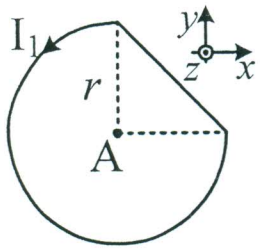
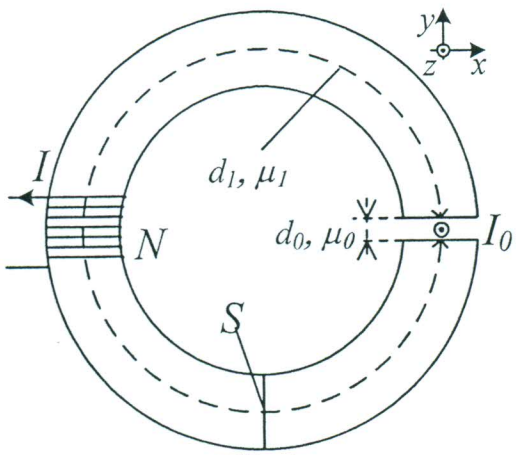
DRUGI KOLOKVIJUM IZ ELEKTROTEHNIKE
24. januar 2018.
GRUPA 1

1. Na Slici 1 prikazana je kontura koja se sastoji iz kružnog luka, koji predstavlja 3/4 kružnice poluprečnika r, i pravolinijskog provodinka, kroz koju protiče struje intenziteta I_1 u označenom smeru. Kontura se nalazi u vazduhu. Odrediti i nacrtati rezultujući vektor jačine magnetnog polja u tački **A** (centar kružnog luka). **(5 poena)**

2. Na Slici 2 prikazano je magnetno kolo, koje se sastoji od torusnog jezgra, magnetne permeabilnosti μ_1 i dužine srednje linije d_1, na koje je namotan namotaj sa N navojaka kroz koji protiče struja intenziteta I. Poprečni presek torusa je površine S i oblika kvadrata, a jezgro ima vazdušni procep debljine d_0.
a) Odrediti fluks vektora magnetne indukcije u magn. kolu i gustinu energije magnetnog polja u procepu. **(8 poena)**
b) Ako se u procep unese pravolinijski provodnik, kroz koji protiče struja intenziteta I_0, odrediti i skicirati **vektor** sile kojom magnetno polje u procepu deluje na provodnik. **(7 poena)**



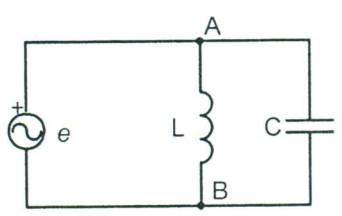
Slika 1



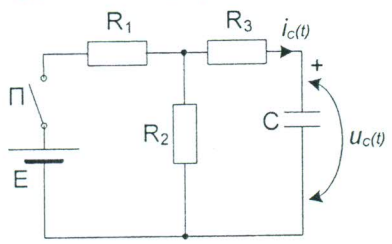
Slika 2

3. U prostom kolu naizmenične struje, pretežno induktivni potrošač priključen je na naponski izvor, parametara $U = 200\text{V}$, $\omega = 300\dfrac{\text{rad}}{\text{s}}$. Aktivna snaga i faktor snage potrošača iznose $P = 4\text{kW}$ i $\cos\varphi = 0.8$.
a) Odrediti efektivnu vrednost struje potrošača i njegovu kompleksnu impedansu. **(7 poena)**
b) Odrediti kapacitivnost kondenzatora, koji je potrebno vezati paralelno potrošaču, tako da se postigne faktor snage jednak 1. **(6 poena)**

4. U kolu na slici 3 poznato je: $e(t) = 100\sqrt{2}\sin(1000t + \pi/2)\text{V}$, $L = 100\,\text{mH}$, $C = 50\mu\text{F}$.
a) Izračunati kompleksnu impedansu $\overline{Z}_e$ i kompleksnu admitansu $\overline{Y}_e$ ekvivalentnog potrošača između tačaka A i B. **(4 poena)**
b) Odrediti kompleksnu vrednost ems i svih struja u kolu i nacrtati odgovarajući fazorski dijagram. **(5 poena)**
d) Odrediti aktivnu, reaktivnu i prividnu snagu ekvivalentnog potrošača. **(3 poena)**



Slika 3

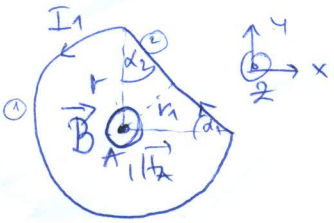


Slika 4

5. Na sistem trofaznog napona $3\times300\text{V}$, 50Hz priključen je simetričan trofazni potrošač povezan u zvezdu sa kompleksnom impedansom svake faze $\overline{Z} = 50\sqrt{3}\cdot e^{-j\frac{\pi}{6}}\Omega$. Odrediti efektivnu vrednost linijske struje, aktivnu, reaktivnu i prividnu snagu potrošača. **(5 poena)**

