \mu_0 \cdot N_1^2 \cdot A}$

ii) $u_2 = \dot{\Phi}_v \quad (i_2 = 0)$

$\Phi_v = N_2 \cdot \phi \qquad \phi = B_2 \cdot A \qquad N_1 \cdot i_1 = H_L \cdot \delta = V$

$\phi = \mu_0 \cdot \frac{N_1 \cdot i_1}{\delta} \cdot A \cdot \sin(\omega t) \qquad H_L = \frac{N_1 \cdot i_1}{\delta}$

$B_L = \mu_0 \cdot \frac{N_1 \cdot i_1}{\delta}$

$\Phi_v = \mu_0 \cdot \frac{N_1 \cdot N_2 \cdot i_1 \cdot A}{\delta} \cdot \sin(\omega t) \qquad B_L = B_2$

$\dot{\Phi}_v = \mu_0 \cdot \omega \cdot N_1 \cdot N_2 \cdot i_1 \cdot \frac{A}{\delta} \cdot \cos(\omega t)$

$u_2 = u_1 \cdot \frac{N_2}{N_1} \quad u_2 = \frac{u_1}{n}$

$\dot{\Phi}_v = u_2$

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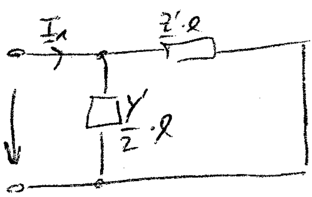
9) $Z_W = \sqrt{Z_B(K) \cdot Z_B(L)}$

$Z_{B1}(K) = \frac{U_1}{I_1}$ bei sek. KS

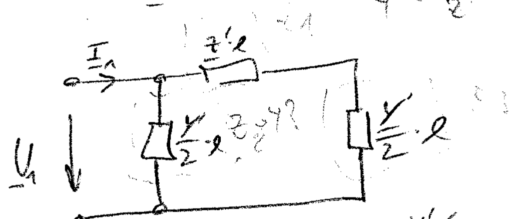


$\frac{U_1}{I_1} = \frac{Z' \cdot l \cdot \frac{Y'}{2} \cdot l}{Z' \cdot l + \frac{Y'}{2} \cdot l} = \frac{Z' \cdot \frac{Y'}{2} \cdot l}{Z' + \frac{Y'}{2}}$

. . . .

$Z_{B1}(L) = \frac{U_1}{I_1}$ bei sek. LL

$Y' = \frac{A}{l}$



$\frac{U_1}{I_1} = \frac{\frac{Y'}{2} \cdot l \cdot (Z' \cdot l + \frac{Y'}{2} \cdot l)}{Z' \cdot l + Y' \cdot l} = \frac{\frac{Y'}{2}(Z' \cdot l + \frac{Y'}{2} \cdot}{Z' + Y'}$

$Z_1 = Z' \cdot l$

$Z_2 = \frac{2}{Y' \cdot l} = \frac{Z' \cdot 2}{l}$

$\rightarrow$

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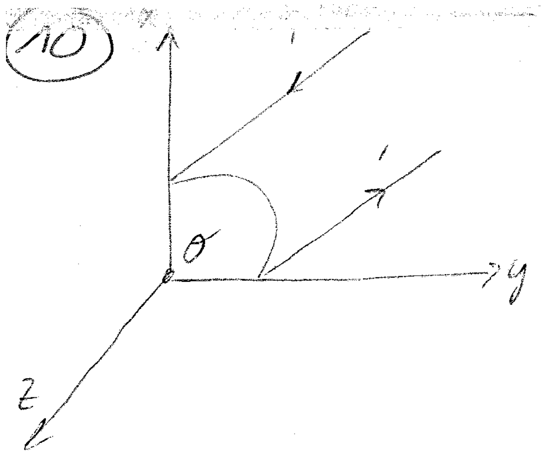
10



<u>gerader Leiter:</u>

$$\vec{B} = \frac{\mu_0 \cdot I}{4\pi\rho} \cdot (\sin\alpha_2 - \sin\alpha_1) \cdot \vec{e}_B$$

<u>Kreissegment:</u>

$$\vec{B} = \frac{\mu_0 \cdot I}{2a} \cdot \frac{\alpha}{2\pi}$$

4

$$u(t) = R \cdot I + \dot{\Phi}_V$$

$\underline{I = 0}$ $\quad u(t) = \dot{\Phi}_V$

$$\Phi_V = N \cdot \Phi \qquad A_y = l \cdot a$$

$$\Phi = B \cdot A$$

$$\Phi = B_y \cdot A_y = 1{,}8\,mT \cdot 0{,}04 \cdot 0{,}01 \cdot \cos(\omega t)$$

$$\dot{\Phi} = -\omega \cdot B_y \cdot A_y \cdot \sin(\omega t) = -0{,}271 \cdot \sin(\omega t)\, m$$

~~0,2715 mV~~

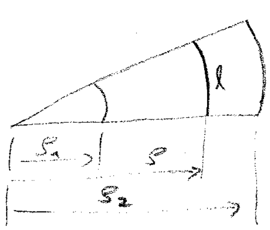
$$\dot{\Phi}_V = N \cdot \dot{\Phi} = 8{,}143\,mWb$$

$$u(t) = \dot{\Phi}_V = 8{,}143\,mV$$

6

$$G_m = \frac{1}{R_m} \qquad R_m = \frac{V}{\Phi} = \frac{l}{\mu \cdot A}$$

$$l = 2\pi \cdot \rho \cdot \frac{\alpha}{2\pi} = \rho\alpha \qquad A = b \cdot c \qquad \mu = \mu_0$$



$$R_m = \int_{\rho_1}^{\rho_2} \frac{\rho \cdot \alpha}{\mu_0 \cdot b \cdot c} \cdot d\rho = \frac{\alpha}{\mu_0 \cdot b \cdot c} \cdot \left[\frac{\rho^2}{2}\right]_a^{a+b}$$

$$R_m = \frac{\alpha}{\mu_0 \cdot b \cdot c} \cdot \left[\frac{(a+b)^2}{2} - \frac{a^2}{2}\right] = \frac{\alpha}{\mu_0 \cdot b \cdot c} \cdot \frac{\cancel{a^2} + 2ab + b^2 - \cancel{a^2}}{2}$$

$$R_m = \frac{\alpha}{\mu_0 \cdot b \cdot c} \cdot \frac{2ab + b^2}{2} \qquad G_m = \frac{1}{R_m}$$

~~5,4~~/6