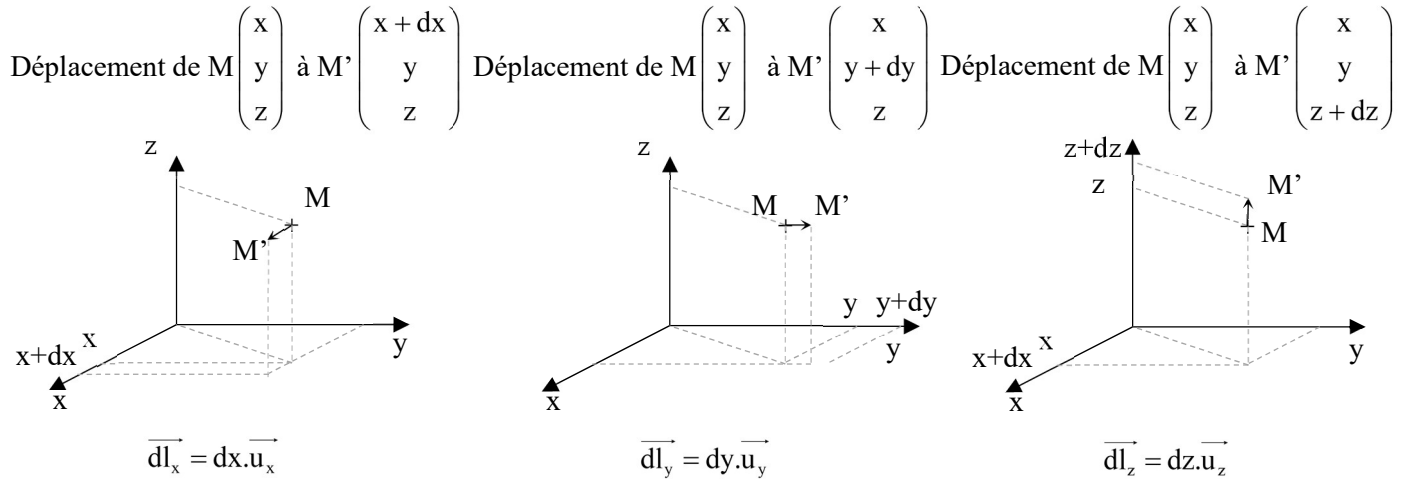
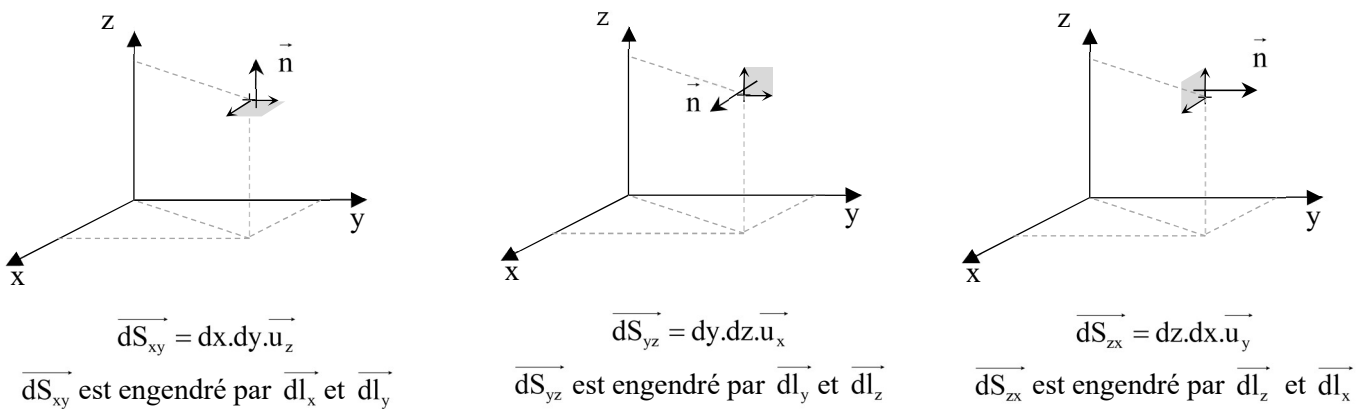


Déplacements, surfaces et volumes élémentaires

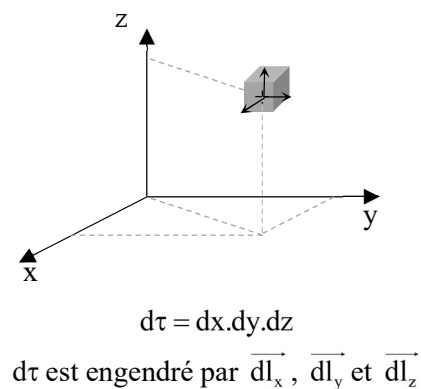
Coordonnées cartésiennes.



