Chap 3

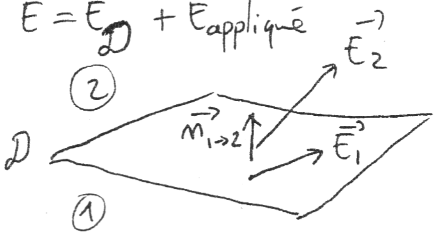
Electromagnétisme

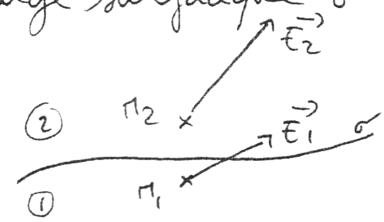
(Synthèse des deux chapitres précédents et généralisation)

I Discontinuités des champs

1) $\vec{E}$: nappe de charge surfacique σ

$\vec{E} = \vec{E}_{\mathcal{D}} + \vec{E}_{\text{appliqué}}$



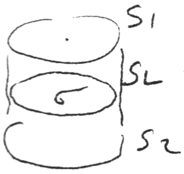


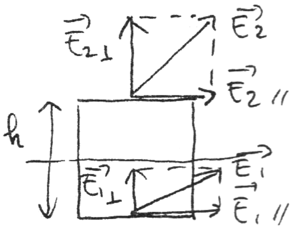
$M_2 \in$ 2

$M_1 \in$ 1

M_1 infiniment voisin de M_2.

relation entre $\vec{E}_1$ et $\vec{E}_2$?





$S = S_1 \cup S_2 \cup S_L$

$\phi_S = \oiint \vec{E}\cdot d\vec{S} = Q_{int}/\varepsilon_0$

$\phi_S = \phi_1 + \phi_2 + \phi_L$

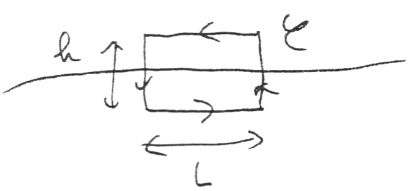
$\phi_L = \iint \vec{E}_{2\parallel}\cdot d\vec{S} + \iint \vec{E}_{1\parallel}\cdot d\vec{S}$

$h \to 0 \quad \phi_L \to 0$ car $S_L \to 0$

$\phi_1 = -E_{1\perp} S_1 \qquad \phi_2 = E_{2\perp} S_2 \quad \Rightarrow \quad (E_{2\perp} - E_{1\perp}) S = S\dfrac{\sigma}{\varepsilon_0}$

$\Rightarrow \quad \boxed{E_{2\perp} - E_{1\perp} = \dfrac{\sigma}{\varepsilon_0}}$

Composante tangentielle : $\oint \vec{E}\cdot d\vec{l} = 0$



$h \to 0 \Rightarrow -E_{2\parallel} L + E_{1\parallel} L = 0$

$\Rightarrow \quad \boxed{E_{2\parallel} - E_{1\parallel} = 0}$

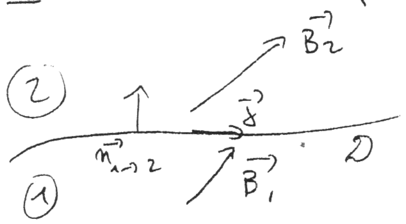
Conclusion $\quad \boxed{\vec{E}_2 - \vec{E}_1 = \dfrac{\sigma}{\varepsilon_0}\vec{n}_{1\to 2}}$

- La composante tangentielle du $\vec{E}$ est toujours continue

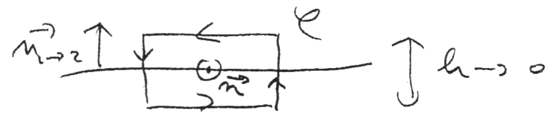
→ La " normale des $\vec{E}$ est discontinue en présence de charges surfacique.

2) $\vec{B}$: courant de surface

$$\oiint \vec{B}\cdot d\vec{S} = 0 \Rightarrow \boxed{B_{2\perp} - B_{1\perp} = 0}$$



$$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{encl} = \mu_0 \int \vec{j}_s \, dl\cdot\vec{n}$$



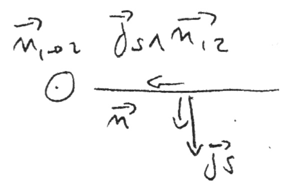
$$\vec{B} = \vec{B}_{\mathcal{D}} + \vec{B}_{appliqué}$$

$$-B_{2//}L + B_{1//}L = \mu_0 \vec{j}_s\cdot\vec{n}\, L$$

$$B_{2//} - B_{1//} = -\mu_0 j_s .$$

Conclusion :

$$\Rightarrow \boxed{\vec{B}_2 - \vec{B}_1 = \mu_0 \vec{j}_s \wedge \vec{n}_{1\to2}}$$



→ La composante normale de $\vec{B}$ est toujours continue

→ " " tangentielle " " est discontinue en présence de courants surfaciques.

II Lois de l'électromagnétisme (statique)

Expressions intégrales :

4 lois.

$\oint \vec{E}\cdot d\vec{l} = 0$	$\oiint \vec{E}\cdot d\vec{S} = \dfrac{Q_{int}}{\varepsilon_0}$
$\oiint \vec{B}\cdot d\vec{S} = 0$	$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{encl}$

dans le vide. — dans la matière. (présence de charges)