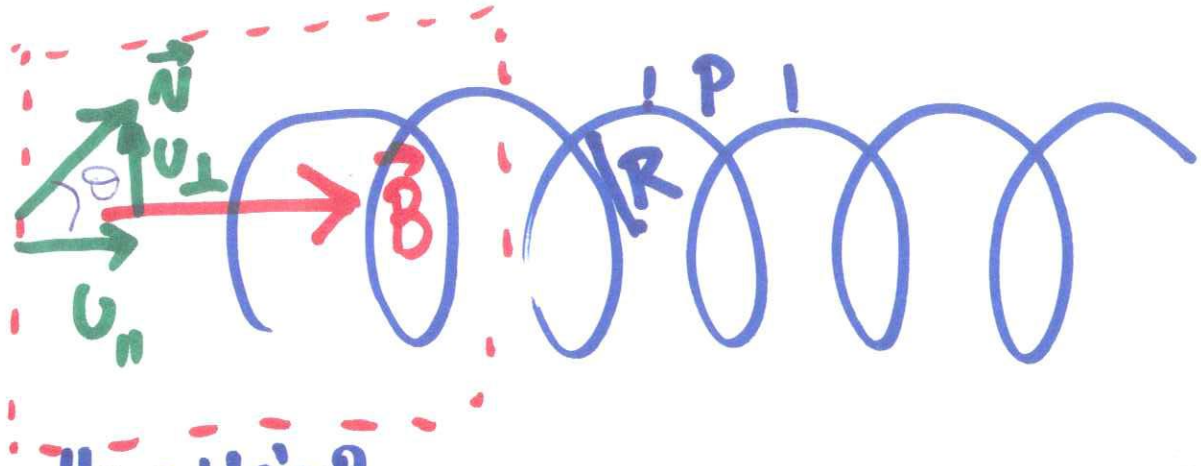
Κίνηση σε πεδίο $\vec{B}$

21/1/22



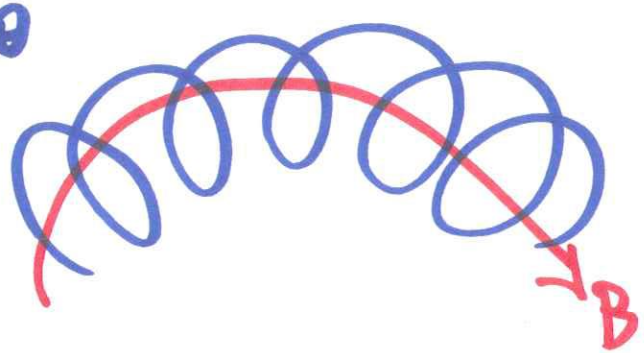
$v_\perp = v\sin\theta$

$v_\parallel = v\cos\theta$

$$qv_\perp B = m\frac{v_\perp^2}{R}$$

$$R = \frac{mv_\perp}{qB}$$

$$P = v_\parallel \cdot T = \dots$$



$$\frac{v_\perp}{R} = \omega = \frac{qB}{m}$$

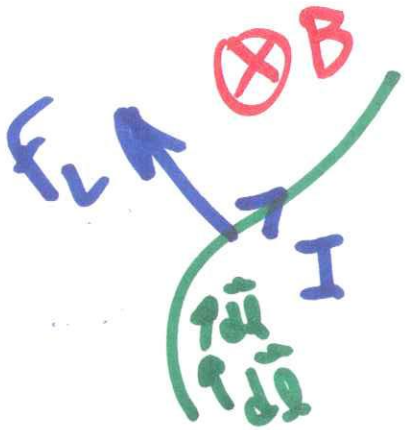
$$T = \frac{2\pi}{\omega} = \frac{2\pi m}{qB}$$

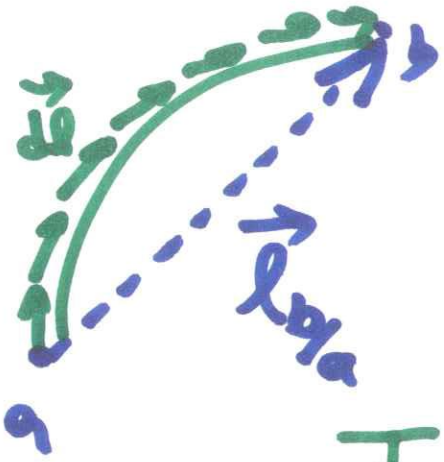
$\vec{F} = q\vec{v}\times\vec{B}$ $\quad d\vec{F} = I\,d\vec{\ell}\times\vec{B}$ $\quad \vec{B}=6\text{T}\alpha$

$q\vec{v} \rightarrow I\,d\vec{\ell}$ $\quad \vec{F} = I\left(\int_a^b d\vec{\ell}\right)\times\vec{B}$ (2)