6. U kolu na Slici 4 poznate su vrednosti elemenata: E, $R_1 = 2R$, $R_2 = R_3 = R$ i C. Prekidač Π je zatvoren i u kolu je uspostavljeno stacionarno stanje. U trenutku $t = 0$, prekidač se otvara.
a) Odrediti izraz za napon i struju kondenzatora nakon otvaranja prekidača i nacrtati odgovarajuće vremenske dijagrame. **(6 poena)**
b) Odrediti vrednost napona na otporniku R_3 u trenutku t_1=4RC. **(2 poena)**
c) Odrediti elektrostatičku energiju kondenzatora u trenutku t_1=4RC. **(2 poena)**

GRUPA 1

① 

$\vec{B}_A = \vec{B}_{A1} + \vec{B}_{A2}$

$\vec{B}_{A1} = \frac{3}{4}\frac{\mu_0 I_1}{2r}\vec{k} = \frac{3\mu_0 I_1}{8r}\vec{k}$

$\vec{B}_{A2} = \frac{\mu_0 I_1}{4\pi r_1}(\cos\alpha_1 + \cos\alpha_2)(+\vec{k})$

$r_1 = \frac{1}{2}r\sqrt{2}$, $\alpha_1 = 45°$, $\alpha_2 = 45°$ $\Rightarrow \vec{B}_{A2} = \frac{\mu_0 I_1}{4\pi \frac{r\sqrt{2}}{2}}\left(\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}\right)(+\vec{k})$

$\vec{B}_{A2} = \frac{\mu_0 I_1}{2\pi r\sqrt{2}}\cdot\sqrt{2}(+\vec{k}) = +\frac{\mu_0 I_1}{2\pi r}\vec{k}$

$\vec{B}_A = \frac{3\mu_0 I_1}{8r}\vec{k} + \frac{\mu_0 I_1}{2\pi r}\vec{k} = \frac{\mu_0 I_1}{2r}\left(\frac{3}{4}+\frac{1}{\pi}\right)\vec{k}$

$$\boxed{\vec{H}_A = \frac{\vec{B}_A}{\mu_0} = \frac{I_1}{2r}\left(\frac{3}{4}+\frac{1}{\pi}\right)\vec{k}}$$

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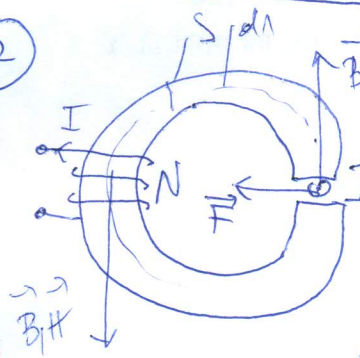
② 

a) $\oint \vec{H}d\vec{l} = \sum I$

$Hd_1 + H_0 d_0 = NI$

$\frac{Bd_1}{\mu_1} + \frac{Bd_0}{\mu_0} = NI$

$\frac{\phi d_1}{\mu_1 S} + \frac{\phi d_0}{\mu_0 S} = NI$

$$\boxed{\phi = \frac{NIS}{\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}}}$$

b) $\vec{F} = I_0\vec{l_0}\times\vec{B_0}$

$\vec{l_0} = \sqrt{S}\,\vec{k}$

$\vec{B_0} = \frac{\phi}{S} = \frac{NI}{\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}}\vec{j}$

$\vec{F} = \frac{NII_0\sqrt{S}}{\left(\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}\right)}\vec{j}\times\vec{k}$

$$\boxed{\vec{F} = -\frac{NII_0\sqrt{S}}{\left(\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}\right)}\vec{i}}$$

$w_0 = \frac{1}{2}B_0H_0 = \frac{1}{2}\frac{\phi}{S}\frac{\phi}{S\mu_0} = \frac{1}{2}\frac{\phi^2}{\mu_0 S^2} = \frac{1}{2}\frac{N^2I^2S^2}{\mu_0\left(\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}\right)^2S^2}$

$$\boxed{w_0 = \frac{N^2I^2}{2\mu_0\left(\frac{d_1}{\mu_1}+\frac{d_0}{\mu_0}\right)^2}}$$

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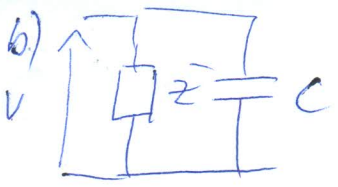
③ a) $P = S\cos\varphi \Rightarrow S = \frac{P}{\cos\varphi} = \frac{4kW}{0,8} = 5kVA$

$S = UI \Rightarrow \boxed{I = \frac{S}{U} = \frac{5000VA}{200V} = 25A}$

$Z = \frac{U}{I} = \frac{200V}{25A} = 8\Omega$ $\quad \sin\varphi = +\sqrt{1-\cos^2\varphi} = 0,6$

