

Electrotechnique : alimentation et machines

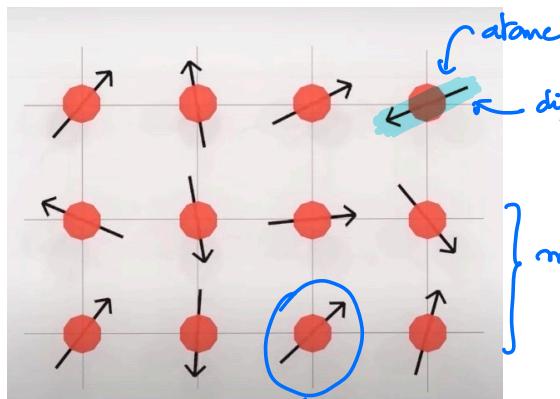
Partie 3. transformateurs *et milieux magnétiques*

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Matière



dipôle magн equivalent (comme un petit aimant)

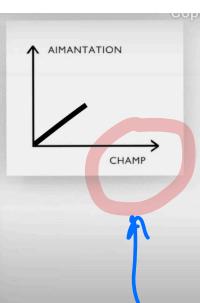
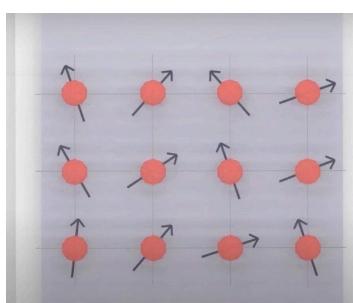
note \vec{m}

↑ "moment dipolaire"

matière non aimante : $\sum_i \vec{m}_i = \vec{0}$

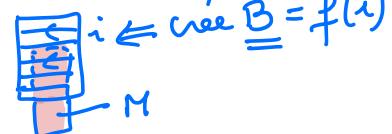
Aimantation : $\vec{M} = K \sum_i \vec{m}_i$ et $[\vec{B}] = [\chi_0 \vec{M}]$

fluctue en directrice à cause de l'agitation thermique

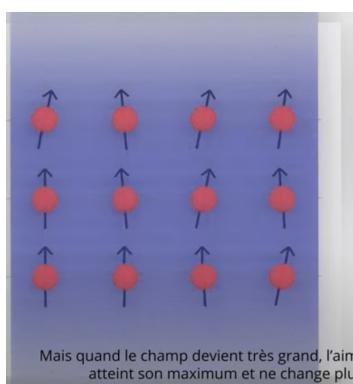
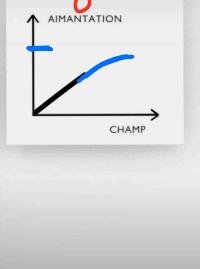
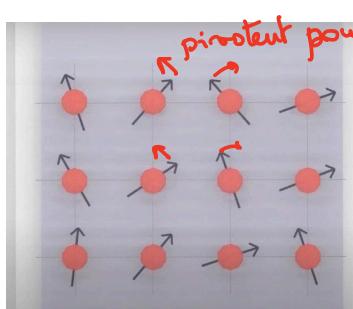


\vec{m} \vec{B} couple
car $\vec{C} = \vec{m} \vec{B}$ couple
et $\vec{C} = \vec{0}$ si \vec{m} et \vec{B} alignés.

champ B imposé par l'ext \Rightarrow il va essayer d'orienter les \vec{m}
exemple



B augmente avec i



saturation : car on ne peut pas orienter plus que "tous dans la direction de B "

Mais quand le champ devient très grand, l'aimantation atteint son maximum et ne change plus.

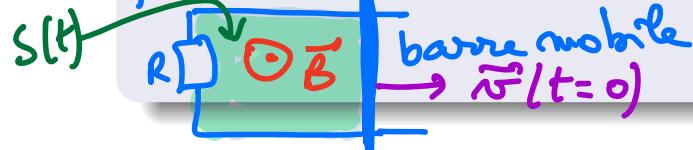
3.A Transformateur idéal et milieu magnétique

3.1 principe

Principe de fonctionnement

Loi de Faraday : une variation de flux à travers une spire crée une f.é.m. e.
Inversement une f.é.m. e dans une spire crée une variation de flux à travers celle-ci.