ΔΥΝΑΜΗ

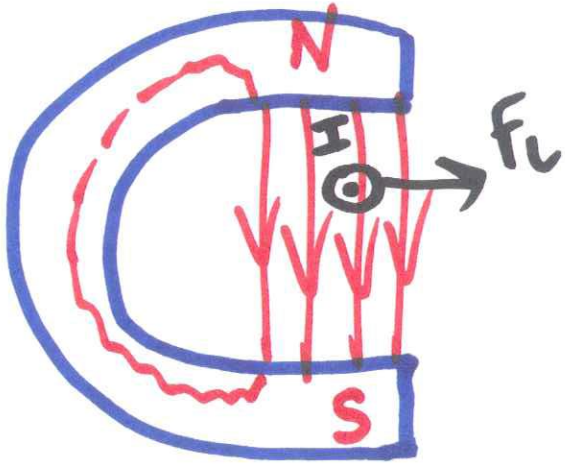
LAPLACE

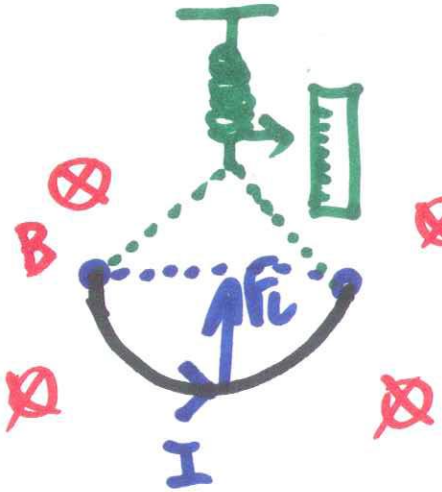




$\vec{F} = I\,\vec{\ell}_{a/a}\times\vec{B}$

$\boxed{F = BI\ell}$



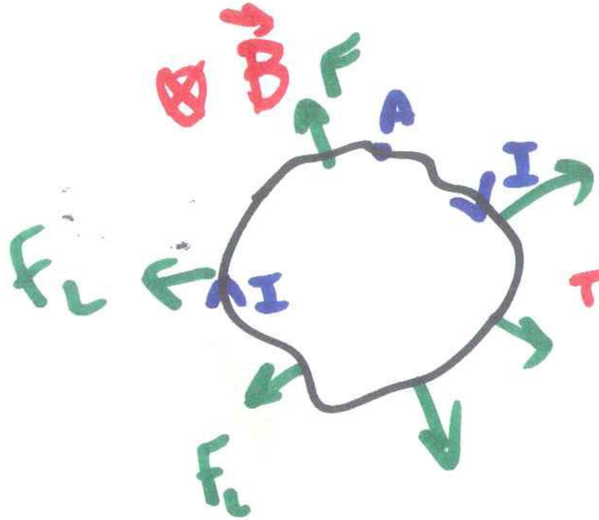


$F_1 = mg$

$F_2 = mg - BI\ell r$

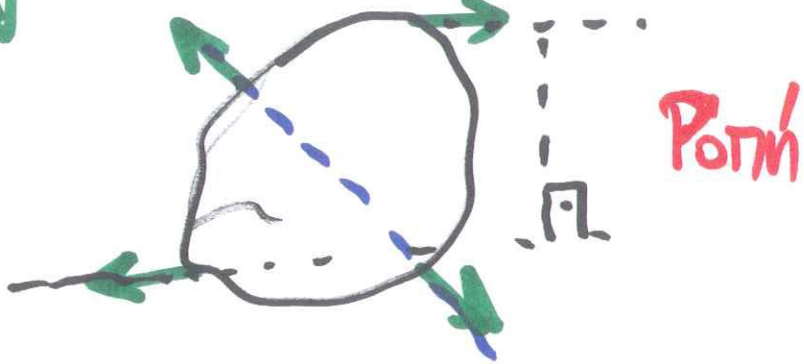
$F_1 - F_2 = 2BI\ell r$ (3)

$$\vec{F} = I \oint_{A/A} d\vec{l} \times \vec{B} = 0 \quad \text{συνισταμένη}$$



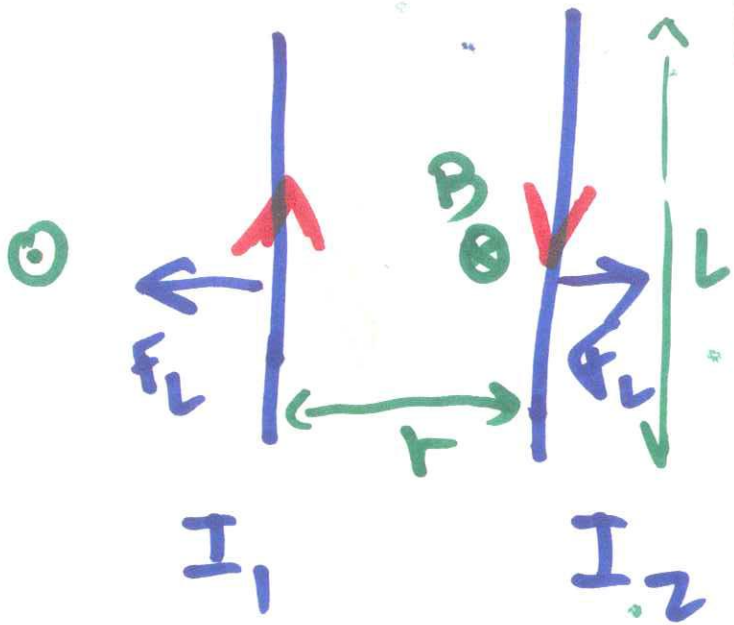
τάσεις

(3)