$\bar{Z} = Z\cos\varphi + jZ\sin\varphi = 8\cdot 0,8 + j\,8\cdot 0,6 = \boxed{(6,4 + j\,4,8)\Omega = \bar{Z}}$

b) 

$P_u = P + P_c = P$ $\quad P_c = 0$

$Q_u = Q + Q_c$ $\quad Q = S \cdot \sin\varphi = 3\ KVAr$

$Q_c = \frac{U^2}{X_c} = -\omega C U^2 \Rightarrow Q_u = Q - \omega C U^2$

$\cos\varphi_u = 1 \Rightarrow \sin\varphi_u = 0 \Rightarrow Q_u = S_u \cdot \sin\varphi_u = 0 \Rightarrow Q - \omega C U^2 = 0$

$\Rightarrow C = \frac{Q}{\omega U^2} = \frac{3000}{300 \cdot 40000} = \frac{1}{4} \cdot 10^{-3} = \frac{1000}{4} \cdot 10^{-6} = \boxed{250\,\mu F = C}$

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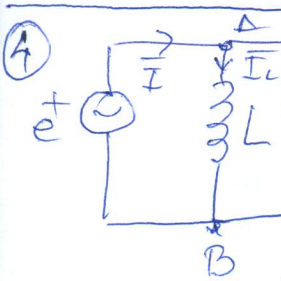
(4) 

a) $e(t) = 100\sqrt{2}\sin(1000t + \pi/2) \Rightarrow \bar{E} = \frac{100\sqrt{2}}{\sqrt{2}} e^{j\pi/2}$

$\bar{E} = 100 e^{j\pi/2}$

$\boxed{\bar{E} = j100\ V}$

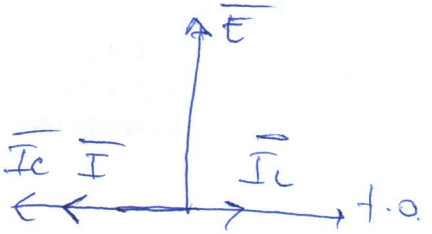
$\bar{Y}_C = j\omega C = j \cdot 1000 \cdot 50 \cdot 10^{-6} = j\,50\,mS$

$\bar{Y}_L = -j\frac{1}{\omega L} = -j\frac{1}{1000 \cdot 100 \cdot 10^{-3}} = -j\,10\,mS$

$\boxed{\bar{Y}_e = \bar{Y}_{AB} = \bar{Y}_C + \bar{Y}_L = j\,40\,mS} \Rightarrow \boxed{\bar{Z}_e = \frac{1}{\bar{Y}_e} = \frac{1}{j40 \cdot 10^{-3}} = -j25\,\Omega}$

b) $\bar{I}_L = \frac{\bar{E}}{\bar{Z}_L} = \bar{E} \cdot \bar{Y}_L = j100 \cdot (-j10m) = 1A$

$\bar{I}_C = \frac{\bar{E}}{\bar{Z}_C} = \bar{E} \cdot \bar{Y}_C = j100\,(j50m) = -5A$



$\bar{I} = \bar{I}_L + \bar{I}_C = -4A$

c) $\bar{S} = \bar{U}\bar{I}^* = \bar{E}\,\bar{I}^* = j100 \cdot (-4) = -j400\ VA = P + jQ$

$\boxed{P = 0\ W}$, $\boxed{Q = -400\ VAr}$, $\boxed{S = 400\ VA}$

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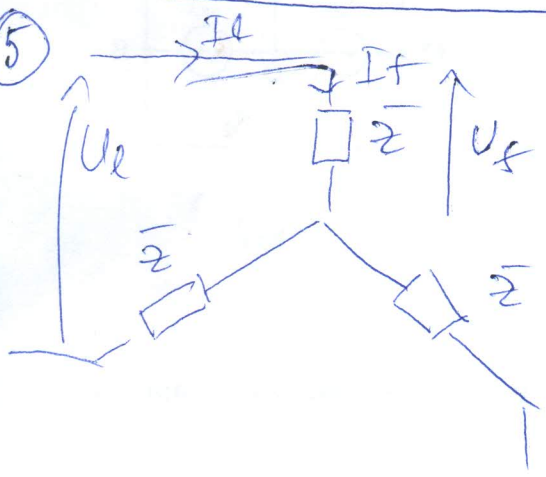
(5) 