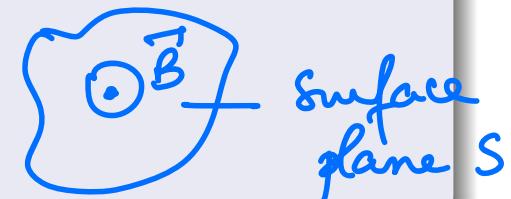
exemple : rails de Laplace



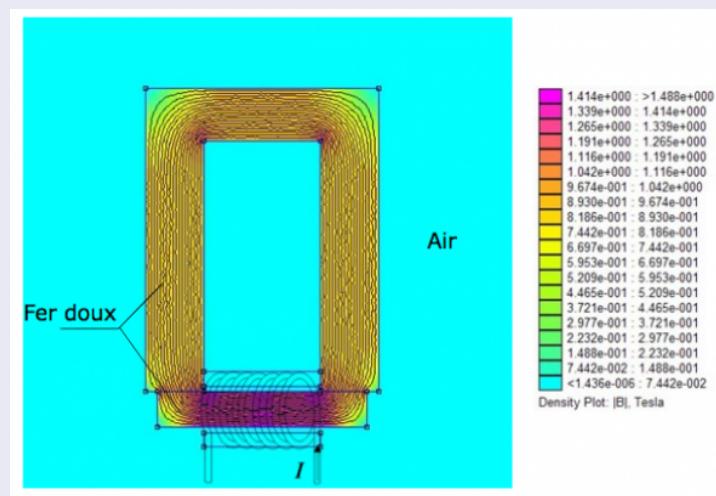
plus
loin

$$e = -\frac{d\Phi}{dt}$$

$$\Phi = B \times S$$



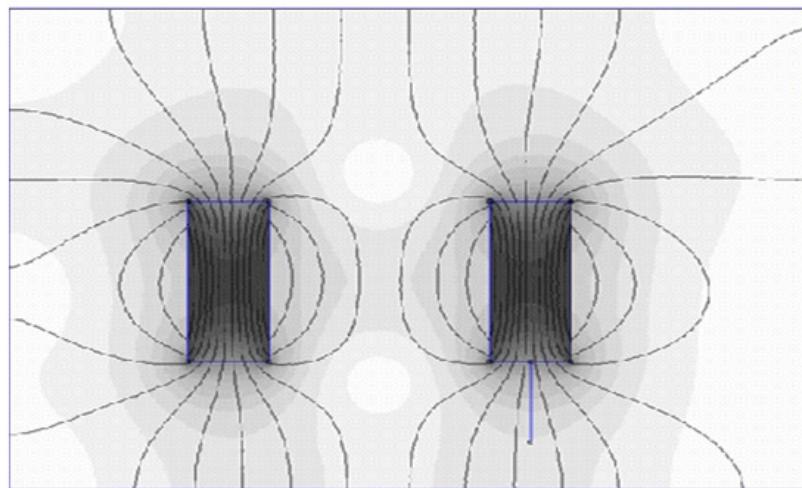
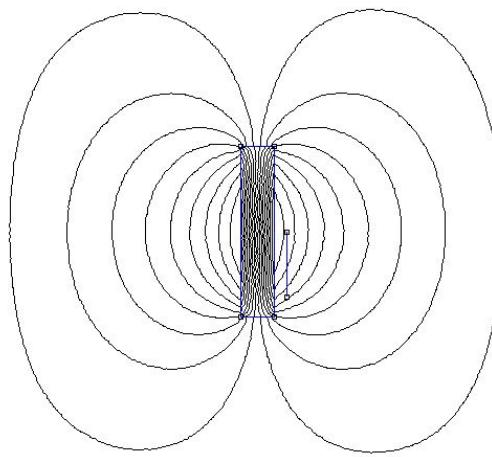
But recherché : la canalisation des lignes de champ \vec{B}



1.414e+000	> 1.488e+000
1.339e+000	1.414e+000
1.265e+000	1.339e+000
1.191e+000	1.265e+000
1.116e+000	1.191e+000
1.042e+000	1.116e+000
9.674e-001	1.042e+000
8.930e-001	9.674e-001
8.186e-001	8.930e-001
7.442e-001	8.186e-001
6.697e-001	7.442e-001
5.953e-001	6.697e-001
5.209e-001	5.953e-001
4.465e-001	5.209e-001
3.721e-001	4.465e-001
2.977e-001	3.721e-001
2.232e-001	2.977e-001
1.488e-001	2.232e-001
7.442e-002	1.488e-001
<1.436e-006	7.442e-002

