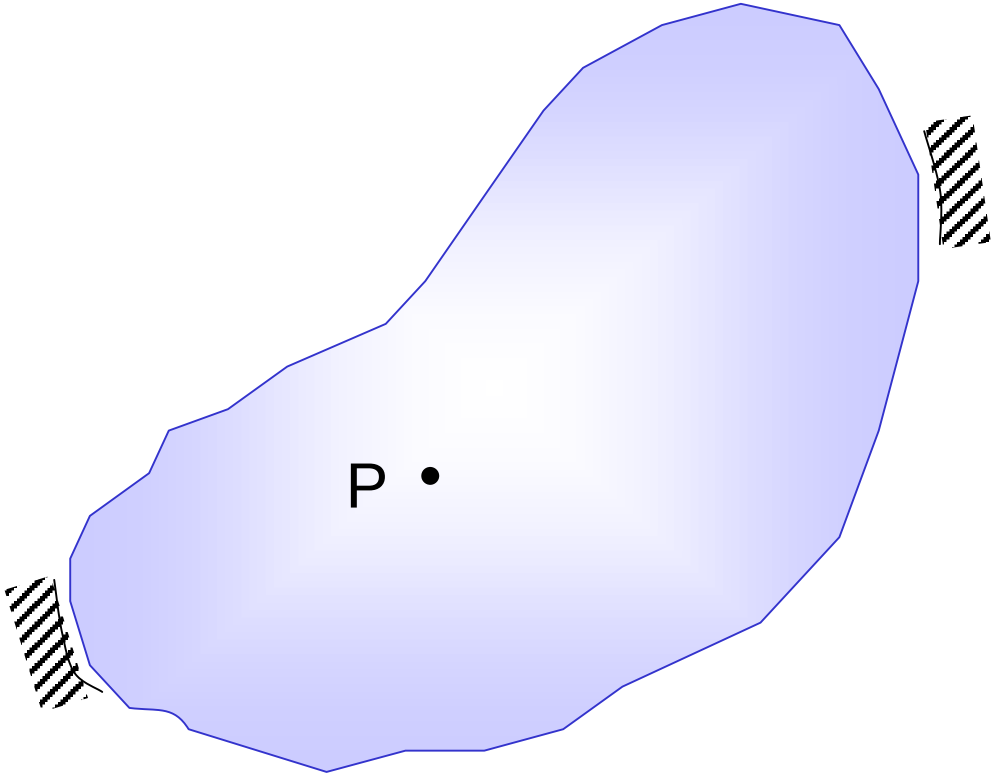
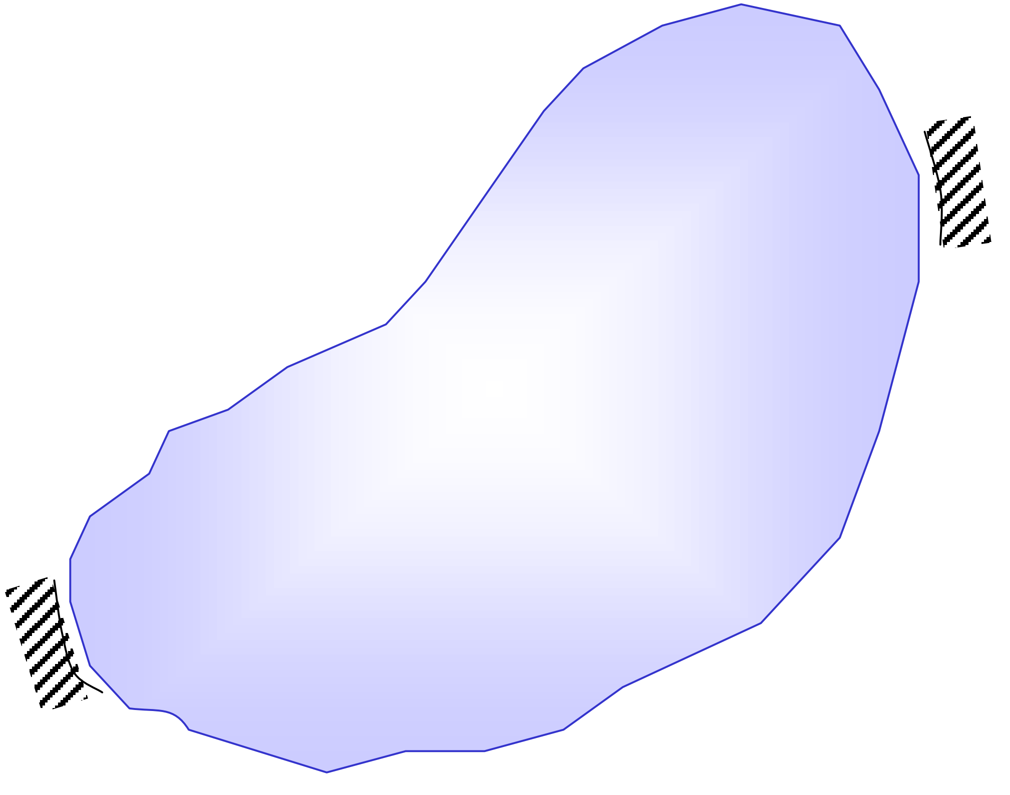