$3 \times 300\ V \Rightarrow U_l = 300V$

$U_f = \frac{U_l}{\sqrt{3}} = \frac{300}{\sqrt{3}}\ V$

$\bar{Z} = 50\sqrt{3}\,e^{-j\pi/6}\,\Omega \Rightarrow Z = 50\sqrt{3}\,\Omega$

$I_f = \frac{U_f}{Z} = \frac{300}{\sqrt{3} \cdot 50\sqrt{3}} = 2A$

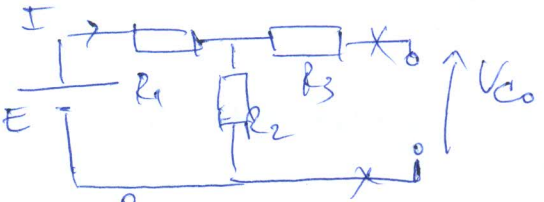
$\boxed{I_l = I_f = 2A}$

$\bar{Z} = 50\sqrt{3}\,e^{-j\pi/6} \Rightarrow \varphi = -\pi/6 \Rightarrow \cos\varphi = \frac{\sqrt{3}}{2}$ $\quad \sin\varphi = -1/2$

$S = 3U_f I_f = 3 \cdot \frac{300}{\sqrt{3}} \cdot 2 = \boxed{600\sqrt{3}\ VA = S}$

$\boxed{P = S\cos\varphi = 600\sqrt{3} \cdot \frac{\sqrt{3}}{2} = 900\ W}$ $\quad \boxed{Q = S\sin\varphi = -300\sqrt{3}\ VAr}$

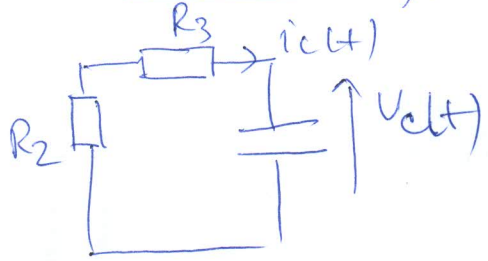
(6) a) $t<0$



$$I = \frac{E}{R_1+R_2} = \frac{E}{2R+R} = \frac{E}{3R}$$

$$U_{co} = R_2 I = R\cdot\frac{E}{3R} = \frac{E}{3}$$

$t>0$



$$(R_2+R_3)\,i_c(t) + u_c(t) = 0$$

$$2R\,i_c(t) + u_c(t) = 0$$

$$i_c(t) = C\frac{du_c(t)}{dt}$$

$$2RC\frac{du_c}{dt} + u_c = 0$$

$$\frac{du_c}{dt} + \frac{u_c(t)}{\underbrace{2RC}_{\tau}} = 0 \quad / \cdot K$$

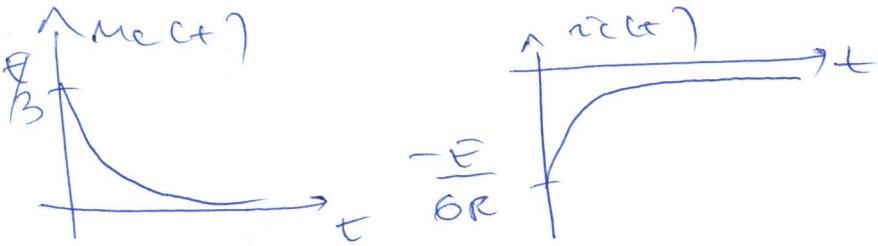
$\boxed{\tau = 2RC}$, $K=0$

$$B = K\cdot\tau = 0$$

$$A+B = U_{co} \Rightarrow A = U_{co} = \frac{E}{3}$$

$$u_c(t) = Ae^{-t/\tau} + B = \frac{E}{3}e^{-t/\tau}\ [V]$$

$$i_c(t) = C\frac{du_c(t)}{dt} = \frac{CE}{3}\cdot\frac{-1}{\tau}e^{-t/\tau} = \frac{-CE}{3\cdot 2RC}e^{-t/\tau} = \boxed{-\frac{E}{6R}e^{-t/\tau}}$$



b) $$i_c(t_1 = 4RC) = \frac{-E}{6R}e^{-\frac{4RC}{2RC}} = \frac{-E}{6R}e^{-2}$$

$$\boxed{u_{R_3}(t) = R_3\,i_c(t) = -\frac{E}{6}e^{-2}\ [A]}$$

c) $$W_c(t) = \frac{1}{2}Cu_c^2(t)$$

$$W_c(t_1) = \frac{1}{2}Cu_c^2(t_1) = \frac{1}{2}\cdot C\cdot\frac{E^2}{9}e^{-\frac{2t_1}{\tau}}$$

$$\boxed{W_c(t_1) = \frac{CE^2}{18}e^{-\frac{8RC}{2RC}} = \frac{CE^2}{18}e^{-4}\ [J]}$$

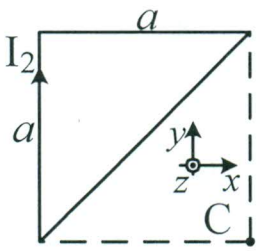
DRUGI KOLOKVIJUM IZ ELEKTROTEHNIKE
24. januar 2018.
GRUPA2

