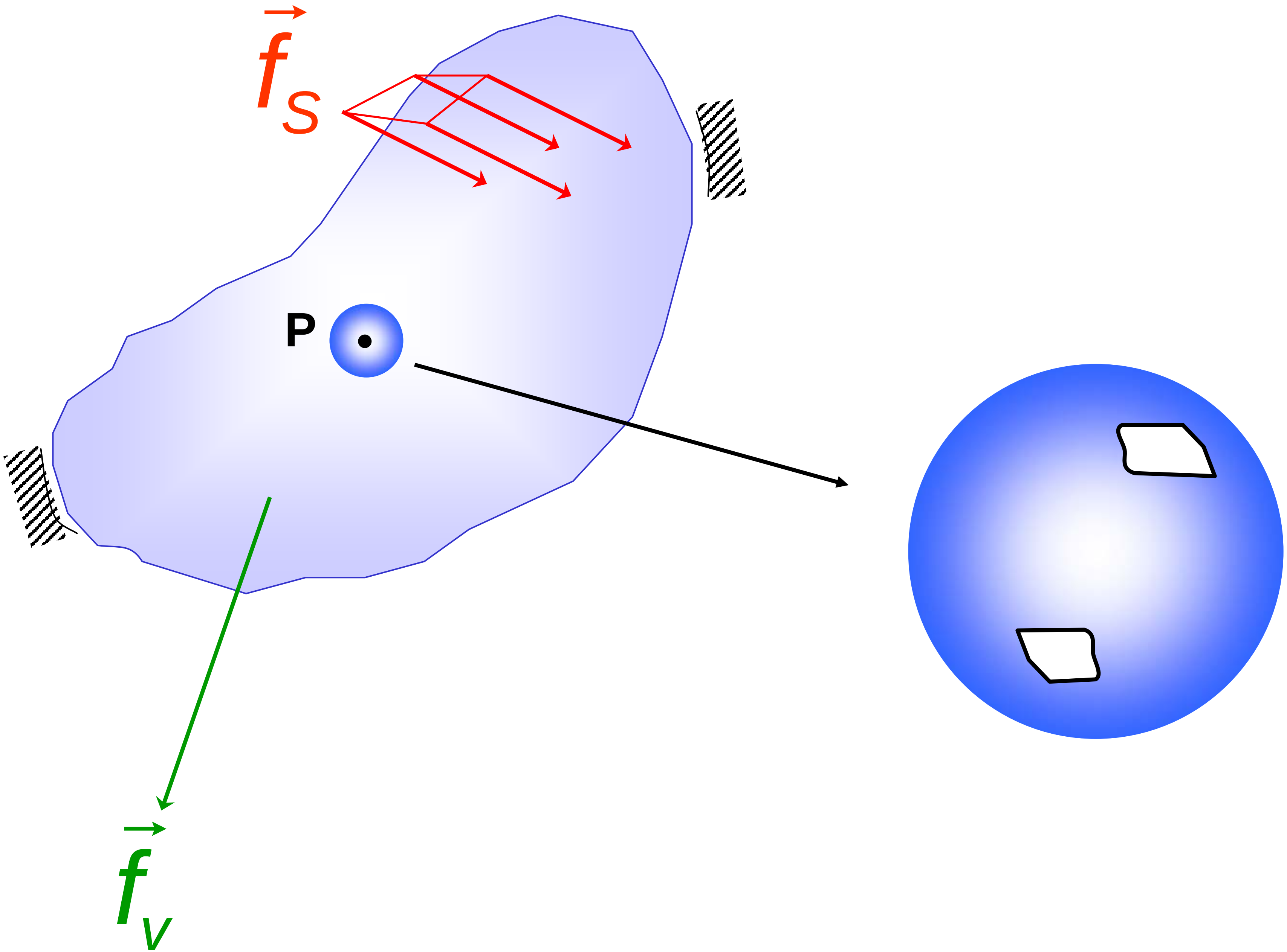
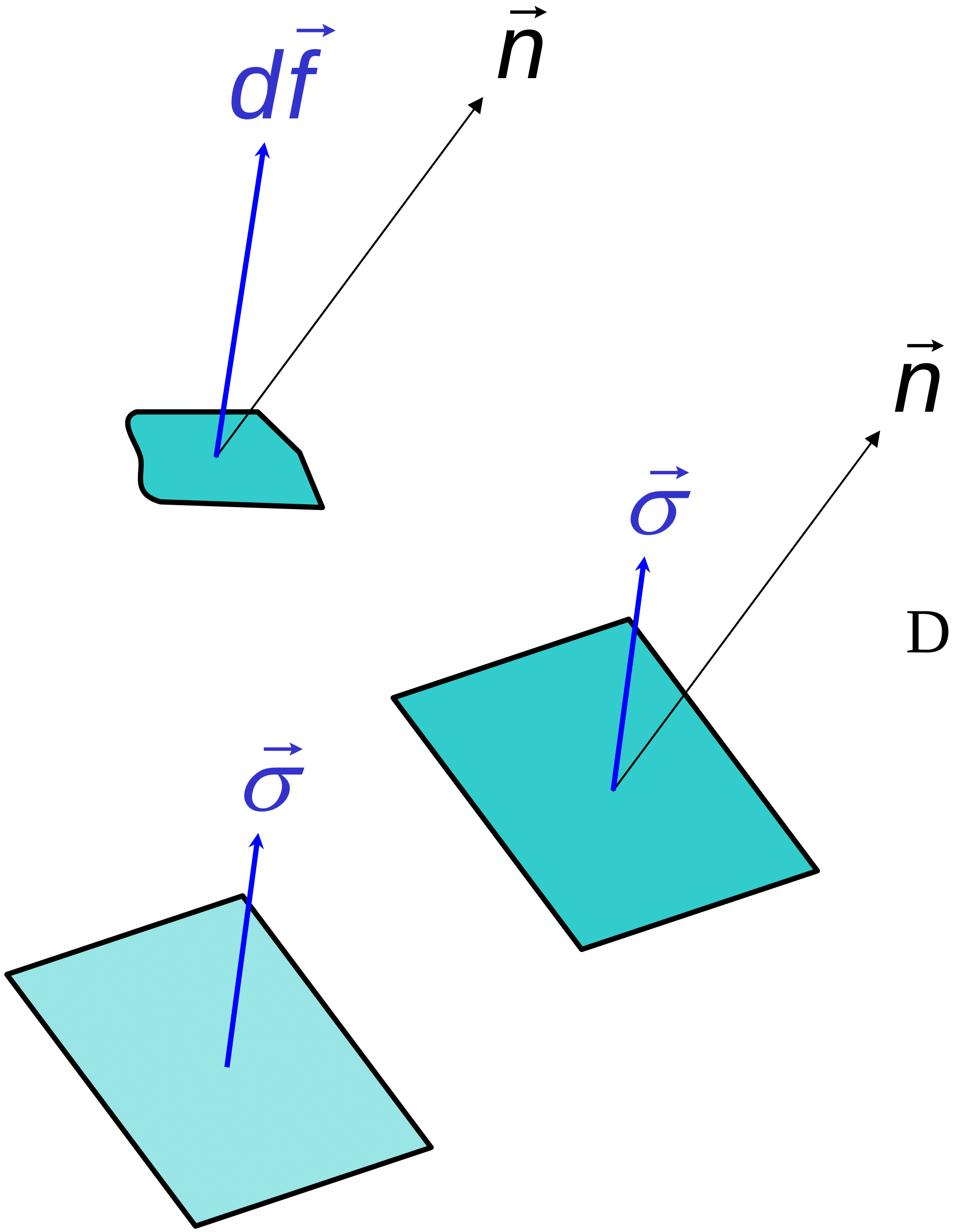
VECTOR TENSIÓN