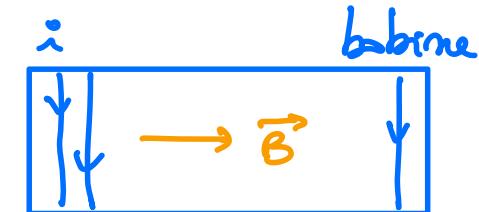
3.A Transformateur idéal

3.1 principe

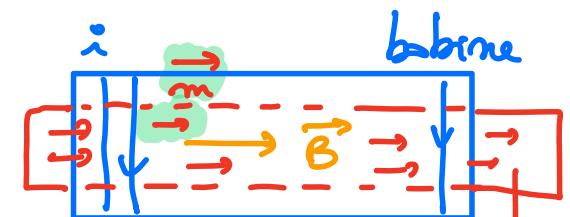


⚠ le matériau magn "amplifie" le champ créé par la bobine.

car

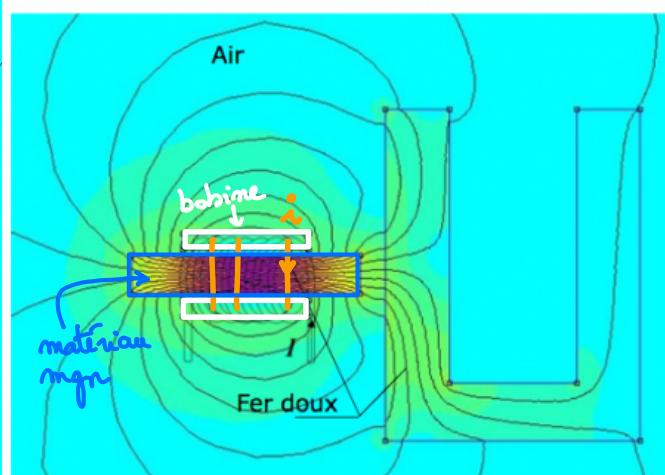
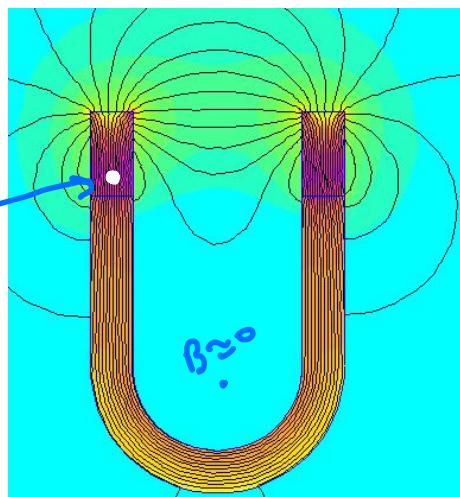


mais en ajoutant le matériau :