1. Na Slici 1 prikazana je kontura obika jednakokrakog pravouglog trougla, čija je kateta dužine a, kroz koju protiče struje intenziteta I_2 u označenom smeru. Kontura se nalazi u vazduhu. Odrediti i nacrtati rezultujući vektor jačine magnetnog polja u tački **C** (čini kvadrat sa temenima trougla). **(5 poena)**

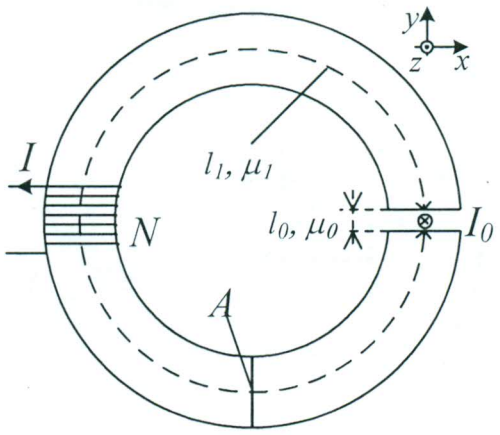
2. Na Slici 2 prikazano je magnetno kolo, koje se sastoji od torusnog jezgra, magnetne permeabilnosti μ_1 i dužine srednje linije l_1, na koji je namotan namotaj sa N navojaka kroz koji protiče struja intenziteta I. Poprečni presek torusa je površine A i oblika kvadrata, a jezgro ima vazdušni procep debljine l_0.

a) Odrediti fluks vektora magnetne indukcije u magn. kolu i gustinu energije magnetnog polja u torusu. **(8 poena)**

b) Ako se u procep unese pravolinijski provodnik, kroz koji protiče struja intenziteta I_0, odrediti i skicirati **vektor** sile kojom magnetno polje u procepu deluje na provodnik. **(7 poena)**



Slika 1



Slika 2

3. U prostom kolu naizmenične struje, pretežno induktivni potrošač priključen je na naponski izvor parametara $U = 100\text{V}$, $\omega = 200\dfrac{\text{rad}}{\text{s}}$. Aktivna snaga i faktor snage potrošača iznose $P = 300\text{W}$ i $\cos\varphi = 0.6$.

a) Odrediti efektivnu vrednost struje potrošača i njegovu kompleksnu impedansu. **(7 poena)**

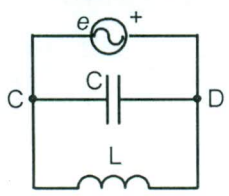
b) Odrediti kapacitivnost kondenzatora, koji je potrebno vezati paralelno potrošaču, tako da se postigne faktor snage jednak 1. **(6 poena)**

4. U kolu na slici 3 poznato je: $e(t) = 50\sqrt{2}\sin(5000t - \pi/2)\text{V}$, $C = 20\mu\text{F}$, $L = 1\text{mH}$.

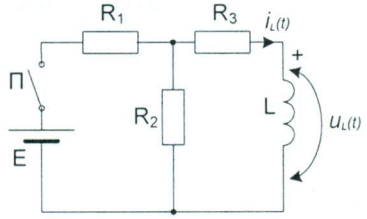
a) Izračunati kompleksnu impedansu $\overline{Z}_e$ i kompleksnu admitansu $\overline{Y}_e$ ekvivalentnog potrošača između tačaka C i D. **(4 poena)**

b) Odrediti kompleksnu vrednost ems i svih struja u kolu i nacrtati odgovarajući fazorski dijagram. **(5 poena)**

d) Odrediti aktivnu, reaktivnu i prividnu snagu ekvivalentnog potrošača. **(3 poena)**



Slika 3



Slika4

5. Na sistem trofaznog napona $3\times100\sqrt{3}\text{V}$, 50Hz priključen je simetričan trofazni potrošač povezan u trougao sa kompleksnom impedansom svake faze $\overline{Z} = 20\sqrt{3}\cdot e^{j\frac{\pi}{3}}\Omega$. Odrediti efektivnu vrednost linijske struje, aktivnu, reaktivnu i prividnu snagu potrošača. **(5 poena)**

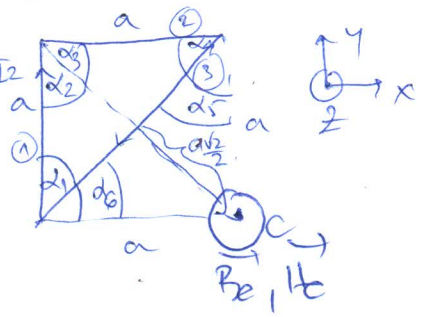
6. U kolu na Slici 4 poznate su vrednosti elemenata: E, $R_1 = R_2 = 2R$, $R_3 = R$ i L. Prekidač П je zatvoren i u kolu je uspostavljeno stacionarno stanje. U trenutku $t = 0$, prekidač se otvara.