Βρόχος ρεύματος σε ομογενές $\vec{B}$

ΔΥΝΑΜΗ ΜΕΤΑΞΥ ΑΓΩΓΩΝ



$$F = I_2 L \cdot B_1 = I_2 L \cdot \frac{\mu_0}{2\pi} \cdot \frac{I_1}{r}$$

$$\frac{F}{L} = \frac{\mu_0}{2\pi} \cdot \frac{I_1 I_2}{r}$$

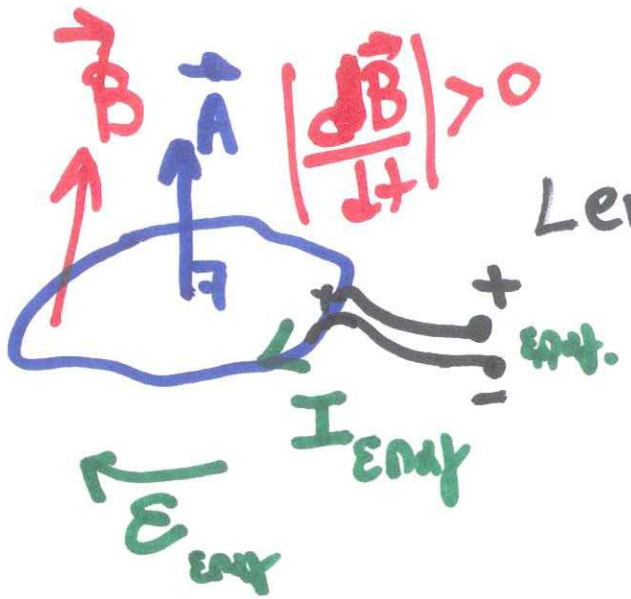
$$\mu_0 = 4\pi \cdot 10^{-7}$$

$$2 \times 10^{-7} N = \frac{2 \cancel{4\pi} 10^{-7}}{\cancel{2\pi}} \cdot \frac{1A \; 1A}{1m}$$

ορισμός του A αμπέρ

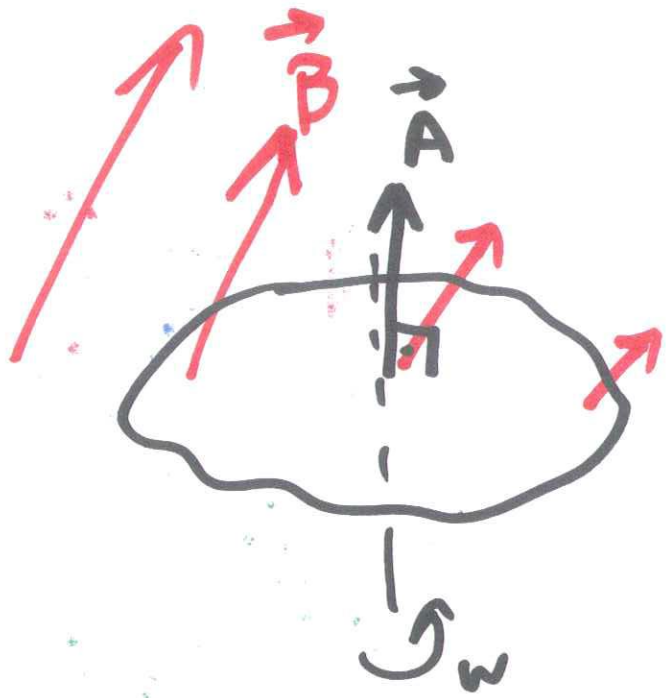
Faraday $\oint \vec{E} \cdot d\vec{l} = \mathcal{E} = -\frac{d\Phi_B}{dt}$

Επαγωγικά ΗΕΔ



Lenz: το επαγωγικό αποτέλεσμα τείνει να αναιρέσει την αιτία που το προκάλεσε

Παραγωγή επαγωγικής ΗΕΔ

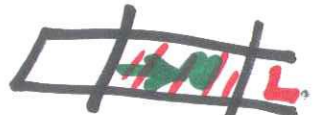


$\Phi_B = \vec{B}\cdot\vec{A} = BA\cos\theta$ (6)

