$\overrightarrow{n_1n_2}$

$$\vec{F}_{n_1n_2} = \int_{n_1n_2} i\,d\vec{l}' \wedge \vec{B} = i\left(\int_0^a d\vec{l}\,\vec{e}_3\right) \wedge \vec{B}$$

$$= Bia\,\vec{e}_3 \wedge \vec{e}_x$$

$\overrightarrow{n_3n_4}$

$$\vec{F}_{n_3n_4} = \int_{n_3n_4} i\,d\vec{l}' \wedge \vec{B} = i\int_a^0 dl\,\vec{e}_3 \wedge \vec{B}$$

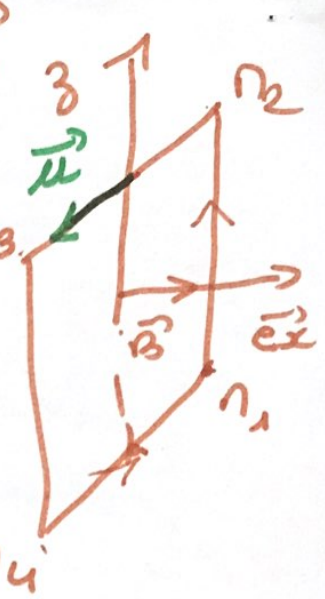
$$= -Bia\,\vec{e}_3 \wedge \vec{e}_x$$

$\overrightarrow{n_2n_3}$

$$\vec{F}_{n_2n_3} = \int i\,d\vec{l} \wedge B = i\left(\int d\vec{l}\right) \wedge \vec{B}$$

$$= ibB\,\vec{u} \wedge \vec{e}_{3x}$$

$\overrightarrow{n_4n_1}$ $\vec{F}_{n_4n_1} = -ibB\,\vec{u} \wedge \vec{e}_x$



Verticale

$\Gamma_1 \Gamma_2$

$\Gamma = (\overrightarrow{on} \wedge \vec{F})\vec{e}_3$

$\overrightarrow{on} = \frac{b}{2}\sin\alpha\,\vec{e}_x + \frac{b}{2}\cos\alpha\,\vec{e}_y + 3\vec{e}_3$

3 varie de $O(\Gamma_1)$ à $a(\Gamma_2)$

$\overrightarrow{d\Gamma_0} = \overrightarrow{on} \wedge \overrightarrow{dF}$

$= \overrightarrow{on} \wedge [i\,d\vec{\ell} \wedge \vec{B}]$

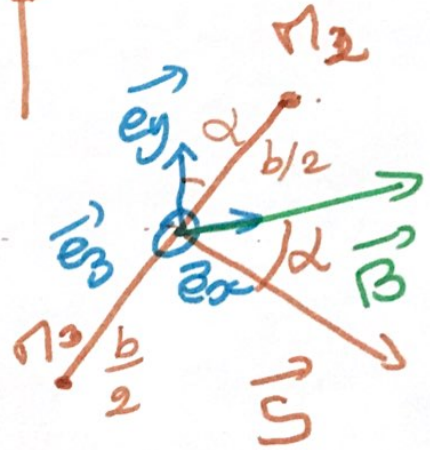
$= \left[\frac{b}{2}\sin\alpha\,\vec{e}_x + \frac{b}{2}\cos\alpha\,\vec{e}_y + 3\vec{e}_3\right] \wedge (i\,dz\,\vec{e}_3 \wedge B\vec{e}_x)$

$= \left(\frac{b}{2}\sin\alpha\,\vec{e}_x + \frac{b}{2}\cos\alpha\,\vec{e}_y + 3\vec{e}_3\right) \wedge iB\vec{e}_y\,dz$

$= iB\left[\frac{b}{2}\sin\alpha\,\vec{e}_3 - 3\vec{e}_x\right]dz$

$d\Gamma_{03} = d\vec{\Gamma}_0 \cdot \vec{e}_3 = iB\frac{b}{2}\sin\alpha\,dz$

$\vec{dF}$



M_1M_2 $\Gamma_{M_1M_2O_3} = iB\frac{b}{2}\sin\alpha \cdot a$

M_3M_4 $\overrightarrow{OM} = -\frac{b}{2}\sin\alpha\,\vec{e}_x' - \frac{b}{2}\cos\alpha\,\vec{e}_y' + 3\vec{e}_z'$