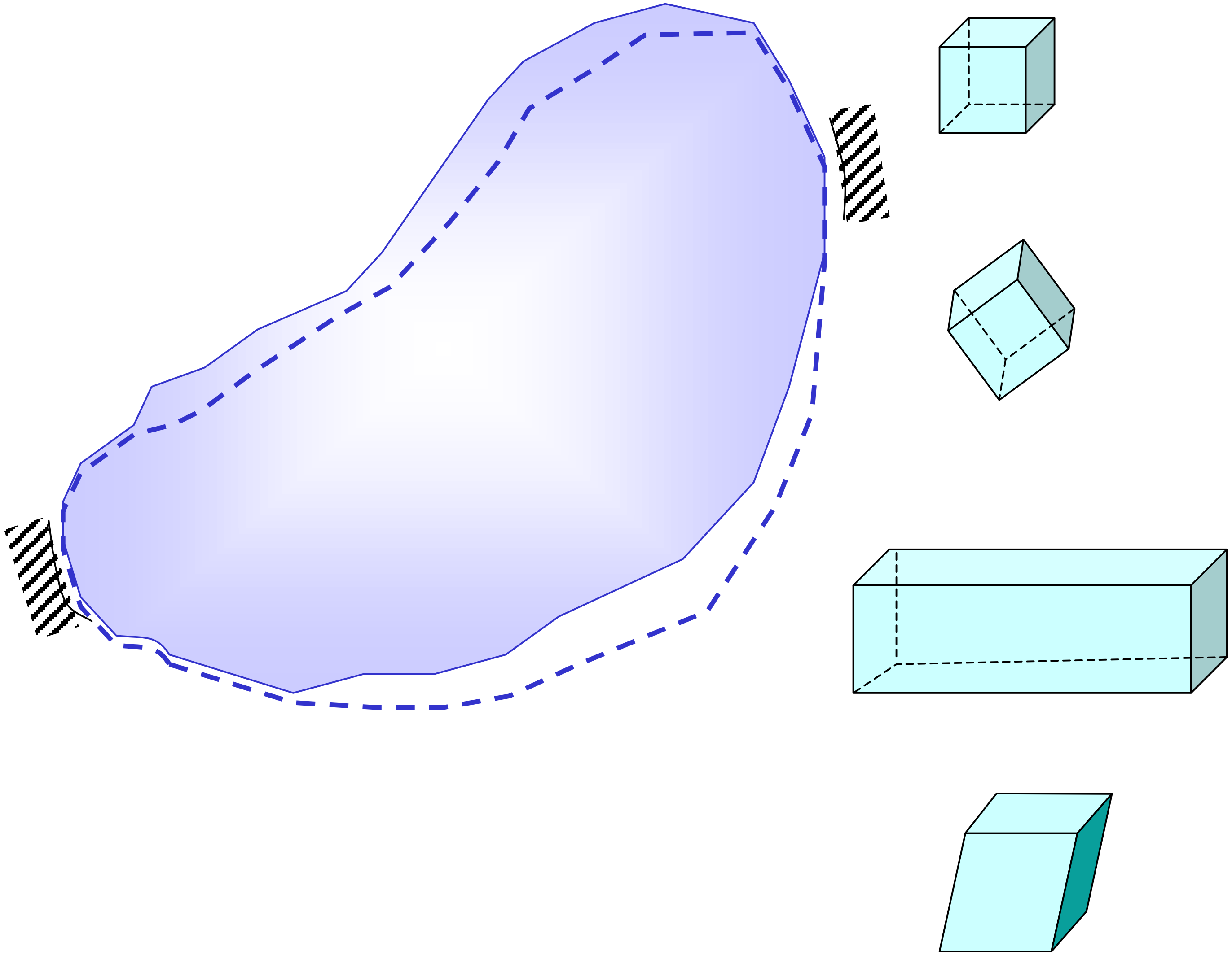
DEFORMACIÓN