1) $\frac{d\vec{B}}{dt} \neq 0$

2) $\frac{d\theta}{dt} \neq 0$ περιστροφή

3) $\frac{dA}{dt} \neq 0$



κίνηση

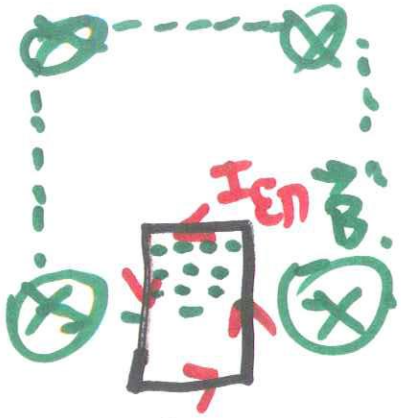
$dx = v\cdot dt$

$dA = L\,dx = L v\,dt$

$A = Na$

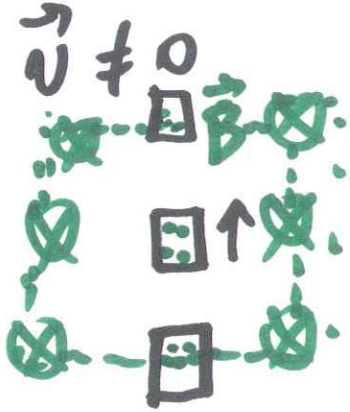
$\frac{dA}{dt} = \frac{dN}{dt}\cdot a$

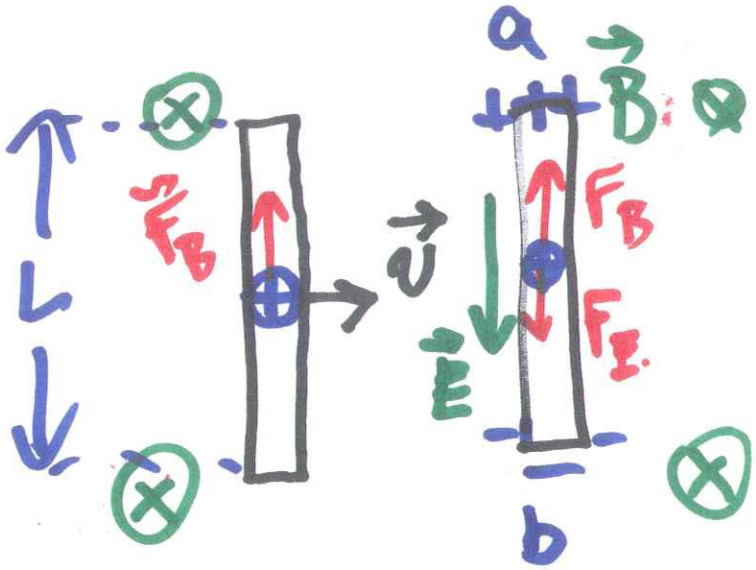
τυλίγω και άλλες σπείρες



4) $\frac{dB}{dx} \neq 0$ μαγνήτης

κίνηση





$F_B = F_E$

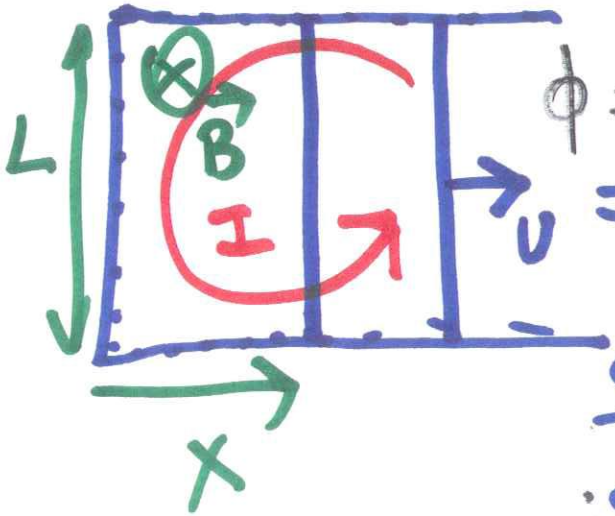
$qvB = qE$

$vB = \dfrac{V_{ab}}{}$

$V_{ab} = V_a - V_b$

$$\boxed{V_{ab} = Bvl}$$

$dx = v \cdot dt$



$\phi = BA$

$v = BLx$

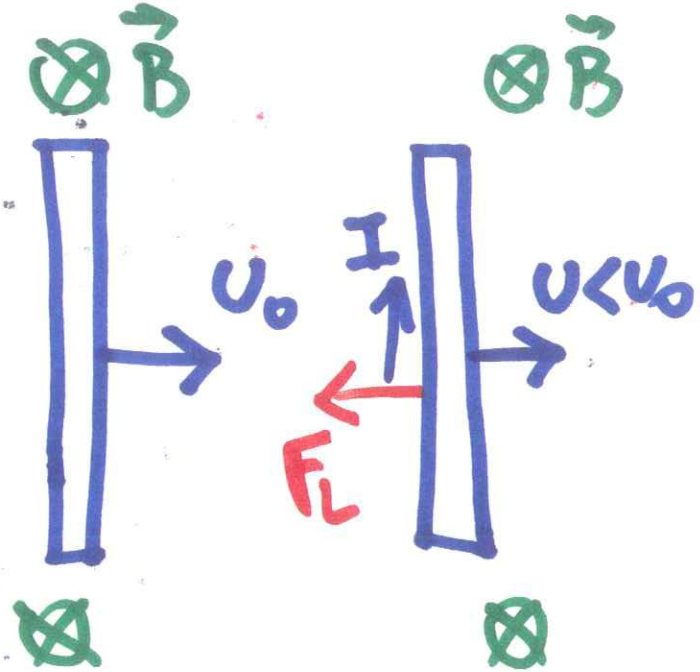
$$\frac{d\phi}{dt} = BL\frac{dx}{dt}$$

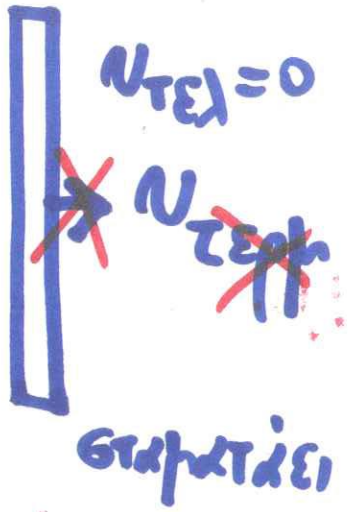
$$= Bvl$$

$V_{ab} = (\vec{v} \times \vec{B}) \cdot \vec{l}_{a/b}$

$d\mathcal{E} = (\vec{v} \times \vec{B}) \cdot d\vec{l}$

Τι κίνηση θα κάνει η ράβδος;