a) Odrediti izraz za struju i napon kalema nakon otvaranja prekidača i nacrtati odgovarajuće vremenske dijagrame. **(6 poena)**

b) Odrediti vrednost napona na otporniku R_3 u trenutku $t_1 = L/R$. **(2 poena)**

c) Odrediti magnetnu energiju kalema u trenutku $t_1 = L/R$. **(2 poena)**

GRUPA 2

① 

$\vec{B_c} = \vec{B_{c1}} + \vec{B_{c2}} + \vec{B_{c3}}$

$\vec{B_{c1}} = \frac{\mu_0 I_2}{4\pi a}(\cos\alpha_1 + \cos\alpha_2)(-\vec{k}) = -\frac{\mu_0 I_2 \sqrt{2}}{8\pi a}\vec{k}$ ($\alpha_1 = 90°$, $\alpha_2 = 45°$)

$\vec{B_{c2}} = \frac{\mu_0 I_2}{4\pi a}(\cos\alpha_3 + \cos\alpha_4)(-\vec{k}) = -\frac{\mu_0 I_2 \sqrt{2}}{8\pi a}\vec{k}$ ($\alpha_3 = 45°$, $\alpha_4 = 90°$)

$\vec{B_{c3}} = \frac{\mu_0 I_2}{4\pi \frac{a\sqrt{2}}{2}}(\cos\alpha_5 + \cos\alpha_6)\vec{k} = \frac{\mu_0 I_2}{2\pi a\sqrt{2}} \cdot \sqrt{2}\,\vec{k}$ ($\alpha_5 = 45°$, $\alpha_6 = 45°$)

$\vec{B_{c3}} = \frac{\mu_0 I_2}{2\pi a}\vec{k}$

$\vec{B_c} = -\frac{\mu_0 I_2 \sqrt{2}}{4\pi a}\vec{k} + \frac{\mu_0 I_2}{2\pi a}\vec{k} = \frac{\mu_0 I_2}{2\pi a}\left(1 - \frac{\sqrt{2}}{2}\right)\vec{k}$

$\vec{H_c} = \frac{\vec{B_c}}{\mu_0} = \frac{I_2}{2\pi a}\left(1 - \frac{\sqrt{2}}{2}\right)\vec{k}$

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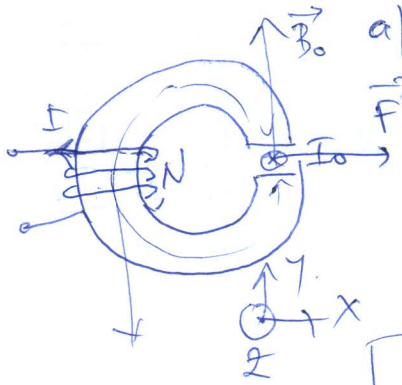
② 

a) $\oint \vec{H}d\vec{l} = \Sigma I$

$H_0 l_0 + H_1 l_1 = NI$

$\frac{B_0 l_0}{\mu_0} + \frac{B l_1}{\mu_1} = NI$

$\frac{\phi l_0}{\mu_0 A} + \frac{\phi l_1}{\mu_1 A} = NI$

$$\boxed{\phi = \frac{NIA}{\frac{l_0}{\mu_0} + \frac{l_1}{\mu_1}}}$$

b) $\vec{F} = I_0 \vec{l_0} \times \vec{B_0}$

$\vec{B_0} = \frac{\Phi}{A}\vec{i} = \frac{NI}{\frac{l_0}{\mu_0} + \frac{l_1}{\mu_1}}\vec{i}$

$\vec{l_0} = \sqrt{A}(-\vec{k})$

$\vec{F} = \frac{NI_0 I\sqrt{A}}{\frac{l_0}{\mu_0} + \frac{l_1}{\mu_1}}(-\vec{k} \times \vec{j})$

$$\boxed{\vec{F} = \frac{NI_0 I\sqrt{A}}{\frac{l_0}{\mu_0} + \frac{l_1}{\mu_1}}\vec{i}}$$

$w_1 = \frac{1}{2}B_1 H_1 = \frac{1}{2}\frac{\Phi_1}{A}\frac{\Phi_1}{A\mu_1} = \frac{1}{2}\frac{\Phi_1^2}{A^2\mu_1} = \frac{N^2 I^2}{2\mu_1\left(\frac{l_0}{\mu_0} + \frac{l_1}{\mu_1}\right)}$

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③ a) $U = 100V$, $\omega = 200\frac{rad}{s}$, $P = 300W$, $\cos\varphi = 0{,}6$

$P = S\cos\varphi \Rightarrow S = \frac{P}{\cos\varphi} = \frac{300W}{0{,}6} = 500VA$