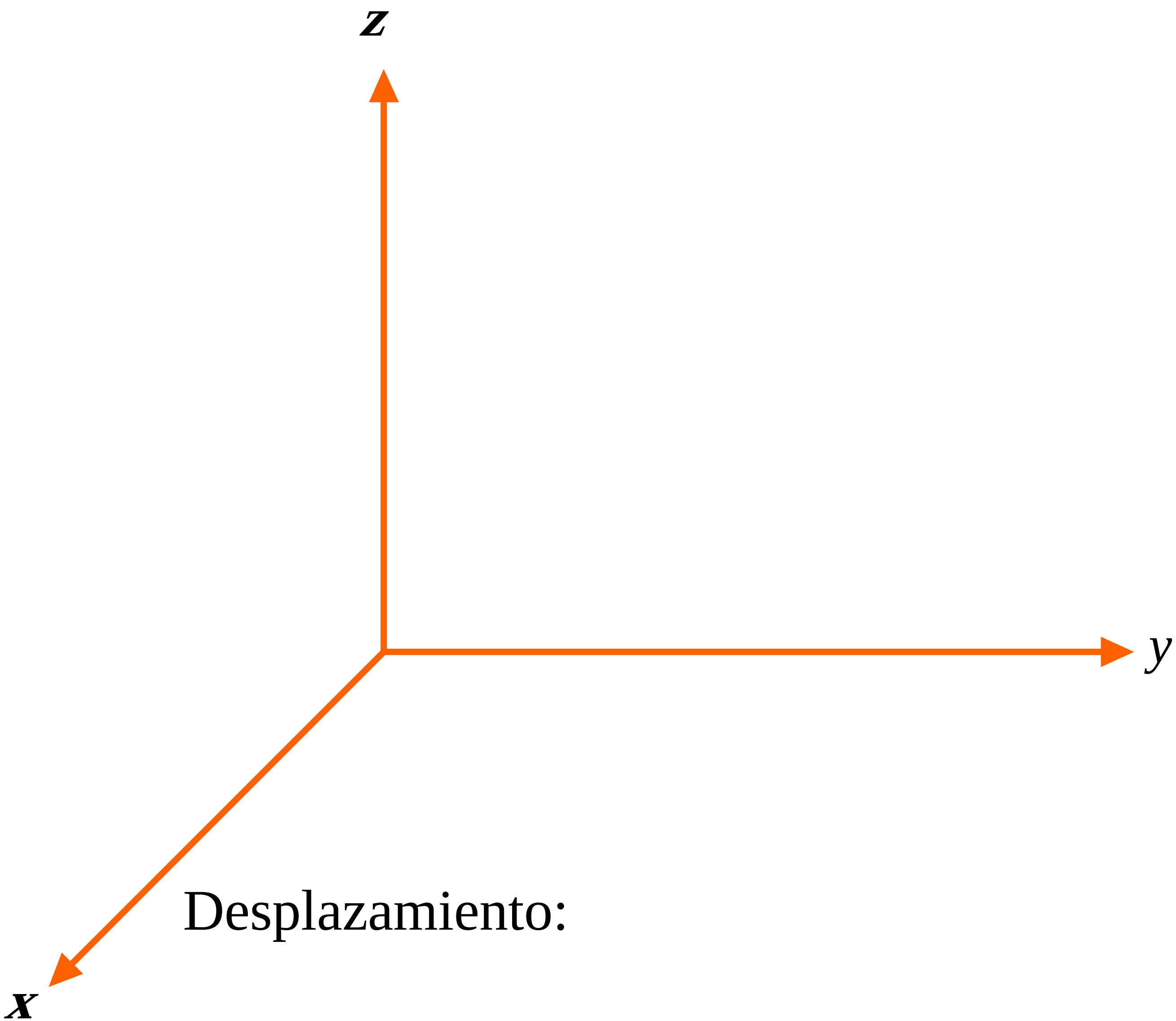


DEFORMACIÓN



DEFORMACIÓN

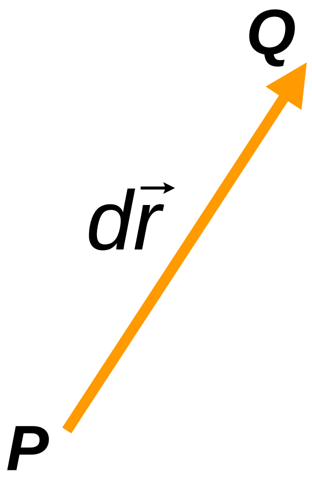




Desplazamiento:

HIPÓTESIS:

- Desplazamientos pequeños
- Las derivadas de los desplazamientos son pequeñas



$$\rightarrow \qquad d\vec{r}\,' = d\vec{r} + d\vec{u}$$

$$dx' = dx + du$$

$$dy' = dy + \frac{\partial v}{\partial x}dx + \frac{\partial v}{\partial y}dy + \frac{\partial v}{\partial z}dz$$

$$dz' = dz + \frac{\partial w}{\partial x}dx + \frac{\partial w}{\partial y}dy + \frac{\partial w}{\partial z}dz$$

$$[A] = grad\,\vec{\delta} = \begin{pmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} & \frac{\partial u}{\partial z} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} & \frac{\partial v}{\partial z} \\ \frac{\partial w}{\partial x} & \frac{\partial w}{\partial y} & \frac{\partial w}{\partial z} \end{pmatrix}$$

$$d\vec{r}\,' = [I]\,d\vec{r} + [\Omega]\,d\vec{r} + [D]\,d\vec{r}$$

- $[I]\,d\vec{r}$ es una

- [Ω] y [D] son

$[\Omega]\,d\vec{r}$ y $[D]\,d\vec{r}$ son operaciones

EFECTO DE [H] $$[\Omega]d\vec{r} = \vec{\omega}\times d\vec{r}$$

Siendo:

[Ω]: Matriz de giro

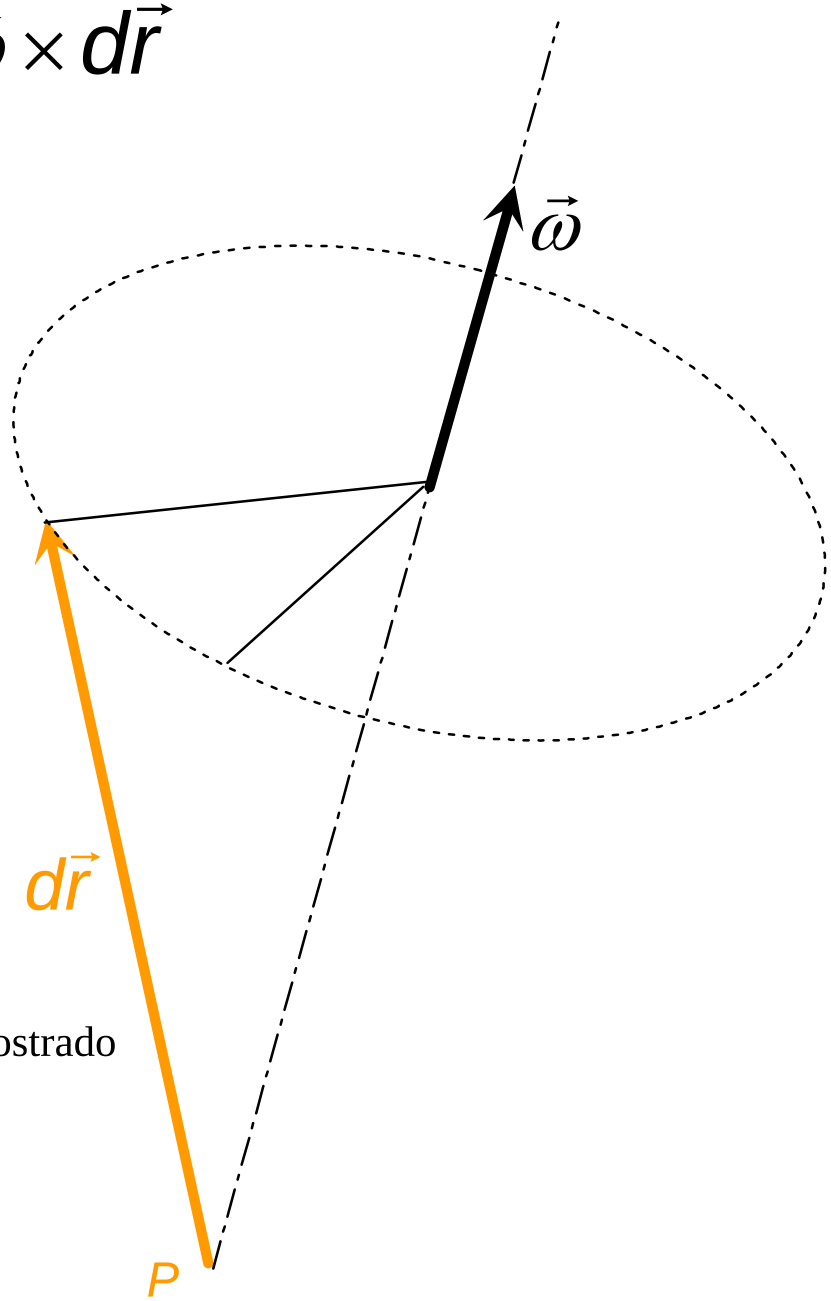
$$[\Omega] = \begin{pmatrix} 0 & -\omega_z & \omega_y \\ \omega_z & 0 & -\omega_x \\ -\omega_y & \omega_x & 0 \end{pmatrix}$$

θ: Ángulo de giro

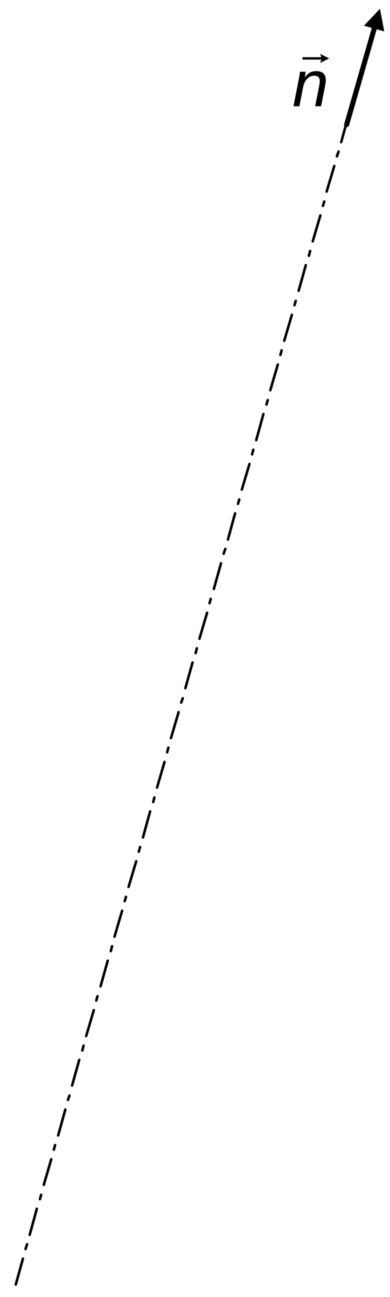
$$\left.\begin{array}{l} \left|\vec{\omega}\times d\vec{r}\right| = r\cdot\theta \\ r = \left|d\vec{r}\right| sen\,\psi \end{array}\right\}$$ Igualando: $\left|\vec{\omega}\times d\vec{r}\right| = \left|d\vec{r}\right|\cdot sen\,\psi\cdot\theta$