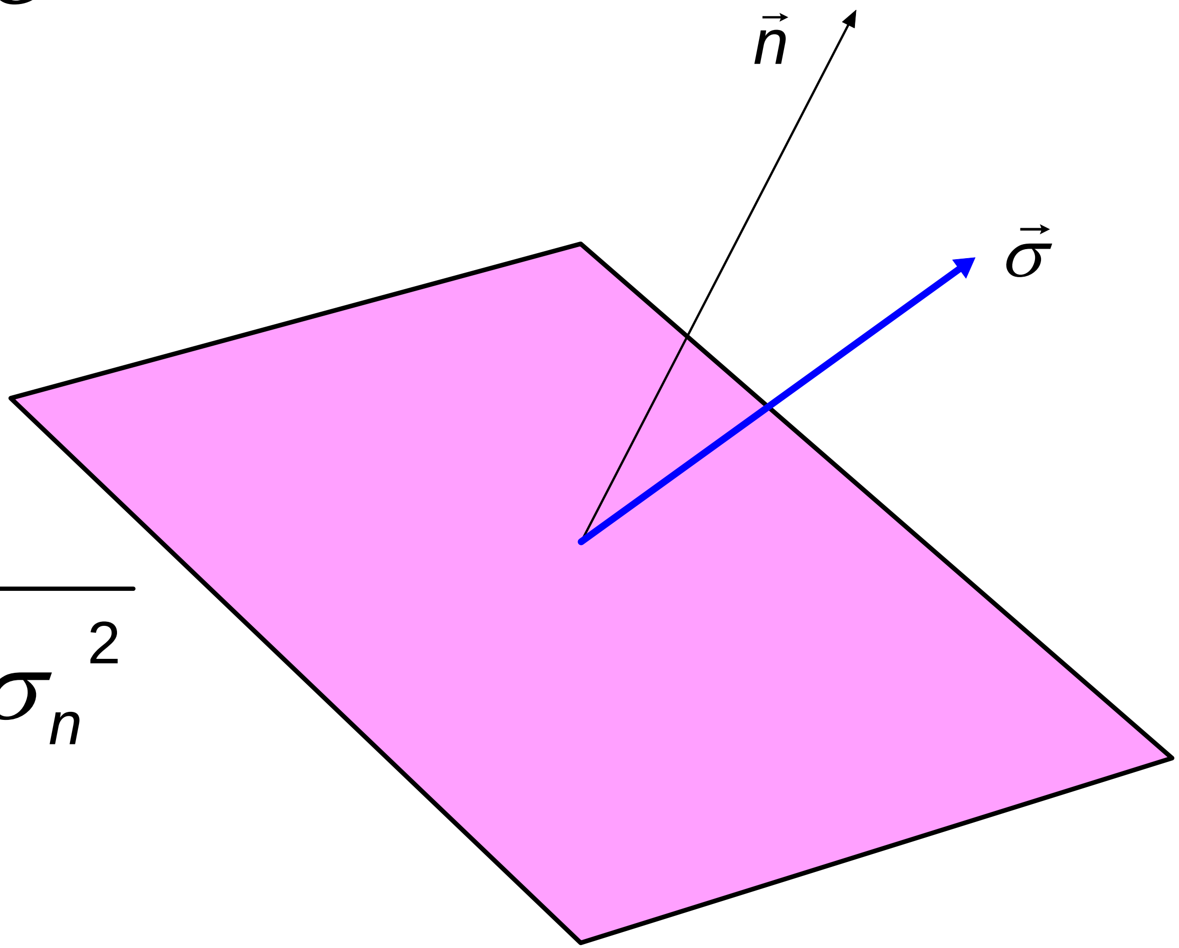
VECTOR TENSIÓN



Depende de:

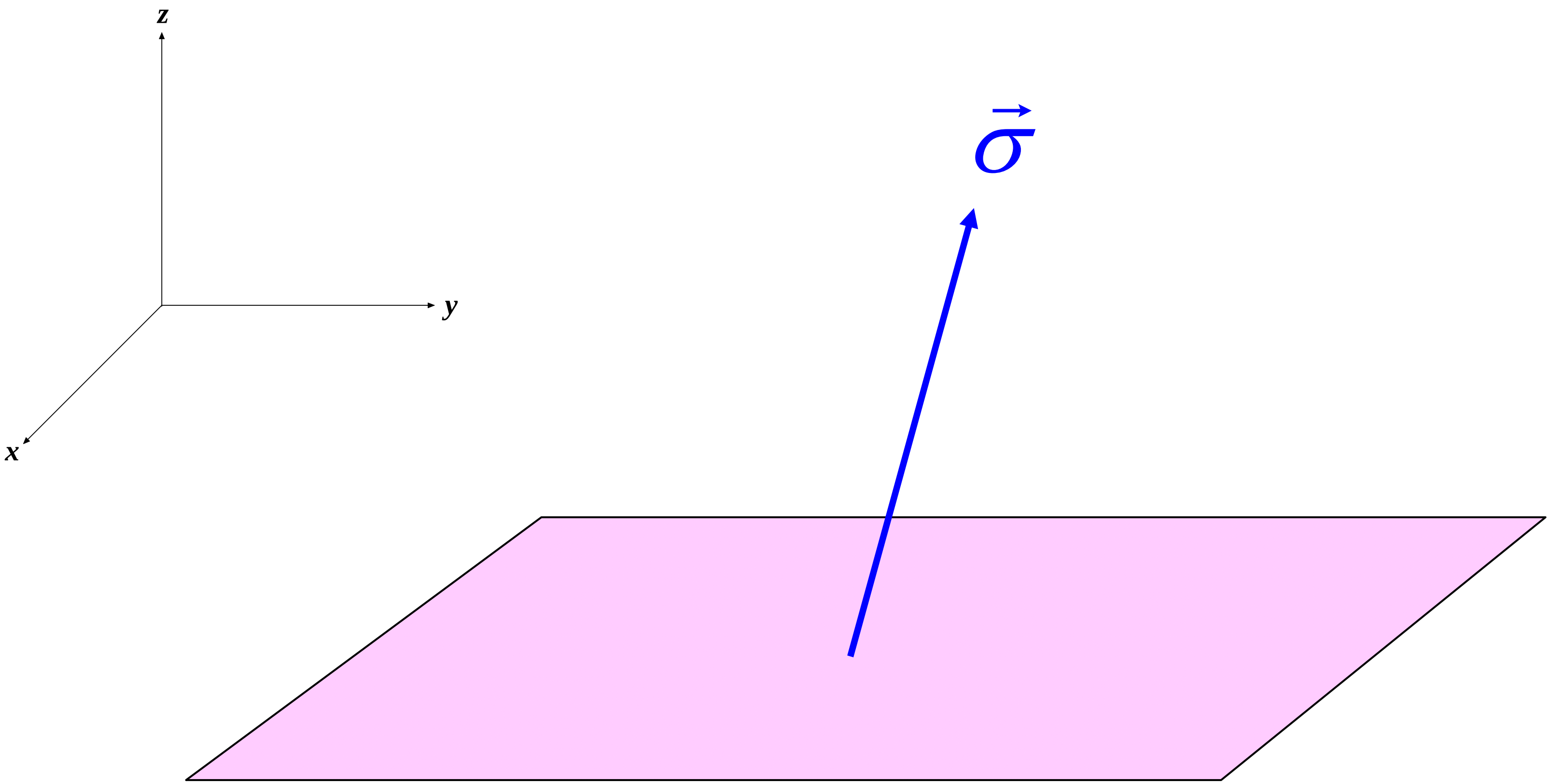
COMPONENTES INTRINSECAS

$$\sigma_n = \vec{n}^t \cdot \vec{\sigma}$$



$$\tau = \sqrt{\left|\vec{\sigma}\right|^2 - {\sigma_n}^2}$$

VECTOR TENSIÓN PARA LOS PLANOS COORDENADOS