$$\Sigma F = ma \quad (B)$$

$$-bv = m\frac{dv}{dt}$$

$$\int_{v_0}^{v}\frac{dv}{v} = -\frac{b}{m}\int_0^t dt$$

$$\ln\frac{v}{v_0} = -\frac{b}{m}t$$

$$v = v_0 e^{-\frac{b}{m}t}$$

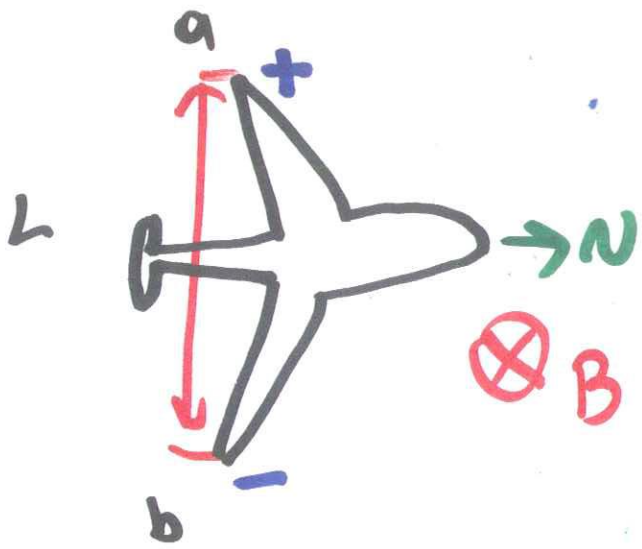
$t \to \infty$

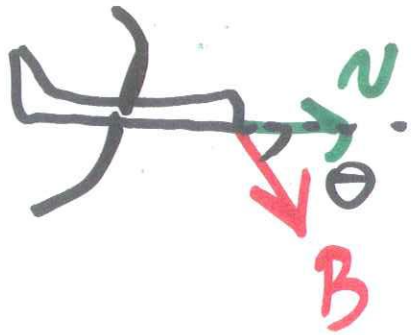
$v = 0$

$$F_L = BIl = B\frac{V}{R}l = B\frac{Bvl}{R}l$$

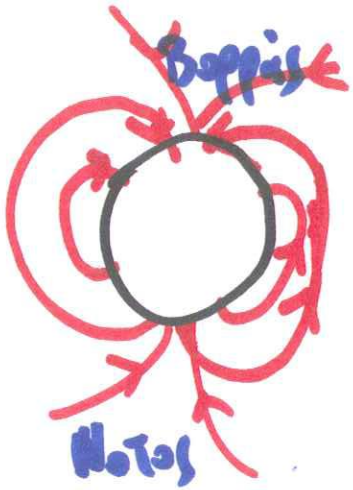
$$\boxed{\vec{F}_L = -\left(\frac{B^2l^2}{R}\right)\cdot\vec{v}}$$