Como $\left|\vec{\omega}\times d\vec{r}\right| = \left|d\vec{r}\right|\cdot\left|\vec{\omega}\right|\cdot sen\,\psi$, igualando queda demostrado

Eje de giro



EFECTO DE [D]

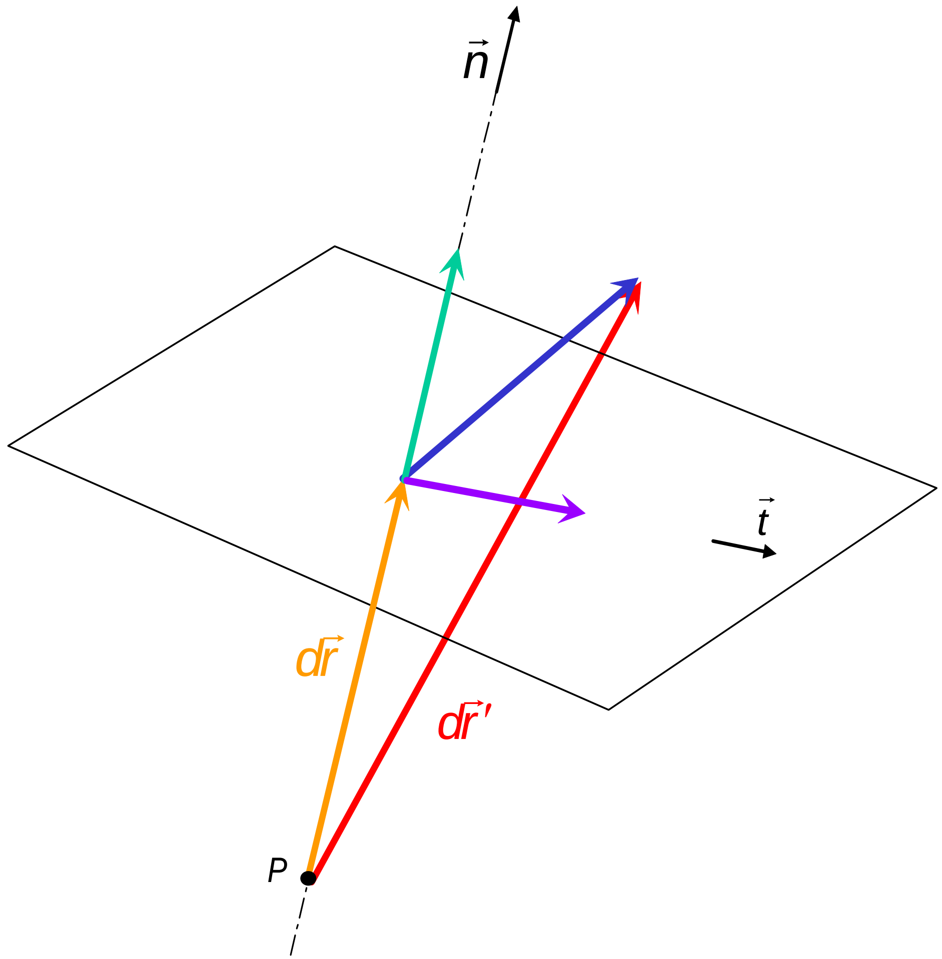


EFECTO DE [D]