$d\vec{F}_0 = \overrightarrow{OM} \wedge (i\,d\vec{l}' \wedge \vec{B}')$

$= \overrightarrow{OM} \wedge (-i\,dz\,\vec{e}_3 \wedge B\vec{e}_x)$

$\Gamma_{O_3}(M_3M_4) = iB\frac{b}{2}\sin\alpha\, a$

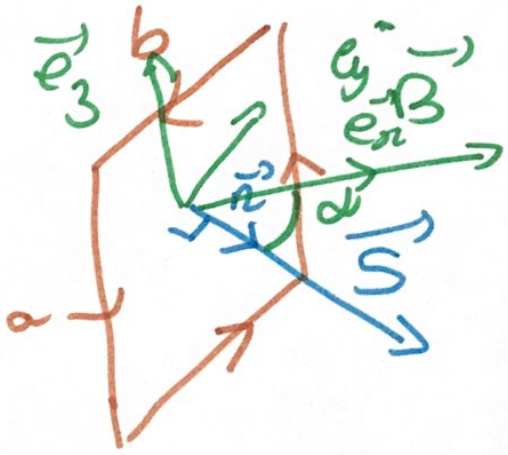
M_2M_3 et M_4M_1 $\vec{F}_L = F\vec{e}_3$

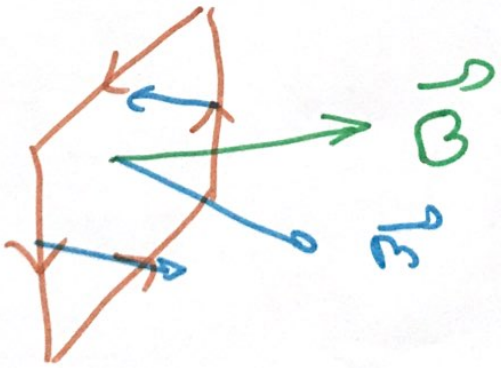
$\Gamma_{O_3} = (\overrightarrow{OM} \wedge \vec{F}) \cdot \vec{e}_3 = 0$

Bilan $\Gamma_{Laplace}(O_3) = iBba\sin\alpha$

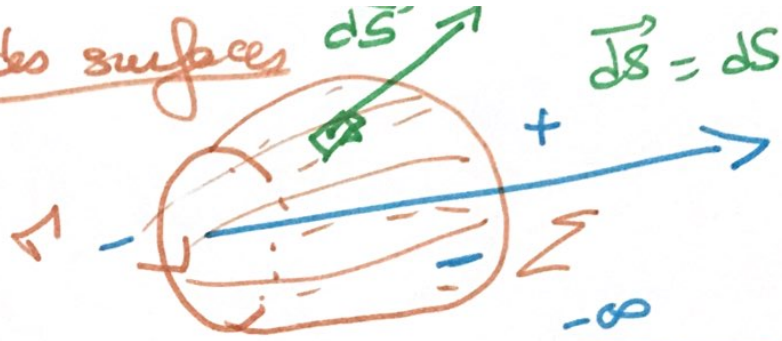
moment magnetique

$$\vec{m} = I\vec{S}$$
$$= I a b \vec{n}$$
$$\Gamma_{O3} = I a b B \sin\alpha$$
$$\boxed{\vec{\Gamma}_{O3} = \vec{m} \wedge \vec{B}}$$





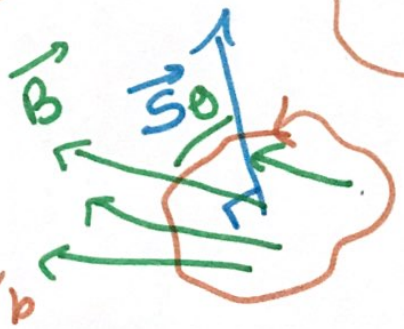
Orientation des surfaces



Le flux élémentaire $d\Phi = \vec{B}.\vec{dS}$

Le flux total $\Phi = \int_{\Sigma} \vec{B}.\vec{dS}$

B uniforme surface plane



$\Phi = BS\cos\theta$

unité : $T.m^2$ = Weber Wb