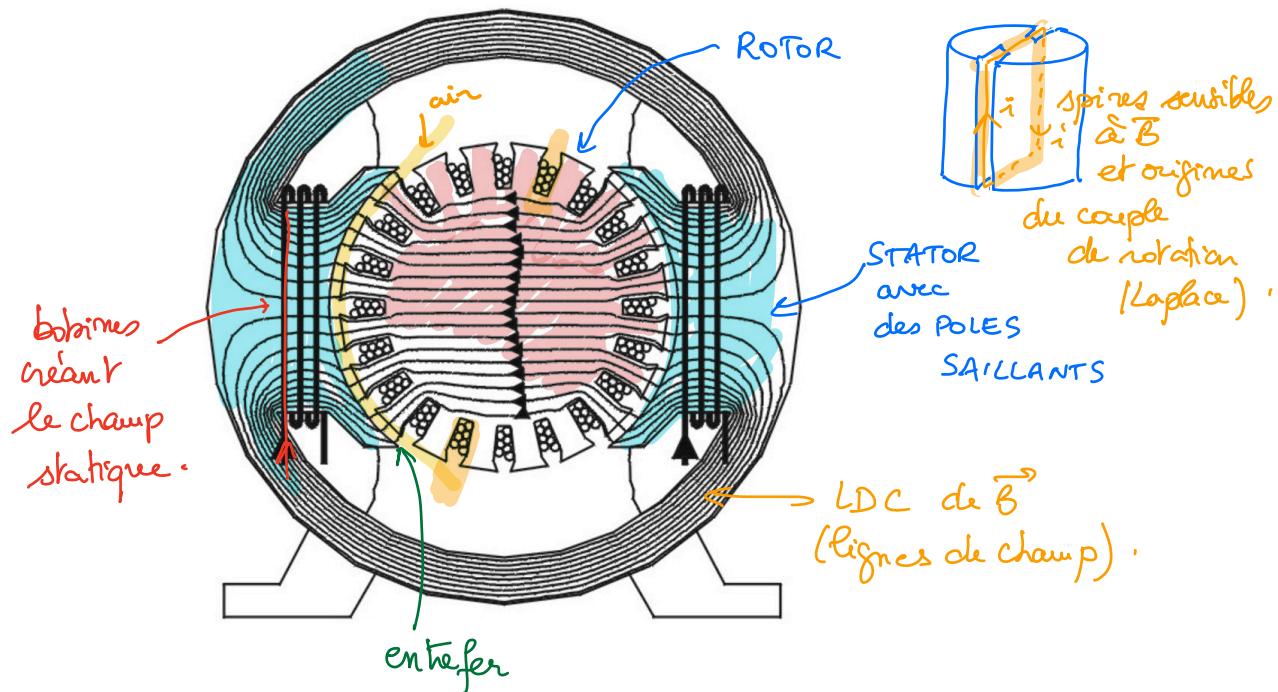


$$\begin{aligned}
 \vec{m} &\Rightarrow \text{crée } \vec{B}_m \\
 \sum_i \vec{m}_i &\Rightarrow \vec{M} \Rightarrow \vec{B}_M \\
 \text{donc } \vec{B}_{TOT} &= \vec{B} + \vec{B}_M \\
 \text{donc on a } &\uparrow \vec{B}
 \end{aligned}$$

matériau magn (μ_r) .

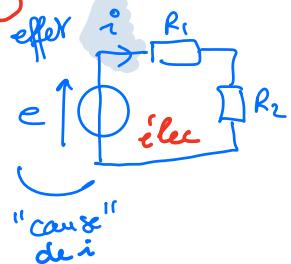


Plus μ_r est élevé, plus la canalisation est efficace.

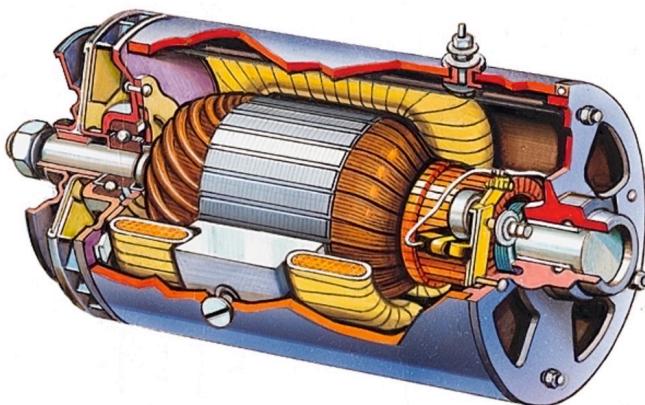
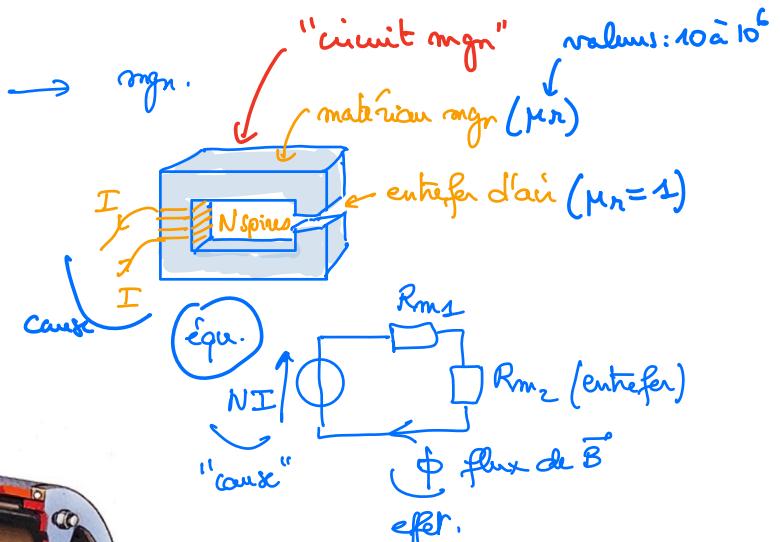


1^{re} question \Rightarrow étude du matériau magnétique qui guide les LK.