$$[D]d\vec{r} = [D]\vec{n}|d\vec{r}|$$

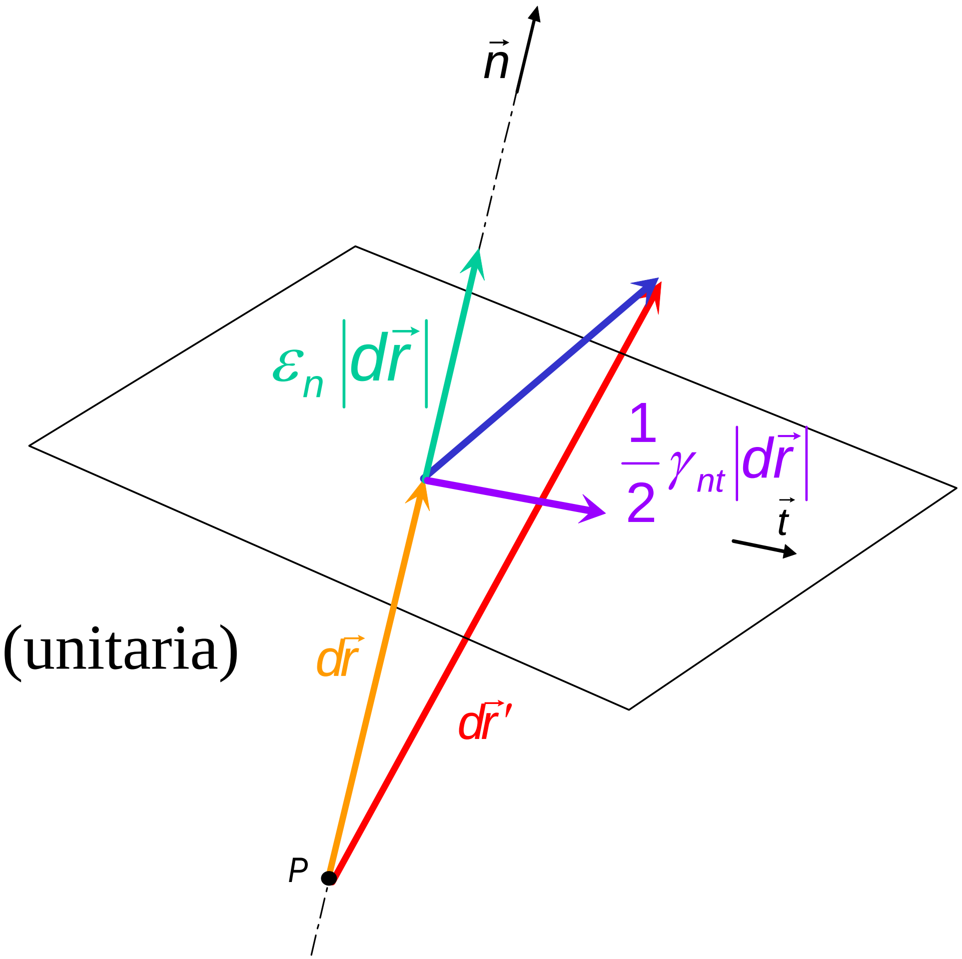
$$\vec{n}^{\,t}[D]d\vec{r} = \vec{n}^{\,t}[D]\vec{n}|d\vec{r}|$$

$$\vec{t}^{\,t}[D]d\vec{r} = \vec{t}^{\,t}[D]\vec{n}|d\vec{r}|$$



EFECTO DE [D]

Significado de ε_n

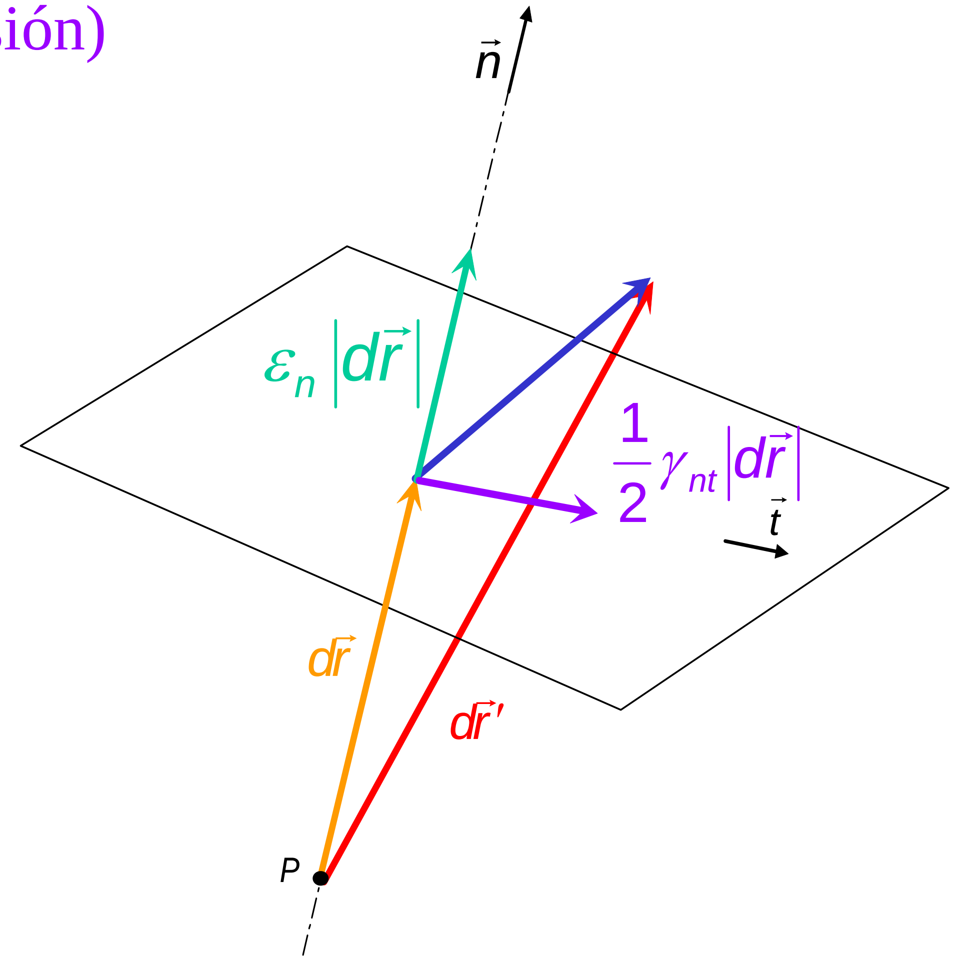


ε_n: Deformación longitudinal (unitaria)

