Ασκ. 7.96

500 σπείρες

$L = 0{,}2\ H$

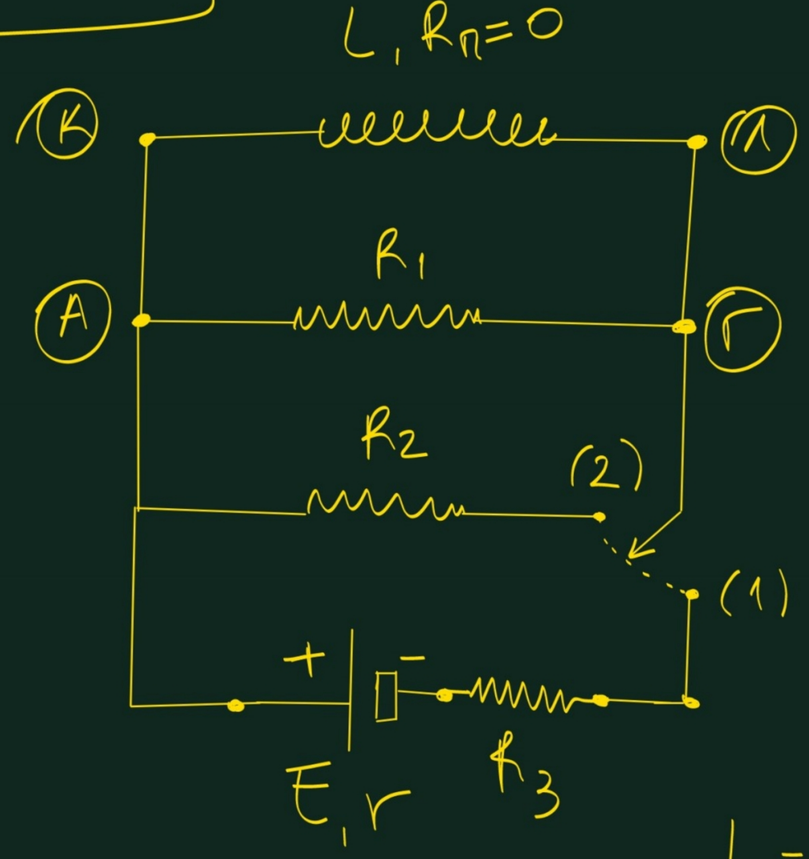
$R_1 = 30\ \Omega$

$R_2 = 60\ \Omega$

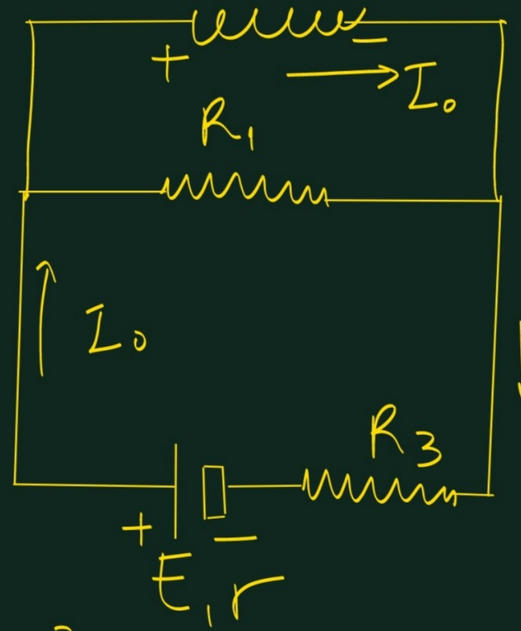
$R_3 = 30\ \Omega$

$\mathcal{E} = 120\ V$

$r = 10\ \Omega$



α) Με το γνωστό στη θέση (1) έχουμε το κύκλωμα:



Στη γόνιμη απόμειση το πηνίο συμπεριφέρεται σαν βραχυκύκλωμα.

$$I_0 = \frac{\mathcal{E}}{R_3 + r} \Rightarrow$$

$$I_0 = \frac{120}{40} = 3A$$

$$L = \gamma_0 \gamma \frac{N^2}{\ell} A$$

$$\Phi_{max} = BA = \gamma \gamma_0 n I_0 A = \gamma \gamma_0 \frac{N}{\ell} \cdot A \cdot I_0 = \frac{L I_0}{N}$$

Άρα: $\Phi_{max} = \frac{LI_0}{N} = \frac{0,2 \cdot 3}{500} \Rightarrow$

$\Phi_{max} = \frac{0,6}{5 \cdot 10^2} = \frac{6 \cdot 10^{-1}}{5 \cdot 10^2} \Rightarrow$

$\Phi_{max} = 1,2 \cdot 10^{-3}$ Wb.

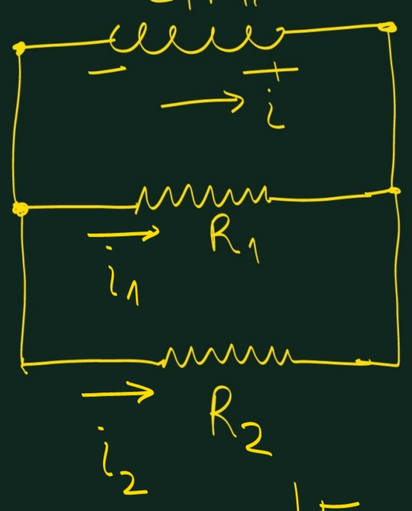
$E_{αυτ} = i R_{1,2} \Rightarrow$

$-L \frac{\Delta i}{\Delta t} = i \frac{R_1 R_2}{R_1 + R_2} \Rightarrow$

$L \frac{\Delta i}{\Delta t} = -i \frac{R_1 R_2}{R_1 + R_2}$

Αν $i = \frac{I_0}{2}$ έχουμε:

β) i)



Μεταφορά στη Θέση (2)

$V_L = L \frac{\Delta i}{\Delta t} = |E_{αυτ}| = \frac{I_0}{2} \frac{R_1 R_2}{R_1 + R_2} = \frac{3}{2} \cdot \frac{30 \cdot 60}{30 + 60}$

$= \frac{3}{2} \cdot \frac{1800}{90} = \frac{3}{2} \cdot 20 = 30$ Volt

$|E_{αυτ}| = \frac{|\Delta \Phi|}{\Delta t}$ για όλες τις σπείρες. Άρα για μία σπείρα:

$$\frac{|\Delta\Phi_{\text{σπείρας}}|}{\Delta t} = \frac{1}{N}\frac{|\Delta\Phi|}{\Delta t} =$$

$$= \frac{1}{N}\cdot|E_{\text{αυτ}}| = \frac{1}{500}\cdot 30 =$$

$$= \frac{0,6}{100} = 6\cdot 10^{-3}\ \text{Wb/sec}\ (\text{Volt})$$

ii) Πρέπει να βρούμε τη διαφορά ισχύ του αντιστάτη R_1.

$$P_1 = i_1^2 R_1 = \frac{\Delta Q_{R_1}}{\Delta t}$$

$$L\cdot\frac{\Delta i}{\Delta t} = -i\frac{R_1 R_2}{R_1+R_2}$$

$$i = i_1 + i_2$$

$$i_1 R_1 = i_2 R_2 \Rightarrow i_1\cdot 30 = i_2\cdot 60 \Rightarrow$$

$$\Rightarrow i_1 = 2i_2 \Rightarrow i_2 = \frac{i_1}{2}$$

$$i = \frac{I_0}{2}$$

$$i = i_1 + \frac{i_1}{2} \Rightarrow i = \frac{3i_1}{2} \Rightarrow$$

$$\frac{I_0}{2} = \frac{3}{2}i_1 \Rightarrow \frac{3}{2} = \frac{3}{2}\cdot i_1 \Rightarrow i_1 = 1\,A$$

Άρα: $\frac{\Delta Q_{R_1}}{\Delta t} = 1^2\cdot 30 = 30\ \text{Watt}$

γ) $U_L = \frac{1}{2} L i^2$

$$\frac{\Delta U_L}{\Delta t} = Li \frac{\Delta i}{\Delta t} = i U_L$$

$$U_L = Q_{R_1} + Q_{R_2} \Rightarrow$$

$$\frac{\Delta U_L}{\Delta t} = \frac{\Delta Q_{R_1}}{\Delta t} + \frac{\Delta Q_{R_2}}{\Delta t} =$$

$$= i_1^2 R_1 + i_2^2 R_2$$

$$\frac{\Delta Q_{R_2}}{\Delta U_L} = \frac{1}{3} \Rightarrow \Delta U_L = 3 \Delta Q_{R_2}$$

$$i_1 R_1 = i_2 R_2 \Rightarrow 30 i = 60 i_2 \Rightarrow i_1 = 2 i_2$$

$$\frac{\frac{\Delta Q_{R_2}}{\Delta t}}{\frac{\Delta U_L}{\Delta t}} = \frac{i_2^2 R_2}{i_1^2 R_1 + i_2^2 R_2} \Rightarrow \frac{\Delta Q_{R_2}}{\Delta U_L} = \frac{i_2^2 R_2}{4 i_2^2 R_1 + i_2^2 R_2} =$$

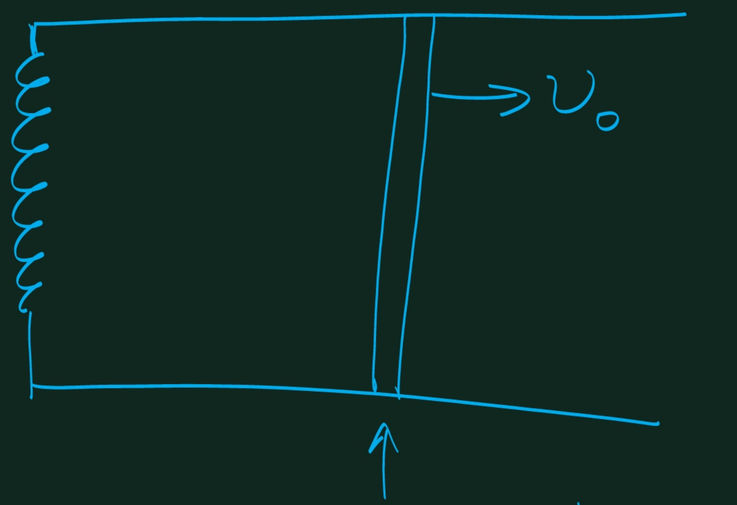
$$= \frac{R_2}{4R_1 + R_2} = \frac{60}{4 \cdot 30 + 60} = \frac{60}{180} =$$

$$= \frac{1}{3}$$

$$\sum \Delta U_L = 3 \sum \Delta Q_{R_2} \Rightarrow$$

$$U_{L,\alpha\rho\chi} = 3 Q_{R_{2,0\lambda}} \Rightarrow \frac{1}{2} L I_0^2 = 3 Q_{R_{2,0\lambda}} \Rightarrow \frac{1}{2} \cdot 0{,}2 \cdot 3^2 = 3 Q_{R_{2,0\lambda}} \Rightarrow$$

$$Q_{R_{2,0\lambda}} = 0{,}3 \text{ Joule.}$$


v_0
γραμμική
αρμονική
ταλάντωση