κίνηση με μεταβλητη επιβράδυνση οπισθέλκουσα



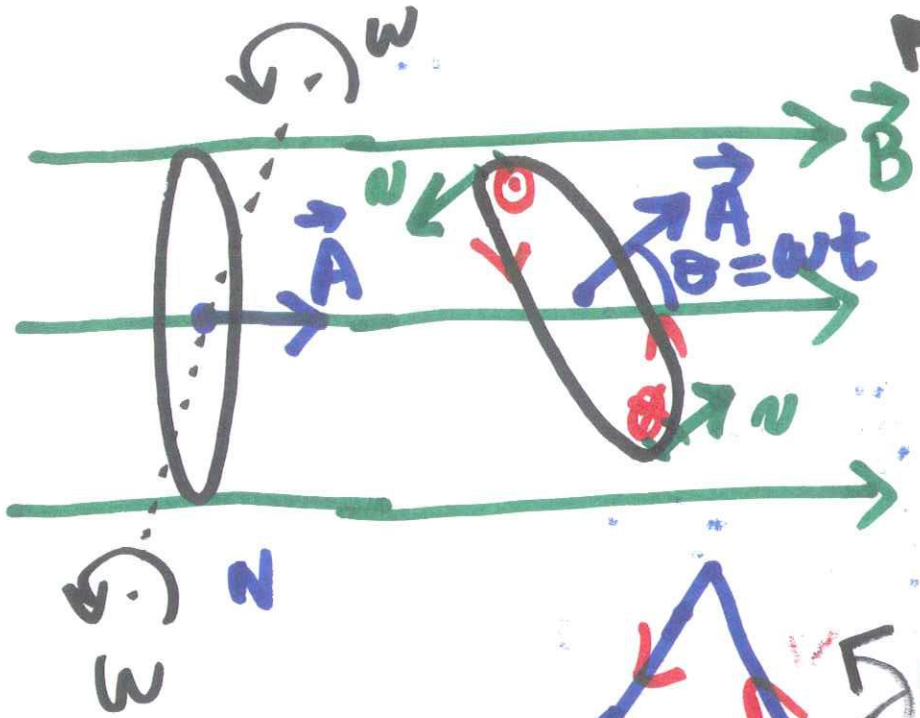


Bappis



$$V_{ab} = vB \sin\theta \, L$$

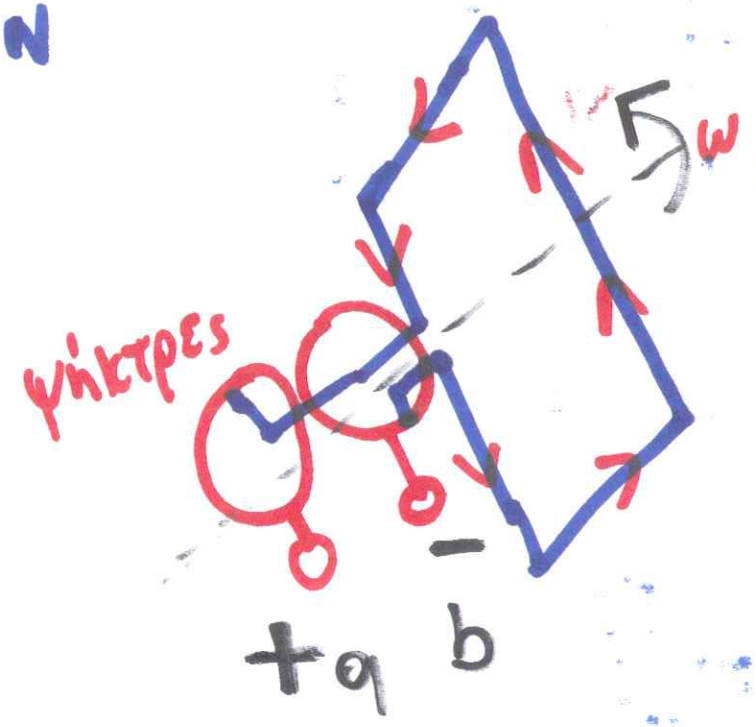
ΓΕΝΝΗΤΡΙΑ



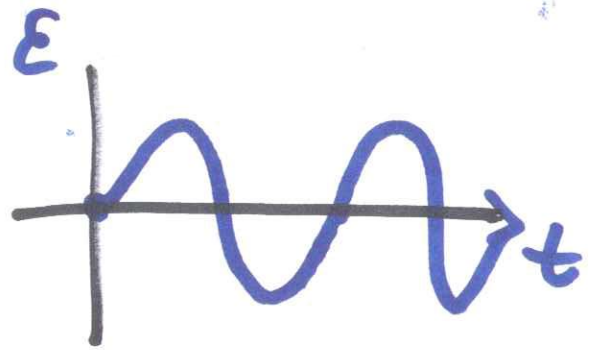
$$\Phi = \vec{B}\cdot\vec{A} = BAN\sigma\upsilon\nu\omega t$$

$$\mathcal{E} = -\frac{d\Phi}{dt} = +BAN(+\eta\mu\omega t)\omega$$

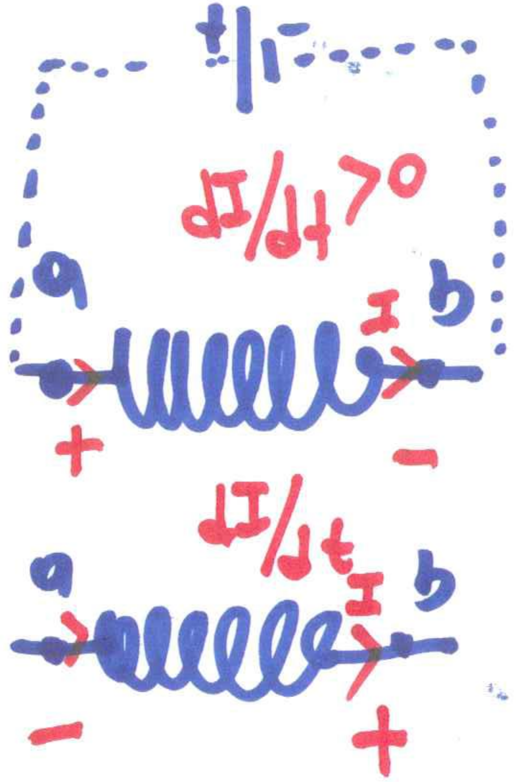
$$\boxed{\mathcal{E} = BNA\omega\,\eta\mu\omega t}$$



$$V_{ab} = \mathcal{E}$$



$V_a - V_b$



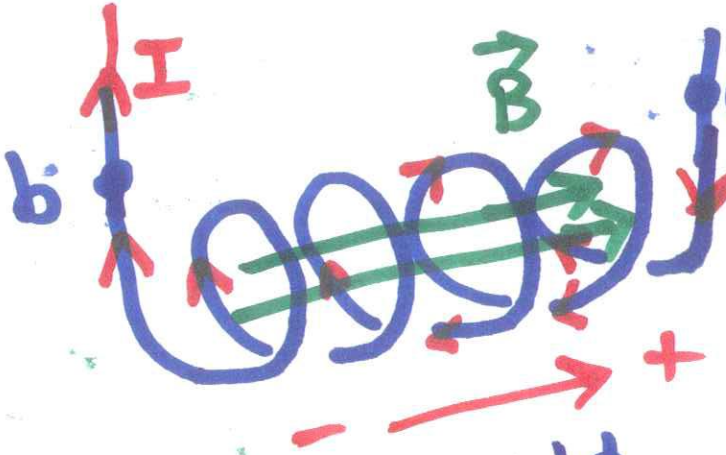
$V_a > V_b$

$$V_{ab} = L\frac{dI}{dt}$$

$$V_{ab} = L\frac{dI}{dt}$$

$V_a < V_b$

$$B = n\mu_0 I \qquad n = \frac{N}{L}$$



I, $\frac{dI}{dt} > 0$

(11)