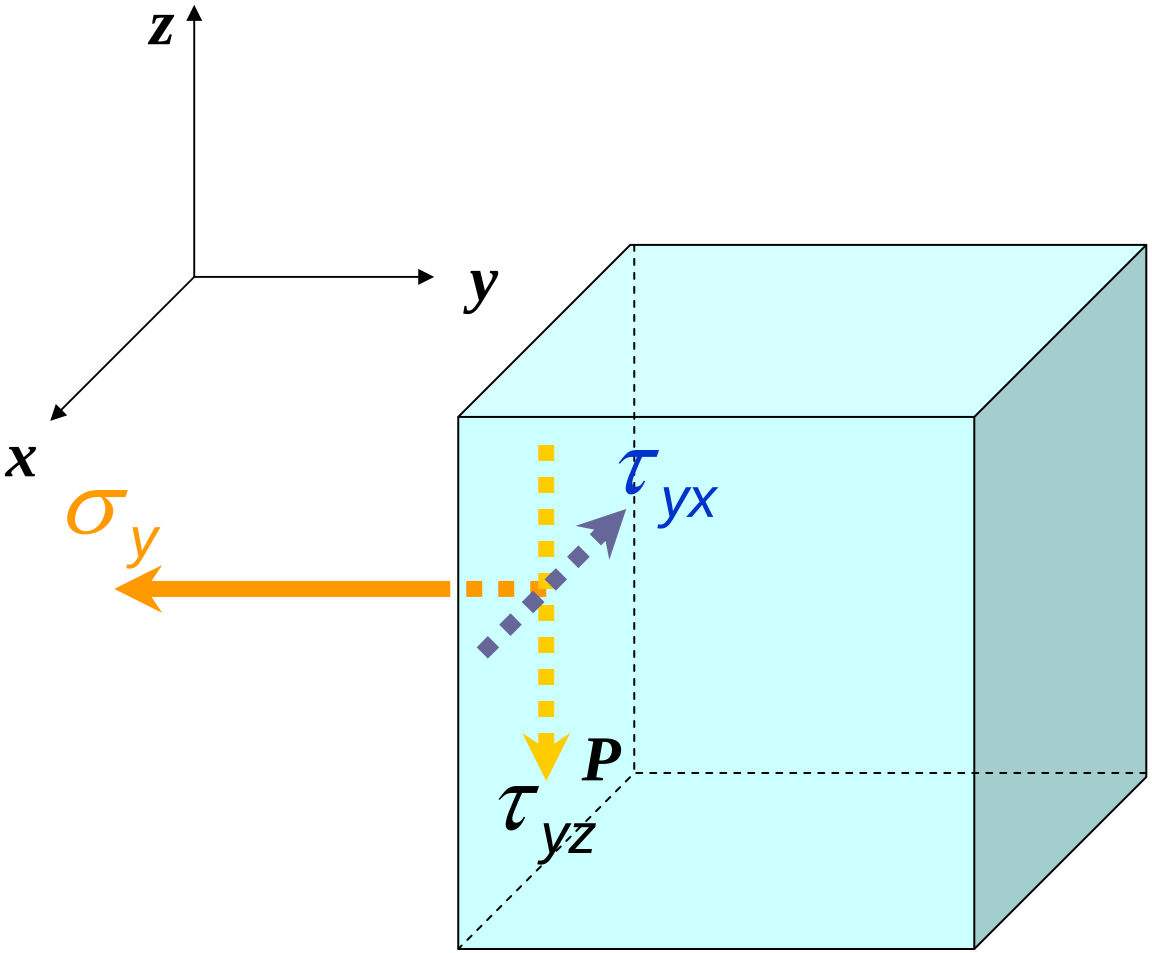
MATRIZ DE TENSIONES

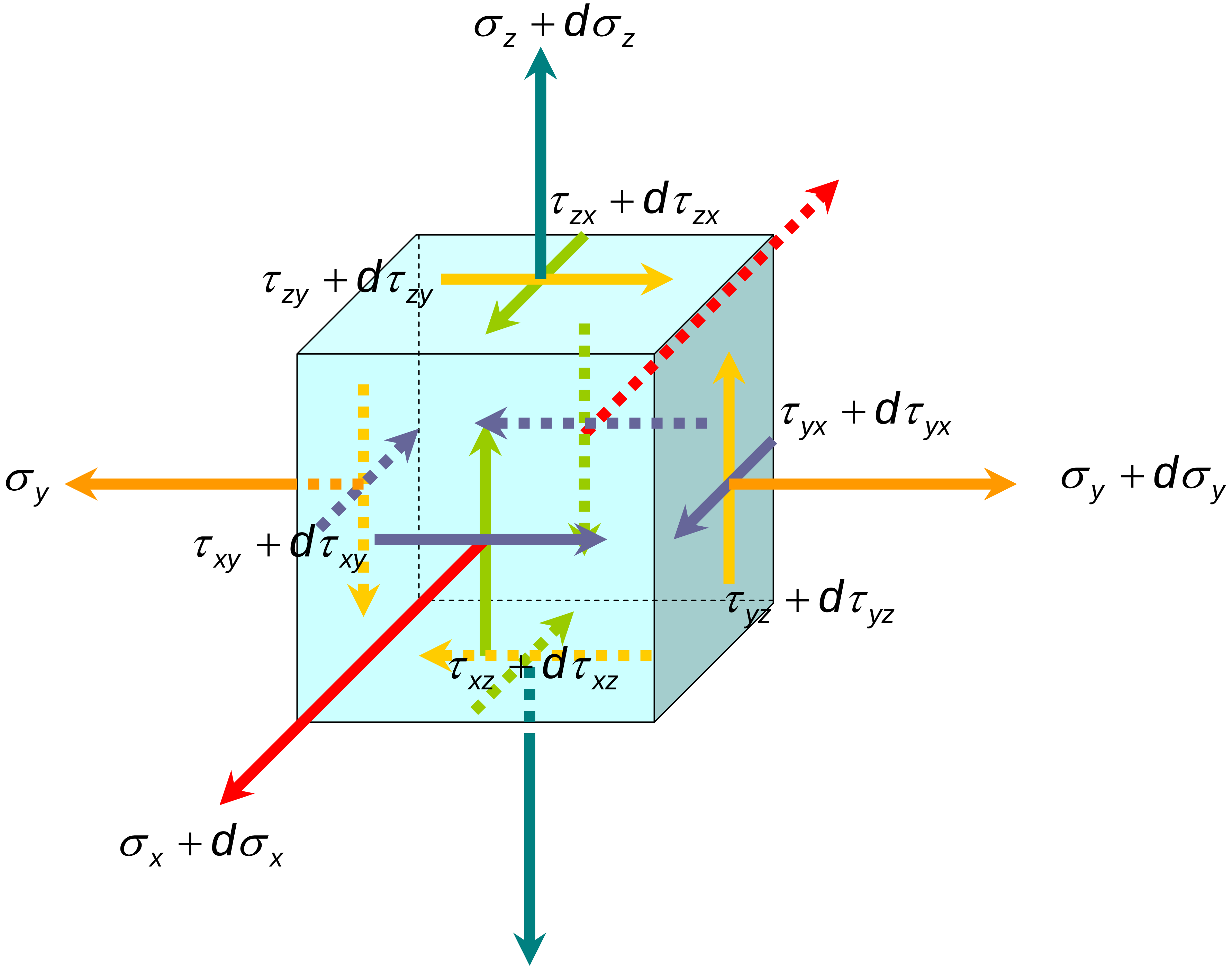
$$[T] = \begin{pmatrix} \sigma_x & \tau_{yx} & \tau_{zx} \\ \tau_{xy} & \sigma_y & \tau_{zy} \\ \tau_{xz} & \tau_{yz} & \sigma_z \end{pmatrix}$$