Analogie avec l'élec?

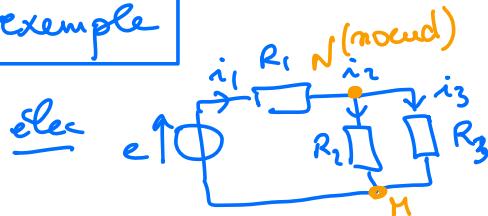


"cause" de i

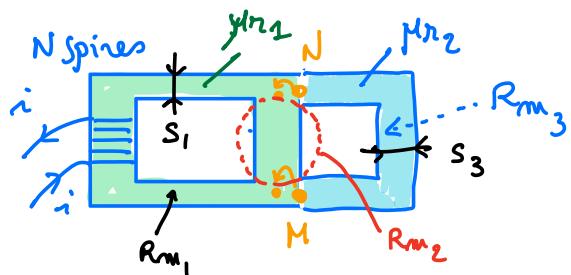


élec	magn
géné: e	NI (bobine)
$R = \frac{U}{I}$	R_m
i	$\phi = B \times S$
$U = RI$	HOPKINSON $R_m \phi = NI$
0HM	

exemple



$$\left\{ \begin{array}{l} i_3 = \frac{R_2}{R_2 + R_3} i_1 \\ i_2 = \frac{R_3}{R_2 + R_3} i_1 \end{array} \right. \text{ avec } i_1 = \frac{e}{R_1 + \frac{R_2 R_3}{R_2 + R_3}}$$



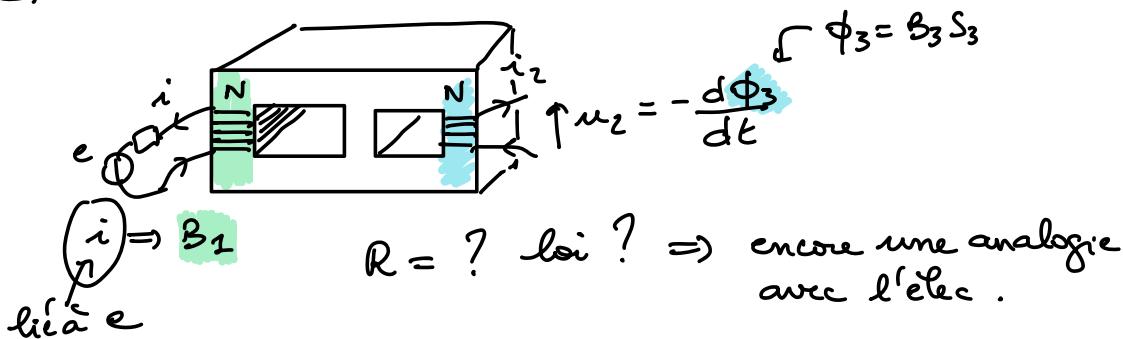
$$\text{dans } \phi_3 = \frac{R_{m2}}{R_{m1} + R_{m3}} \phi_1 \quad \phi_1 < \phi_3$$

$\frac{B_3 S_3}{B_1 S_1}$

si $S_1 = S_3 \Rightarrow$ on a donc demandé

$$\text{que } B_3 < B_1$$

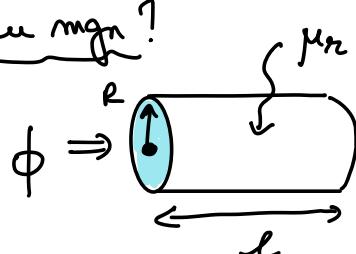
Application pour les transfos.



γ : "conductivité" du conducteur.

$i \Rightarrow \text{cylindre}$ $\Rightarrow R = \frac{1}{\gamma} \frac{l}{S}$ avec $S = \pi R^2$

Milieu magn?



$R_m = \frac{1}{\mu_0 \mu_r} \frac{l}{S}$ avec $S = \pi R^2$.

$\mu = \mu_0 \mu_r \Rightarrow$ "pér. absolue".

$$[\mu_r] = 1$$

$$[\mu_0] \neq 1$$

μ_r : "perméabilité" magn du matériau dite relative

pour le vide.