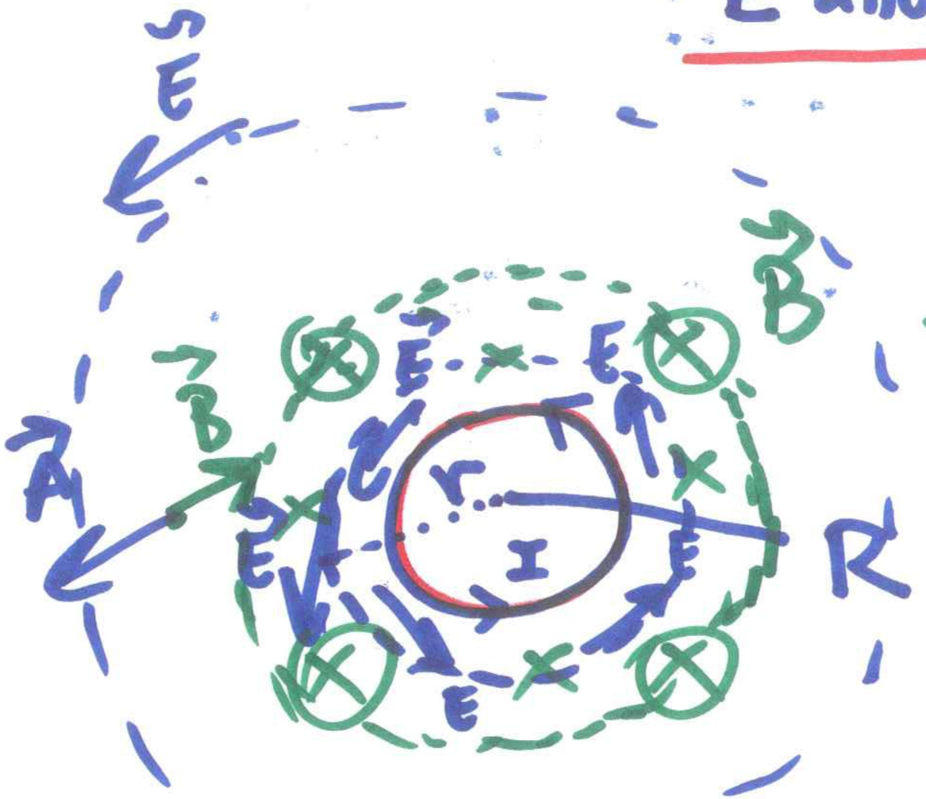
$$\mathcal{E} = \frac{d\phi}{dt} = \frac{d}{dt}(BA) = \frac{d}{dt}(\mu_0 n A I)$$

$$\mathcal{E} = \underbrace{(\mu_0 n A)}_{L}\frac{dI}{dt}$$

ΑΥΤΕΠΑΓΩΓΗ

ΠΗΝΙΟ

$\vec{E}$ από χρονικά μεταβαλλόμενο $\vec{B}$

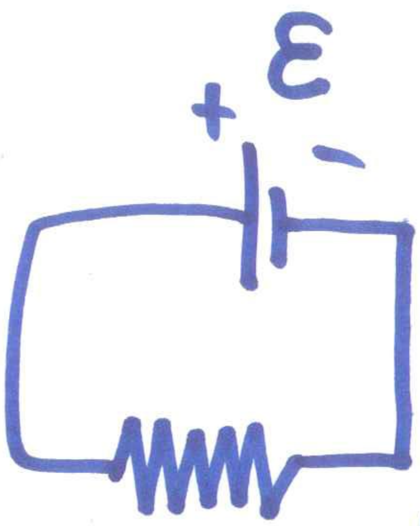


$\frac{dB}{dt} > 0$ σταθ

$r < R$	$E = \left(\frac{dB}{dt}\right) \cdot \frac{r}{2}$
$r > R$	$E = \left(\frac{dB}{dt} R^2\right) \cdot \frac{1}{2r}$

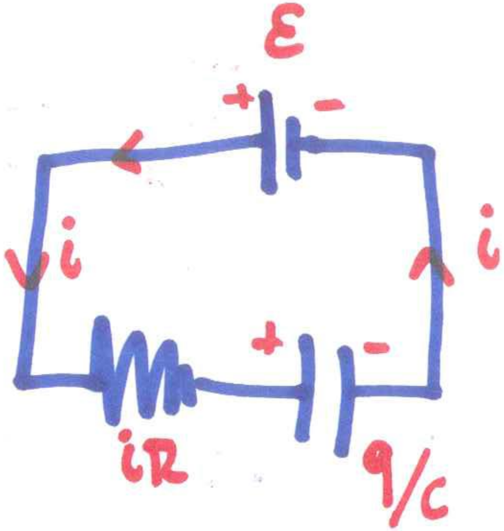
$$\oint_C \vec{E} \cdot d\vec{l} = \int E\, dl = E \int dl = E \cdot 2\pi r$$

$$-\frac{d\Phi}{dt} = -\frac{d}{dt}\left(\vec{B} \cdot \vec{A}\right) = \left(\frac{dB}{dt}\right) \cdot A \begin{cases} \pi r^2 \\ \pi R^2 \end{cases}$$