Surfaces élémentaires

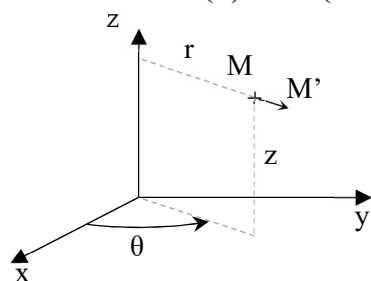


Volume élémentaire



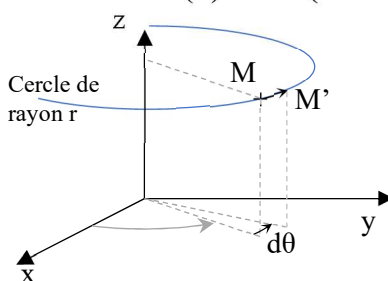
Coordonnées cylindriques

Déplacement de $M \begin{pmatrix} r \\ \theta \\ z \end{pmatrix}$ à $M' \begin{pmatrix} r+dr \\ \theta \\ z \end{pmatrix}$



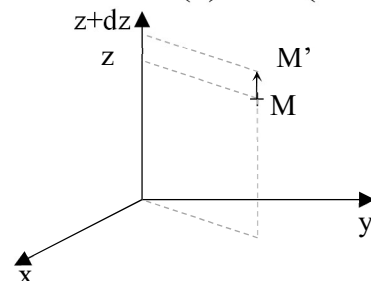
$$\overrightarrow{dl}_r = dr \cdot \overrightarrow{u}_r$$

Déplacement de $M \begin{pmatrix} r \\ \theta \\ z \end{pmatrix}$ à $M' \begin{pmatrix} r \\ \theta+d\theta \\ z \end{pmatrix}$



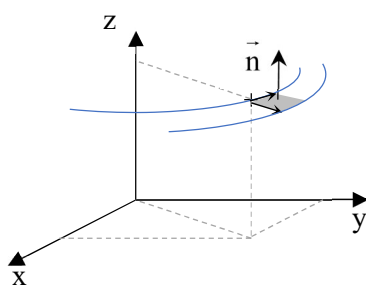
$$\overrightarrow{dl}_\theta = r \cdot d\theta \cdot \overrightarrow{u}_\theta$$

Déplacement de $M \begin{pmatrix} r \\ \theta \\ z \end{pmatrix}$ à $M' \begin{pmatrix} r \\ \theta \\ z+dz \end{pmatrix}$



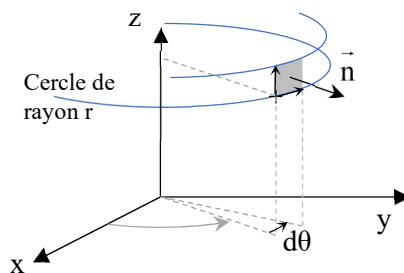
$$\overrightarrow{dl}_z = dz \cdot \overrightarrow{u}_z$$

Surfaces élémentaires



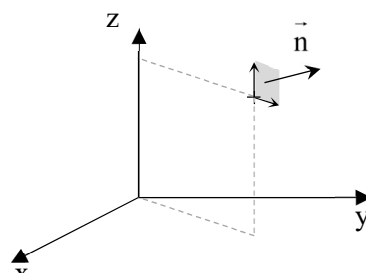
$$\overrightarrow{dS}_{r\theta} = dr \cdot rd\theta \cdot \overrightarrow{u}_z$$