CARACTERÍSTICAS DE LA MATRIZ DE TENSIONES

- Relacionada con las fuerzas exteriores
- Sus componentes deben variar de forma

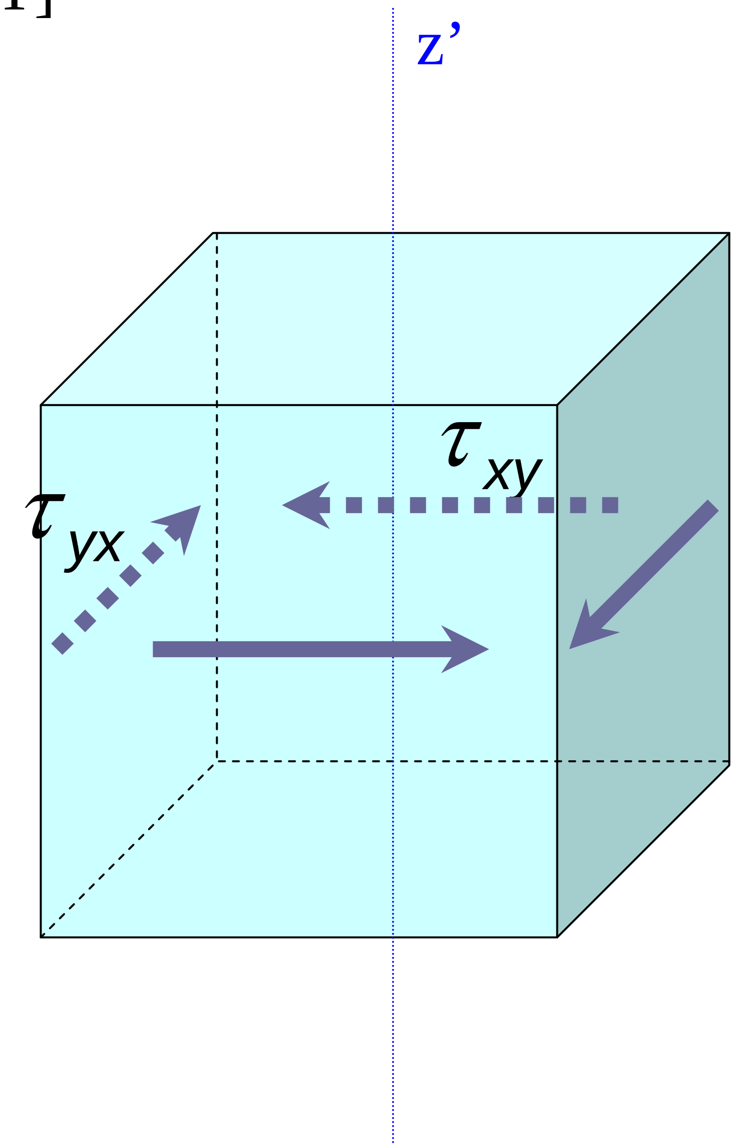
VARIACIÓN DE [T]:

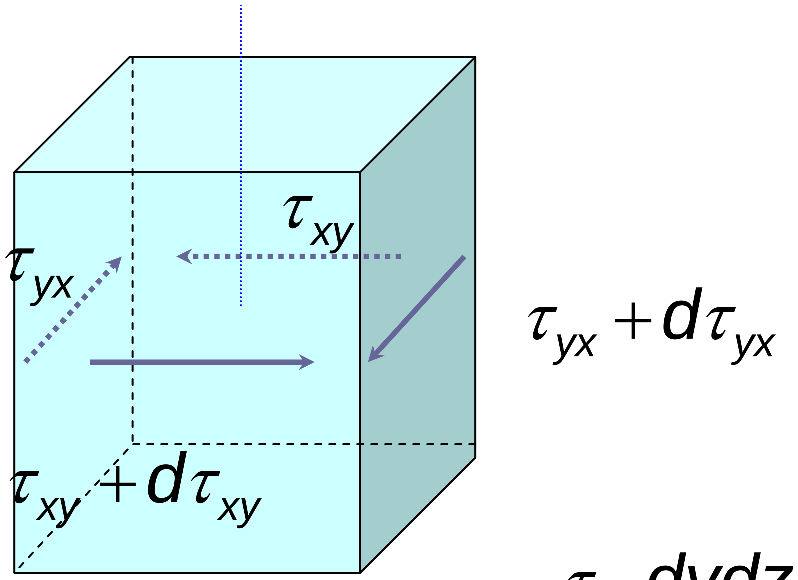



$\sigma_z + d\sigma_z$
$\tau_{zx} + d\tau_{zx}$
$\tau_{zy} + d\tau_{zy}$
$\tau_{yx} + d\tau_{yx}$
σ_y
$\sigma_y + d\sigma_y$
$\tau_{xy} + d\tau_{xy}$
$\tau_{yz} + d\tau_{yz}$
$\tau_{xz} + d\tau_{xz}$
$\sigma_x + d\sigma_x$

EQUILIBRIO ROTACIONAL
EN UN CUBO DIFERENCIAL:
SIMETRÍA DE [T]

$$\sum M_{z'} = 0$$





$$\sum M_{z'} = 0$$

$$\tau_{xy} dydz \frac{dx}{2} + \left(\tau_{xy} + d\tau_{xy}\right) dydz \frac{dx}{2} -$$

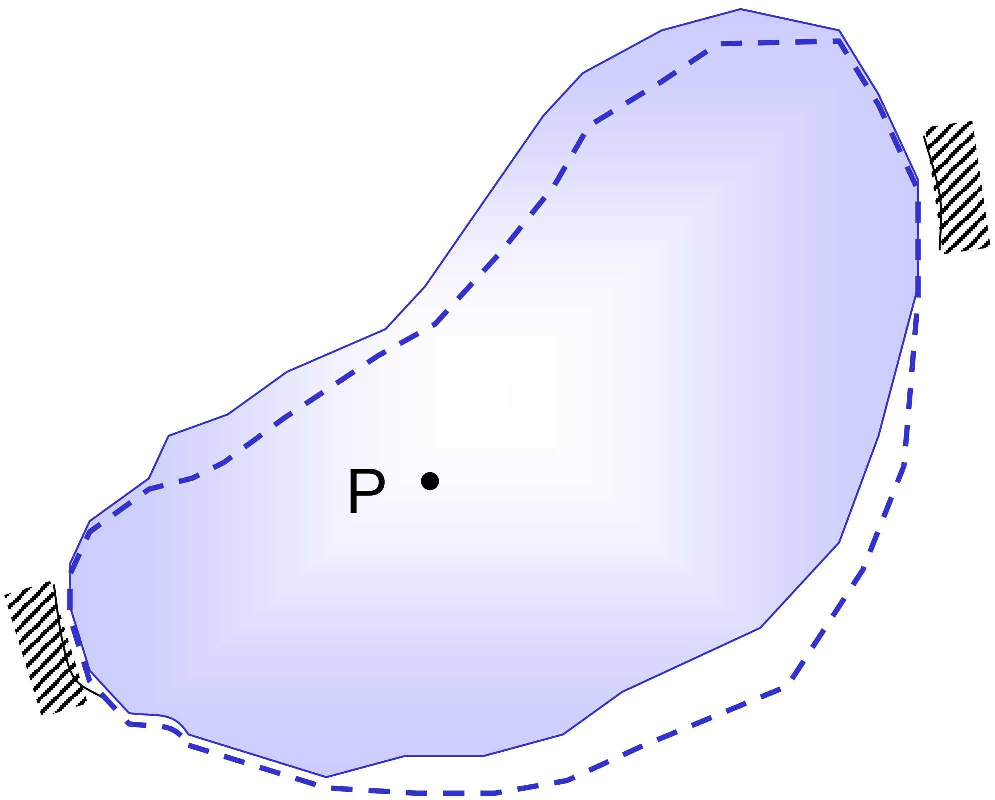
$$- \tau_{yx} dxdz \frac{dy}{2} - \left(\tau_{yx} + d\tau_{yx}\right) dxdz \frac{dy}{2} = 0$$

Hay otras dos ecuaciones de equilibrio:

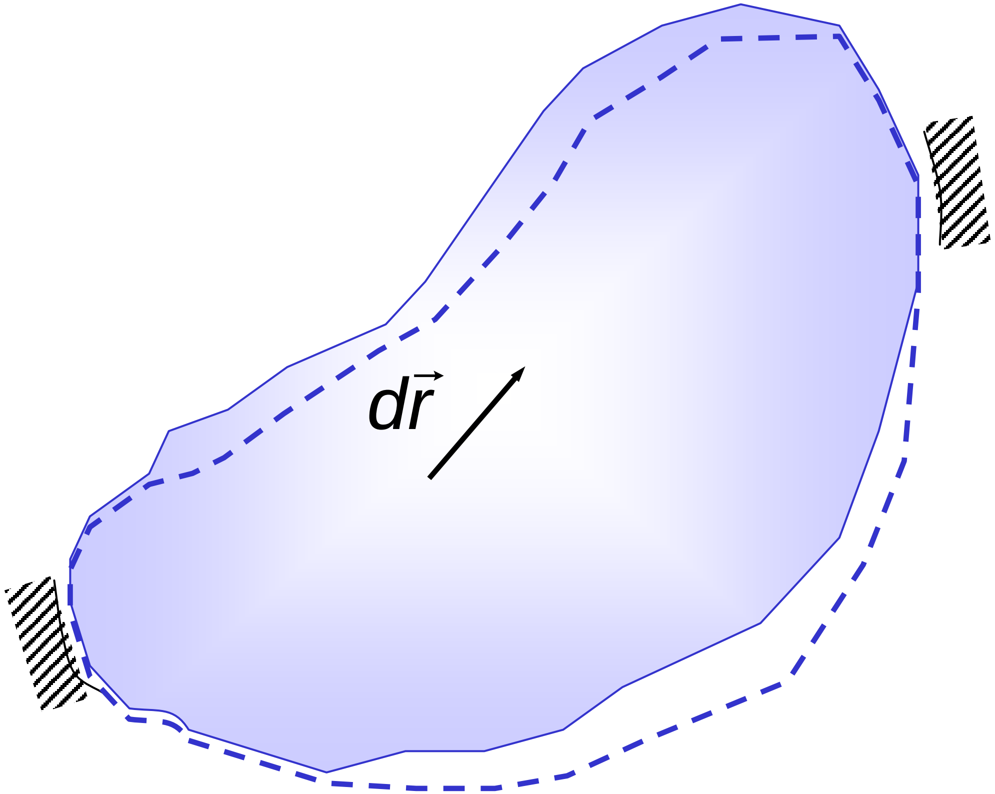
$$\sum M_Y = 0 \rightarrow \boxed{\tau_{xz} = \tau_{zx}}$$