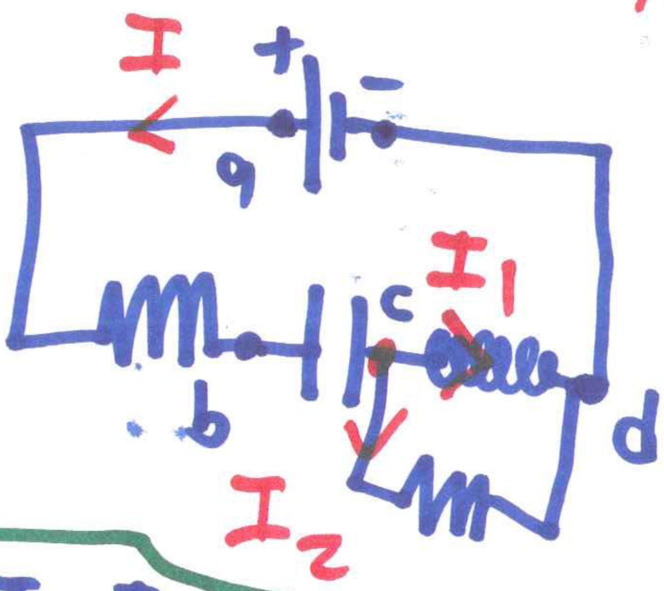
$I = \frac{\varepsilon}{R}$

$R = \rho \frac{l}{A}$



(13)

ΚΑΝΟΝΕΣ KIRCHHOFF

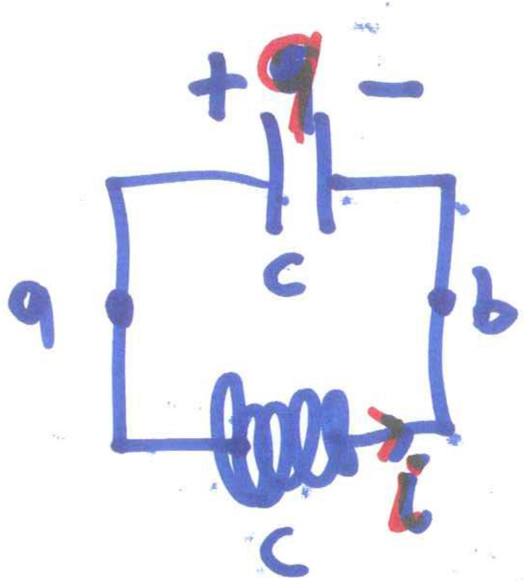


KCL κανόνας κόμβων

$\sum I_i = 0$ $\quad I = I_1 + I_2$ Διατήρηση ηλεκτρ. φορτίου

KVL κανόνας βρόχων

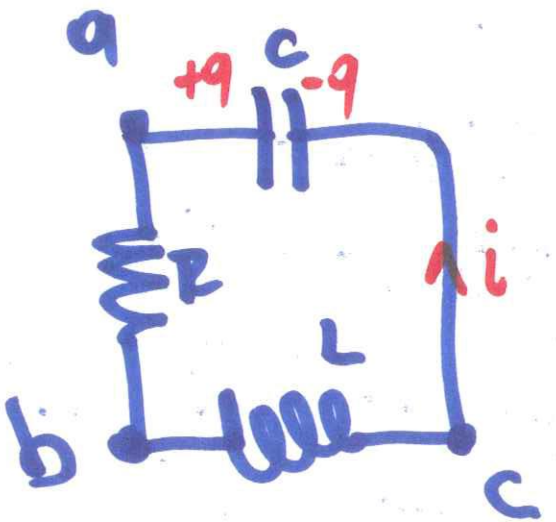
διατήρηση ενέργειας $\sum V_{ij} = 0$ $\quad V_{ab} + V_{bc} + V_{cd} + V_{da} = 0$



$$V_{ab} + V_{ba} = 0 \qquad i = \frac{dq}{dt}$$

$$L\frac{di}{dt} + \frac{q}{C} = 0 \qquad \alpha.\alpha.\tau.$$

$$\frac{d^2q}{dt^2} + \left(\frac{1}{LC}\right)\cdot q = 0 \qquad \omega = \sqrt{\frac{1}{LC}}$$



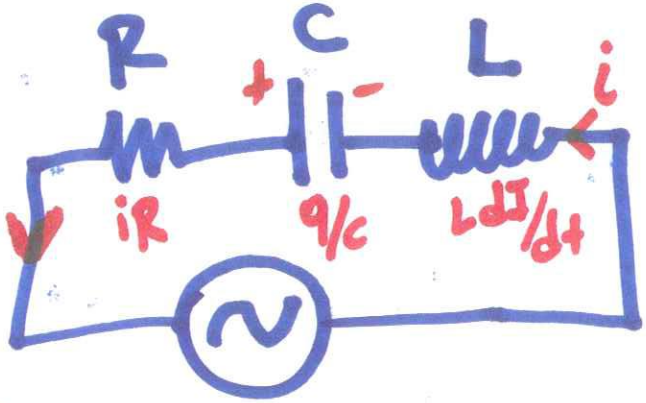
$$V_{ab} + V_{bc} + V_{ca} = 0$$

$$iR + L\frac{di}{dt} + \frac{q}{C} = 0$$

$$\frac{d^2q}{dt^2} + \left(\frac{R}{L}\right)\frac{dq}{dt} + \left(\frac{1}{LC}\right)q = 0$$

φθίνουσα ταλάντωση

Μηχανική → Ηλεκτρ. κύκλωμα
· $x \rightarrow q$
$v \rightarrow i$



$\mathcal{E}, \omega$

$$iR + \frac{q}{c} + L\frac{di}{dt} = \mathcal{E}\sin\omega t$$

$$\frac{d^2q}{dt^2} + \left(\frac{R}{L}\right)\frac{dq}{dt} + \left(\frac{1}{LC}\right)q = \frac{\mathcal{E}}{L}\sin\omega t$$

εξαναγκασμένη ταλάντωση