① $m = 300\,kg$
$h = 550\,km$
$M = 6 \cdot 10^{24}\,kg$
$R = 6400\,km$
$r = R + h$

a) $F_g = ?$
b) $a_r = ?$
c) $v_t = ?$
d) $t_0 = ?$

a) $F_g = G\frac{mM}{r^2} = \underline{2500\,N}$ 5

b) $F_g = m \cdot a_r$

$a_r = G\frac{M}{r^2} = \underline{8{,}3\,m/s^2}$ 5

c) $a_r = \omega^2 r$

$v_t = \omega \cdot r \rightarrow \omega = \frac{v_t}{r}$

$a_r = \frac{v_t^2}{r^2} \cdot r$

$v_t = \sqrt{a_r \cdot r} = \underline{7590\,m/s}$ 5

d) $v = \frac{s}{t} \rightarrow v_t = \frac{2\pi r}{t_0}$

$t_0 = \frac{2\pi r}{v_t} = 5750\,s = \underline{96\,min}$ 5

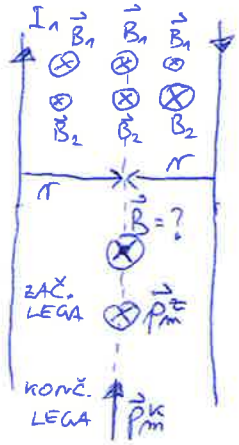
5 za pravilne št. rezultate

② $a = 0{,}4\,m$
$I_1 = 0{,}1\,A$
$I_2 = 0{,}2\,A$
$r = 0{,}2\,m$

$B(r = 0{,}2\,m) = ?$

$N = 60$
$I = 0{,}1\,A$
$r_T = 5\,cm$

$\Delta W_m = ?$



$B = B_1 + B_2$

$B = \frac{\mu_0 I_1}{2\pi r} + \frac{\mu_0 I_2}{2\pi r}$

$B = \frac{\mu_0}{2\pi r}(I_1 + I_2)$

$B = \underline{3 \cdot 10^{-7}\,T}$ 5

5 $p_m = N \cdot I \cdot S = N I \pi r_T^2 = \underline{0{,}047\,Am^2}$

$\Delta W_m = W_m^k - W_m^z$

W_m^k: $\vec{p}_m^k \perp \vec{B} \rightarrow W_m^k = -|\vec{p}_m^k| \cdot |\vec{B}| \cos 90^\circ = 0$ 5

W_m^z: $\vec{p}_m^z \parallel \vec{B} \rightarrow W_m^z = -|\vec{p}_m^z| \cdot |\vec{B}| \cos 0^\circ = -p_m \cdot B$ 5

$\Delta W_m = -W_m^z = p_m \cdot B = \underline{1{,}4 \cdot 10^{-8}\,J}$

5 za pravilne št. rezultate

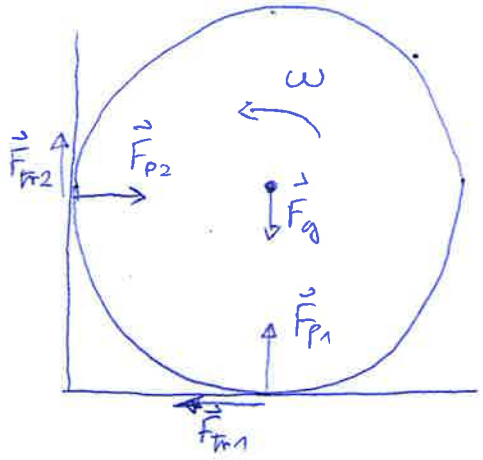
③ $r = 0{,}1\,m$

$\omega = 60\,Hz$

$k_{tr} = 0{,}1$

$N = ?$

$(\varphi = ?)$



5

x: $F_{p2} - F_{tr1} = 0 \rightarrow F_{p2} = F_{tr1}$ (1)

y: $F_{p1} + F_{tr2} - F_g = 0 \rightarrow F_{p1} = F_g - F_{tr2}$ (2)

5

$F_{tr1} = k_{tr} \cdot F_{p1}$

$F_{tr2} = k_{tr} \cdot F_{p2}$ (1)

$F_{tr2} = k_{tr} \cdot F_{tr1}$

$F_{tr2} = k_{tr} \cdot k_{tr} \cdot F_{p1}$ (2)