Significado de $\frac{1}{2}\gamma_{nt}$

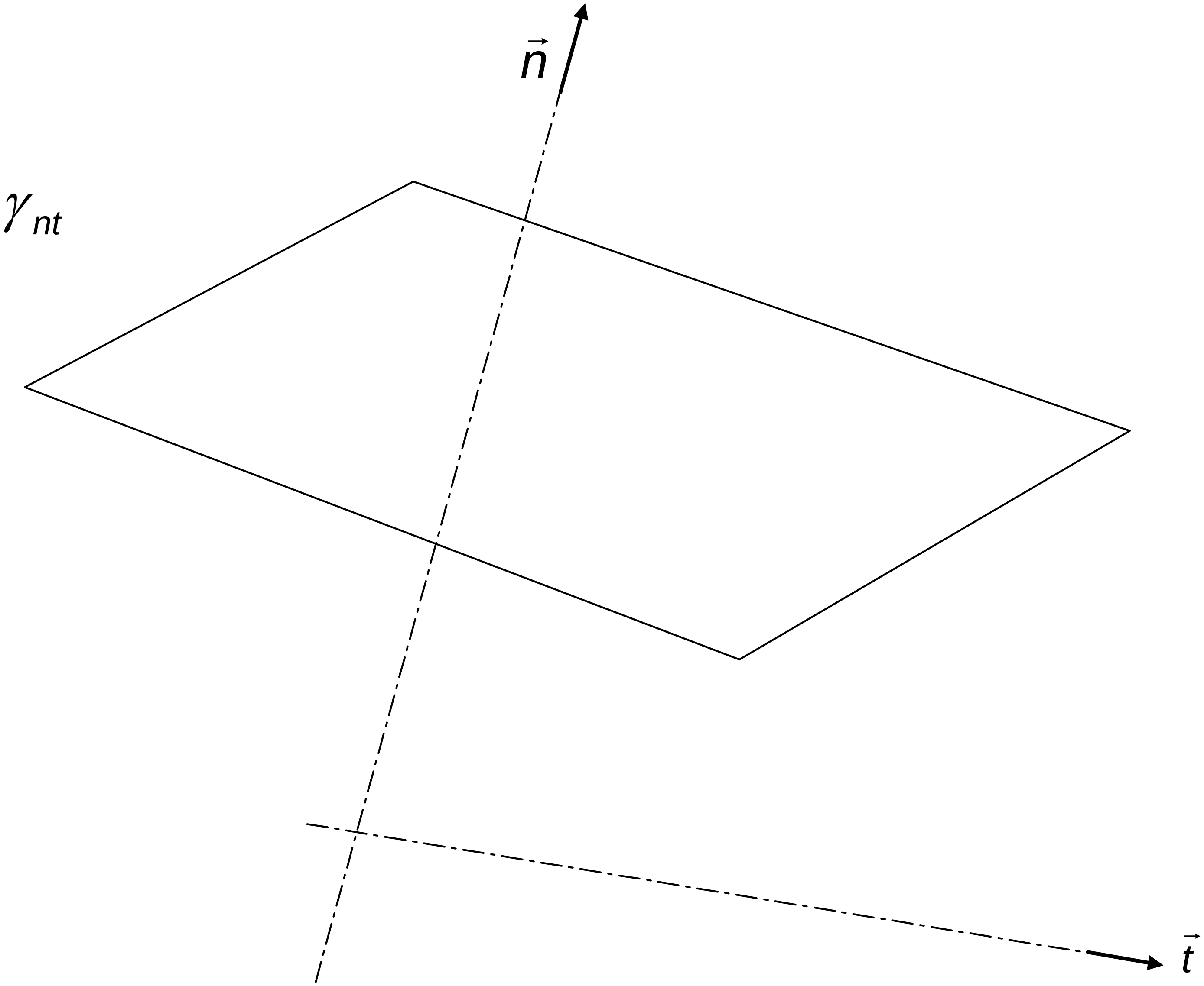
Significado de $\frac{1}{2}\gamma_{nt}$ (otra visión)