$\overrightarrow{dS}_{r\theta}$ est engendré par $\overrightarrow{dl}_r$ et $\overrightarrow{dl}_\theta$



$$\overrightarrow{dS}_{0z} = rd\theta \cdot dz \cdot \overrightarrow{u}_r$$

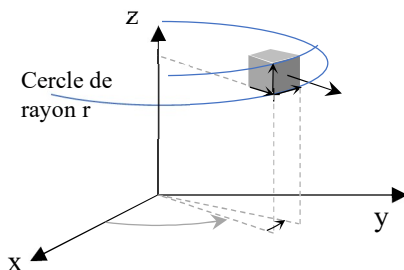
$\overrightarrow{dS}_{0z}$ est engendré par $\overrightarrow{dl}_\theta$ et $\overrightarrow{dl}_z$



$$\overrightarrow{dS}_{zr} = dz \cdot dr \cdot \overrightarrow{u}_\theta$$

$\overrightarrow{dS}_{zr}$ est engendré par $\overrightarrow{dl}_z$ et $\overrightarrow{dl}_r$

Volume élémentaire

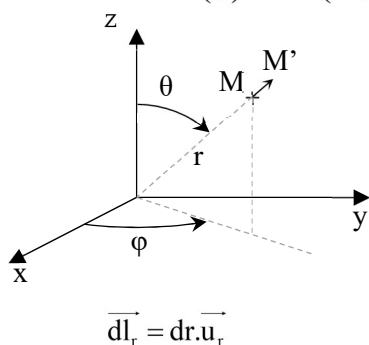


$$d\tau = dr \cdot rd\theta \cdot dz$$

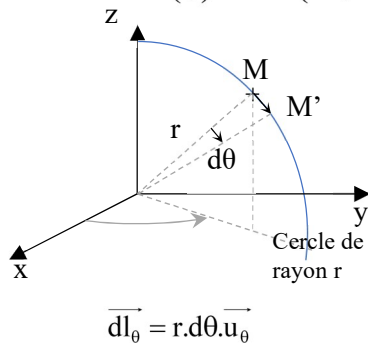
$d\tau$ est engendré par $\overrightarrow{dl}_r$, $\overrightarrow{dl}_\theta$ et $\overrightarrow{dl}_z$

Coordonnées sphériques

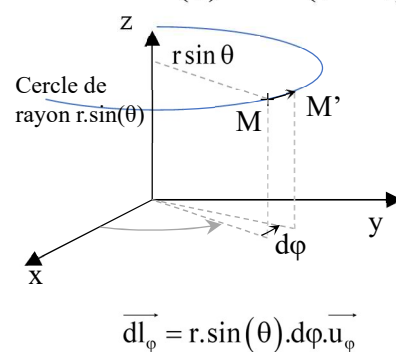
Déplacement de $M \begin{pmatrix} r \\ \theta \\ \varphi \end{pmatrix}$ à $M' \begin{pmatrix} r+dr \\ \theta \\ \varphi \end{pmatrix}$



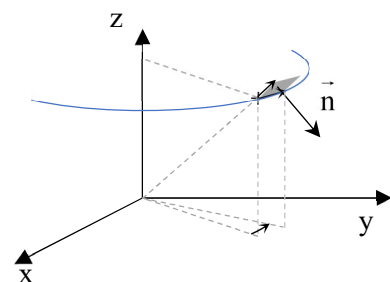
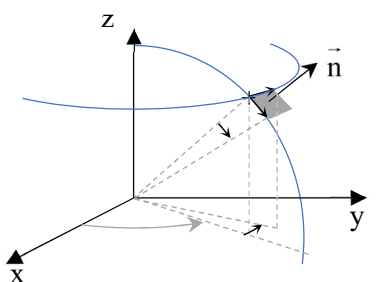
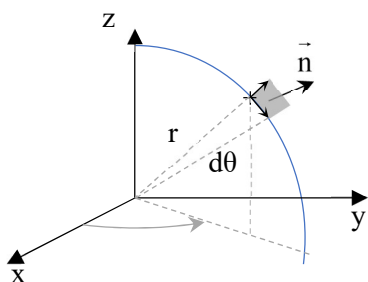
Déplacement de $M \begin{pmatrix} r \\ \theta \\ \varphi \end{pmatrix}$ à $M' \begin{pmatrix} r \\ \theta+d\theta \\ \varphi \end{pmatrix}$



Déplacement de $M \begin{pmatrix} r \\ \theta \\ \varphi \end{pmatrix}$ à $M' \begin{pmatrix} r \\ \theta \\ \varphi+d\varphi \end{pmatrix}$



Surfaces élémentaires



Volume élémentaire