$Q = S\sin\varphi$

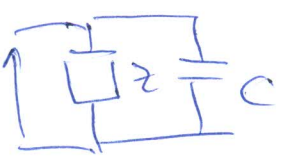
$Q = 400VAr$

$S = UI \Rightarrow I = \frac{S}{U} = \frac{500VA}{100V} = 5A = I$

$Z = \frac{U}{I} = \frac{100V}{5A} = 20\Omega$

$\sin\varphi = \sqrt{1 - \cos^2\varphi} = 0{,}8$

$\bar{Z} = Z\cos\varphi + jZ\sin\varphi = 20 \cdot 0{,}6 + j20 \cdot 0{,}8 = (12 + j16)\Omega$

b) 

$P_u = P + P_c = P \quad (P_c = 0)$

$Q_u = Q + Q_c$

$Q_c = \frac{U^2}{X_c} = -\omega C U^2$

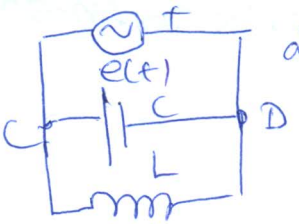
$\Rightarrow Q_u = Q - \omega C U^2 = 0 \Rightarrow$

$\cos\varphi_u = 1 \Rightarrow \sin\varphi_u = 0$

$Q_u = S_u \sin\varphi_u \Rightarrow Q_u = 0$

$$\boxed{C = \frac{Q}{\omega U^2} = \frac{400}{200 \cdot 10000} = 200\mu F}$$

(4)



a) $\bar{Y}_C = j\omega C = j\,5000 \cdot 20\mu = j\,100\text{m}S$

$\bar{Y}_L = -j\frac{1}{\omega L} = -j\frac{1}{5000 \cdot 10^{-3}} = -j\frac{1}{5} = -j\,200\text{m}S$

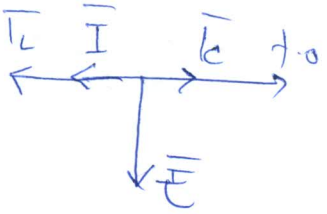
$\bar{Y}_e = \bar{Y}_C + \bar{Y}_L = -j\,100\text{m}S$

$\bar{Z}_e = \frac{1}{\bar{Y}_e} = \frac{1}{-j\,100 \cdot 10^{-3}} = \boxed{j\,10\Omega = \bar{Z}_e}$

b) $\bar{E} = \frac{50\sqrt{2}}{\sqrt{2}} e^{-j\pi/2} = 50 e^{-j\pi/2} = -j\,50\,V$

$\bar{I}_C = \frac{\bar{E}}{\bar{Z}_C} = \bar{E} \cdot \bar{Y}_C = -j50 \cdot j\,100 \cdot 10^{-3} = 5A$

$\bar{I}_L = \frac{\bar{E}}{\bar{Z}_L} = \bar{E} \cdot \bar{Y}_L = -j\,50 \cdot (-j\,200 \cdot 10^{-3}) = -10A$



$\bar{I} = \bar{I}_C + \bar{I}_L = -5A$

c) $\bar{S} = \bar{E} \cdot \bar{I}^* = -j\,50(-5) = j\,250\,VA$

$P = 0\,W \quad Q = 250\,VAr \quad S = 250\,VA$

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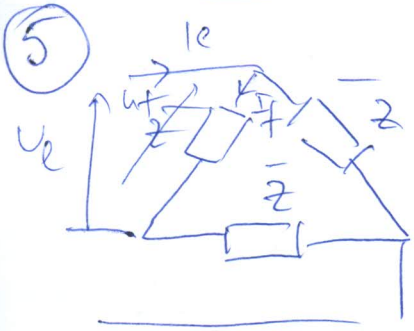
(5)



$U_e = U_f = 100\sqrt{3}\,V$

$\bar{Z} = 20\sqrt{3}\,e^{j\pi/3} \Rightarrow Z = 20\sqrt{3}\,\Omega$

$I_f = \frac{U_f}{Z} = \frac{100\sqrt{3}}{20\sqrt{3}} = 5A$

$I_e = I_f\sqrt{3} = 5\sqrt{3}\,A$

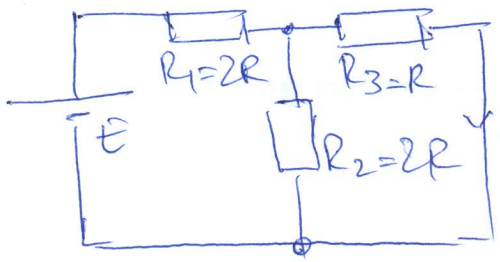
$\bar{Z} = 20\sqrt{3}\,e^{j\pi/3} \Rightarrow \varphi = \pi/3 \Rightarrow \cos\varphi = \frac{1}{2},\ \sin\varphi = \frac{\sqrt{3}}{2}$