$$tg\varphi = \rule{4cm}{0.4pt}$$

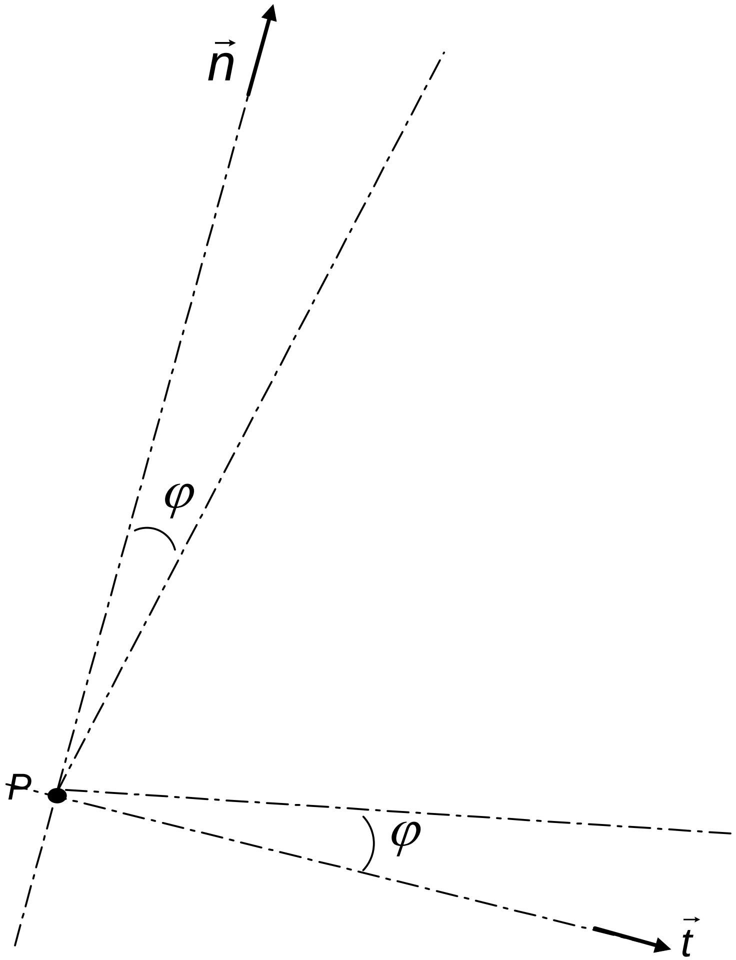


Significado de $\frac{1}{2}\gamma_{nt}$ (otra visión)

$$\varphi = \frac{1}{2}\gamma_{nt}$$



Significado de $\frac{1}{2}\gamma_{nt}$ (otra visión)



$$\varphi = \frac{1}{2}\gamma_{nt}$$

SIGNIFICADO DE [D]:

$$[D]=\frac{[A]+[A]^t}{2}=\begin{pmatrix} \dfrac{\partial u}{\partial x} & \dfrac{1}{2}\left(\dfrac{\partial u}{\partial y}+\dfrac{\partial v}{\partial x}\right) & \dfrac{1}{2}\left(\dfrac{\partial u}{\partial z}+\dfrac{\partial w}{\partial x}\right) \\ \dfrac{1}{2}\left(\dfrac{\partial u}{\partial y}+\dfrac{\partial v}{\partial x}\right) & \dfrac{\partial v}{\partial y} & \dfrac{1}{2}\left(\dfrac{\partial w}{\partial y}+\dfrac{\partial v}{\partial z}\right) \\ \dfrac{1}{2}\left(\dfrac{\partial u}{\partial z}+\dfrac{\partial w}{\partial x}\right) & \dfrac{1}{2}\left(\dfrac{\partial w}{\partial y}+\dfrac{\partial v}{\partial z}\right) & \dfrac{\partial w}{\partial z} \end{pmatrix}$$

$$\varepsilon_x=\vec{i}^{\,t}[D]\,\vec{i}\;\rightarrow\varepsilon_x=\frac{\partial u}{\partial x}$$

$$\frac{1}{2}\gamma_{xy}=\vec{i}^{\,t}[D]\,\vec{j}\rightarrow\frac{1}{2}\gamma_{xy}=\frac{1}{2}\left(\frac{\partial u}{\partial y}+\frac{\partial v}{\partial x}\right)$$

CONTENIDO DE [D]:

$$[D] = \begin{pmatrix} D_x & D_{xy} & D_{xz} \\ D_{yx} & D_y & D_{yz} \\ D_{zx} & D_{zy} & D_z \end{pmatrix}$$

$$\varepsilon_x = \vec{i}^{\,t}[D]\vec{i}$$

$$\frac{1}{2}\gamma_{xy} = \vec{i}^{\,t}[D]\vec{j}$$

RELACIONES [D]-$\vec{u}$:

$$[D] = \begin{pmatrix} \varepsilon_x & \frac{1}{2}\gamma_{xy} & \frac{1}{2}\gamma_{xz} \\ \frac{1}{2}\gamma_{xy} & \varepsilon_y & \frac{1}{2}\gamma_{yz} \\ \frac{1}{2}\gamma_{xz} & \frac{1}{2}\gamma_{yz} & \varepsilon_z \end{pmatrix} =$$

$$\varepsilon_x =$$

$$\frac{1}{2}\gamma_{xy} =$$

$$\varepsilon_y = \frac{\partial v}{\partial y}$$

$$\frac{1}{2}\gamma_{xz} = \frac{1}{2}\left(\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x}\right)$$

$$\varepsilon_z = \frac{\partial w}{\partial z}$$

$$\frac{1}{2}\gamma_{yz} = \frac{1}{2}\left(\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z}\right)$$