$F_{tr2} = k_{tr}^2 \cdot F_g - k_{tr}^2 F_{tr2}$

$F_{tr2}(1 + k_{tr}^2) = k_{tr}^2 F_g$

$F_{tr2} = \frac{k_{tr}^2}{1 + k_{tr}^2} F_g$

$F_{tr1} = \frac{k_{tr}}{1 + k_{tr}} F_g$

$\sum M_i = J \cdot \alpha$

5

$M_1 = F_{tr1} \cdot r$

$M_2 = F_{tr2} \cdot r$

$M = M_1 + M_2 = mgr \frac{k_{tr}(k_{tr}+1)}{1+k_{tr}^2}$

$\alpha = \frac{M}{\frac{1}{2}mr^2} = \frac{2g}{r} \frac{k(k+1)}{1+k^2}$

$\alpha = 21{,}8\,s^{-2}$

5

$\omega_k^2 = \omega_z^2 - 2\alpha\varphi$ ker rovina

0

$\varphi = \frac{\omega_z^2}{2\alpha} = 82{,}6\,rad$

$N = \frac{\varphi}{2\pi} = 13{,}2$

5

④ $C = 1\,\mu F$

$L = 0{,}3\,H$

$R = 1000\,\Omega$

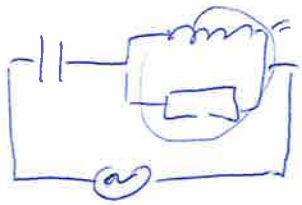
$U_0 = 0{,}58\,V$

$\omega = 1732\,Hz$

$I_0 = ?$

$\delta = ?$

$P_R = ?$



$\frac{1}{Z_{N1}} = \frac{1}{R} + \frac{1}{i\omega L} = \frac{i\omega L + R}{i\omega LR}$

5

$Z_{N1} = \frac{i\omega LR}{i\omega L + R} = \frac{\omega LR^2}{R^2 + \omega^2 L^2} i + \frac{\omega^2 L^2 R}{R^2 + \omega^2 L^2}$

$Z_N = Z_{N1} + \frac{1}{i\omega C} = Z_{N1} - \frac{1}{\omega C} \cdot i$

$Z_N = \frac{\omega^2 L^2 R}{R^2 + \omega^2 L^2} + \left(\frac{\omega LR^2}{R^2 + \omega^2 L^2} - \frac{1}{\omega C} \right) i$

$U_0 = |Z_N| I_0$

$I_0 = \frac{U_0}{|Z_N|}$

$|Z_N| = \sqrt{Re(Z_N)^2 + Im(Z_N)^2}$

$|Z_N| = \sqrt{\left(\frac{\omega^2 L^2 R}{R^2 + \omega^2 L^2} \right)^2 + \left(\frac{\omega LR^2}{R^2 + \omega^2 L^2} - \frac{1}{\omega C} \right)^2}$

5

$I_0 = 2{,}14\,mA$

$\delta = arctg\left(\frac{Im(Z_N)}{Re(Z_N)} \right) = -38{,}4°$

5

$U_g = U_c + U_R$ 5

$U_R = U_g - U_c = U_g\left(1 - \frac{Z_c}{Z_N}\right)$

$U_R = U_g\left(1 - \frac{|Z_c| e^{i(-\frac{\pi}{2})}}{|Z_N| e^{i\sigma}}\right)$

$U_R = U_g\left(1 - \frac{|Z_c|}{|Z_N|} e^{-i(\frac{\pi}{2}+\sigma)}\right)$

$U_R = U_g\left(\underbrace{1 - \frac{|Z_c|}{|Z_N|}\cos\left(\frac{\pi}{2}+\sigma\right) - \frac{|Z_c|}{|Z_N|}\sin\left(\frac{\pi}{2}+\sigma\right)i}_{\tilde{Z}}\right)$

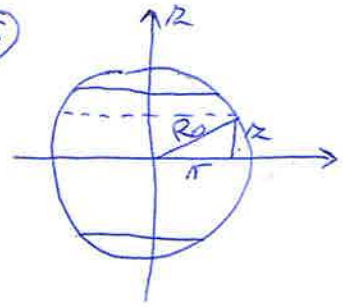
$U_R^0 = U_g^0 \cdot |\tilde{Z}|$, $|\tilde{Z}| = \sqrt{\left(1 - \frac{|Z_c|}{|Z_N|}\cos\left(\frac{\pi}{2}+\sigma\right)\right)^2 + \left(\frac{|Z_c|}{|Z_N|}\sin\left(\frac{\pi}{2}+\sigma\right)\right)^2}$

$|\tilde{Z}| = 1{,}7$

$U_R^0 = 0{,}98\,V$ 5

$P_R = \frac{1}{2}\frac{U_R^{0\,2}}{R} = 0{,}49\,mW$

(5)



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$R = \frac{\xi L}{S}$

$R^2 = r^2 = R_0^2 - z^2$ 5

$S(z) = \pi r^2 = \pi(R_0^2 - z^2)$

$I = U/R = 3MA$

5

$R = \int_{-0{,}9R_0}^{0{,}9R_0} dR = 2\int_0^{0{,}9R_0} dR = 2\int_0^{0{,}9R_0} \frac{\xi}{S(z)}dz = \frac{2\xi}{\pi}\int_0^{0{,}9R_0} \frac{dz}{R^2 - z^2} =$

$= \frac{2\xi}{\pi R}\left[\operatorname{atanh}(0{,}9) - \operatorname{atanh}(0)\right]$ 5

$= 1{,}57 \cdot 10^{-6}\,\Omega$

$\operatorname{atanh}(x) = \frac{1}{2}\ln\left|\frac{x+1}{x-1}\right|$