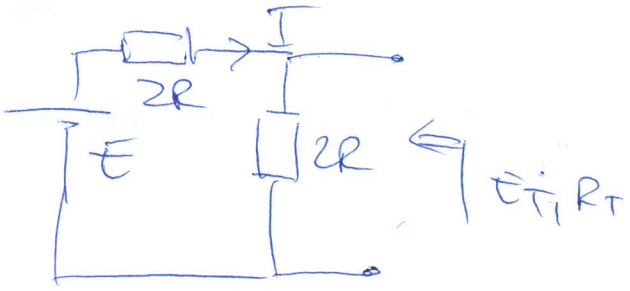
$S = 3U_f I_f = 3 \cdot 100\sqrt{3} \cdot 5 = 1500\sqrt{3}\,VA$

$P = S\cos\varphi = 1500\sqrt{3} \cdot \frac{1}{2} = 750\sqrt{3}\,W$

$Q = S\sin\varphi = 1500\sqrt{3} \cdot \frac{\sqrt{3}}{2} = 750 \cdot 3 = 2250\,VAr$

(6) Dati

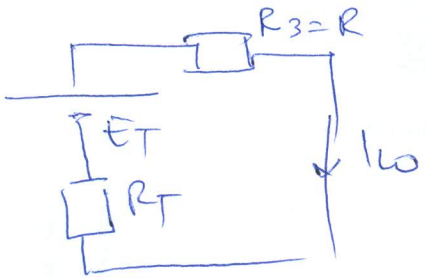




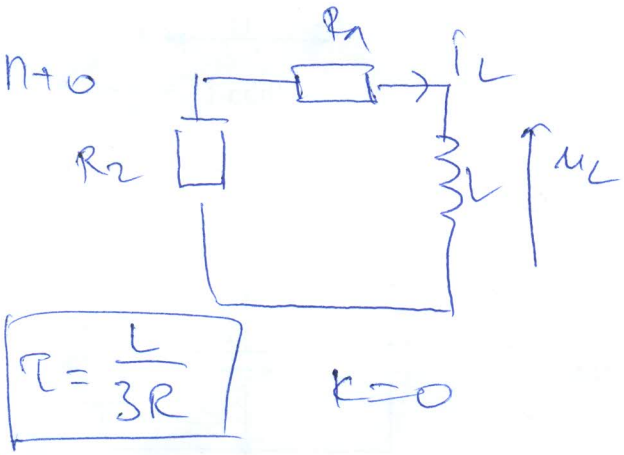
$I = \frac{E}{4R}$

$E_T = 2R \cdot I = E/2$

$R_T = 2R \| 2R = R$



$I_{L0} = \frac{E_T}{R_T + R_3} = \frac{E/2}{R+R} = \frac{E}{4R}$



$\tau = \frac{L}{3R}$ $\quad k = 0$

$B = k \cdot \tau = 0$

$A + B = I_{L0} \Rightarrow A = I_{L0} = \frac{E}{4R}$

$(R_1 + R_2)\, i_L + u_L = 0$

$3R i_L + u_L = 0$

$u_L = L \frac{di_L}{dt}$

$\Rightarrow 3R i_L + L \frac{di_L}{dt} = 0$

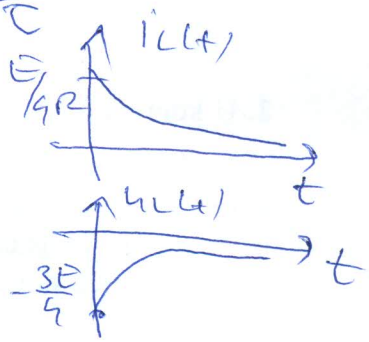
$\frac{di_L}{dt} + \frac{i_L}{L/3R} = 0$ $\quad k$

τ

$i_L(t) = A e^{-t/\tau} + B = \frac{E}{4R} e^{-t/\tau}$

$u_L(t) = L \frac{di_L}{dt} = \frac{LE}{4R} \left(-\frac{1}{\tau}\right) e^{-t/\tau}$

$= \frac{LE}{4R} \left(-\frac{3R}{L}\right) e^{-t/\tau} = -\frac{3}{4} E e^{-t/\tau}$



b) $i_L(t_1) = i_L(t_1 = \frac{L}{R}) = \frac{E}{4R} e^{-\frac{4R}{3R}} = \frac{E}{4R} e^{-3}$

$u_{R_3}(t) = R_3 i_L(t_1) = R i_L(t_1) = \frac{E}{4} e^{-3}$ [V]

c) $W_L(t_1 = \frac{L}{R}) = \frac{1}{2} L\, i_L^2(t_1) = \frac{1}{2} L \cdot \frac{E^2}{16R^2} (e^{-3})^2 = \frac{LE^2}{32R^2} e^{-6}$ [J]