$$\sum M_x = 0 \rightarrow \boxed{\tau_{yz} = \tau_{zy}}$$

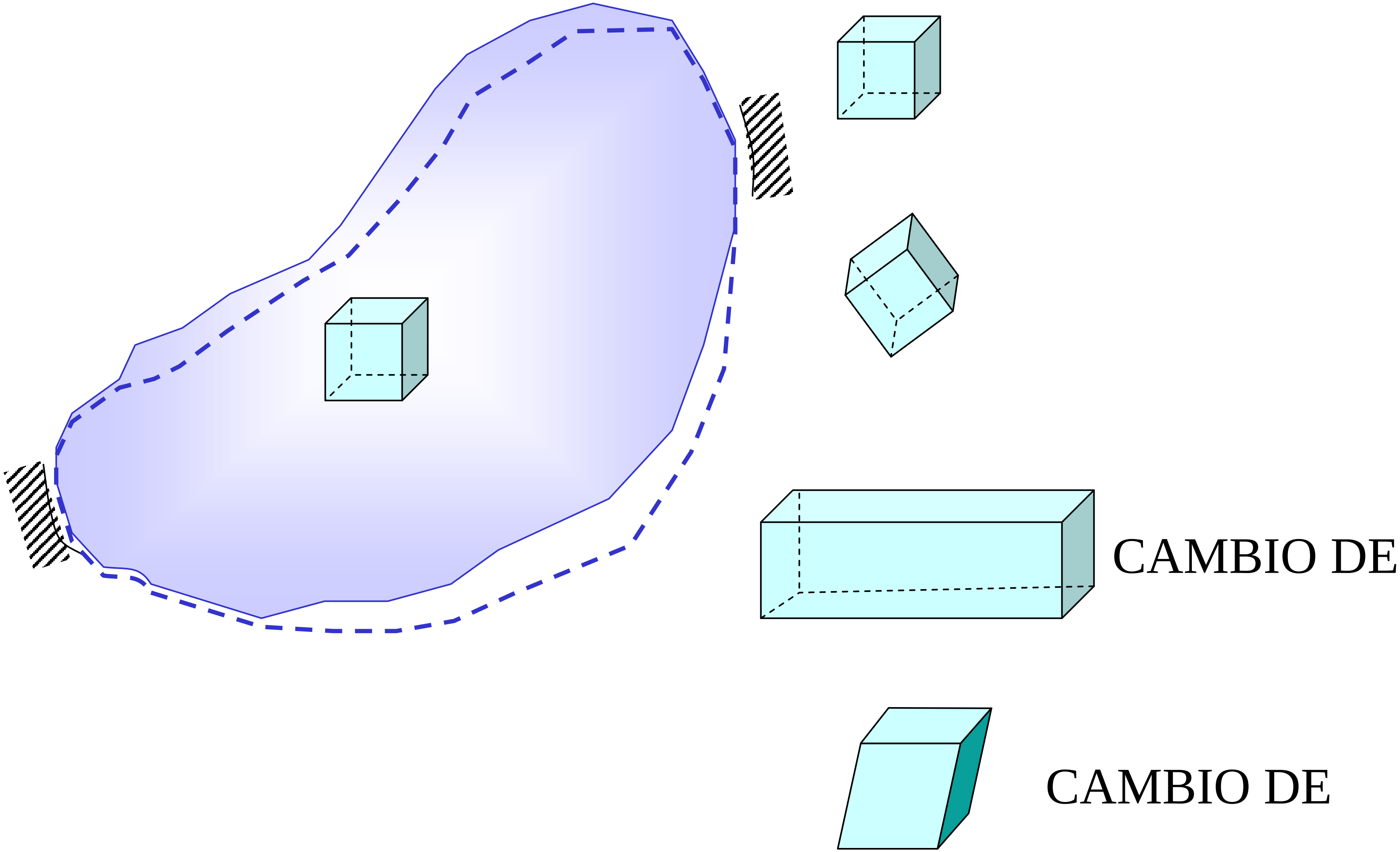
DEFORMACIÓN



DEFORMACIÓN

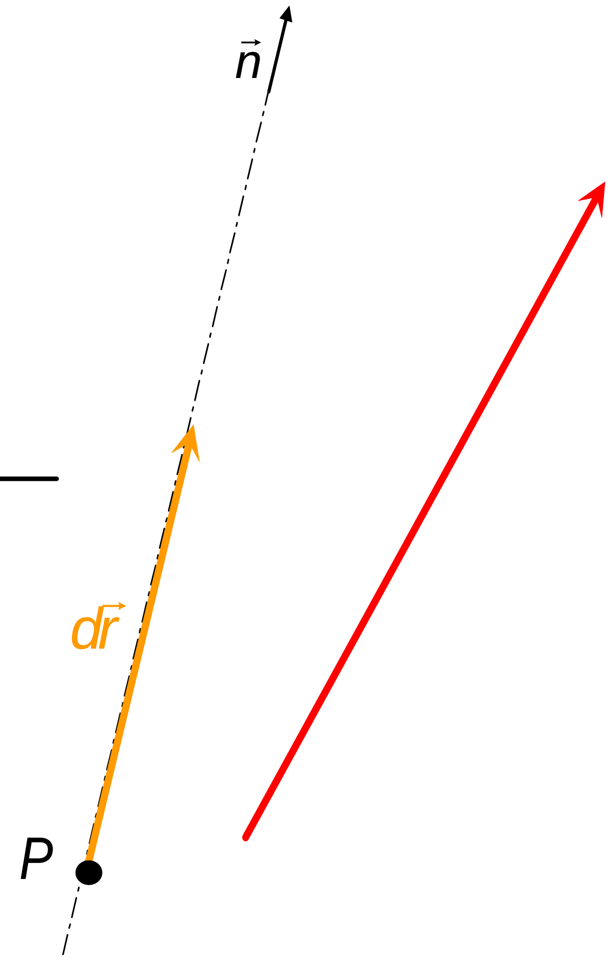


DEFORMACIÓN

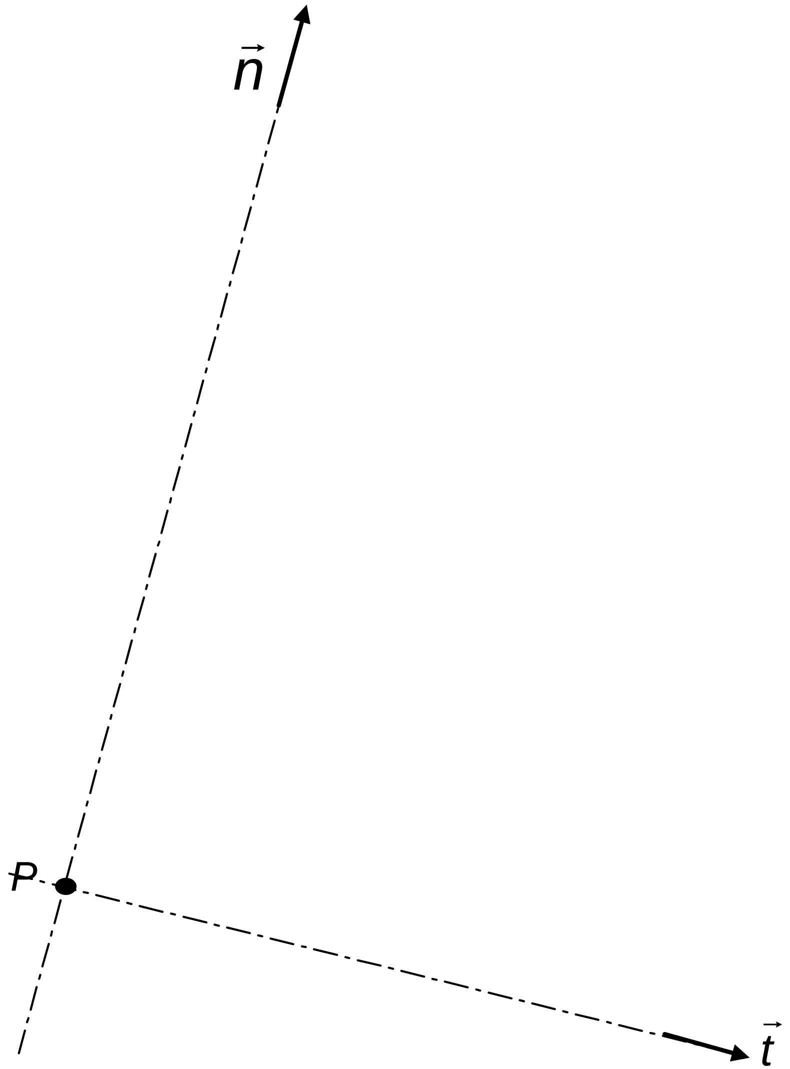


Deformación longitudinal (unitaria)

$$\varepsilon_n = \frac{\qquad\qquad\qquad}{\qquad\qquad\qquad} = \frac{\qquad\qquad}{\qquad\qquad}$$



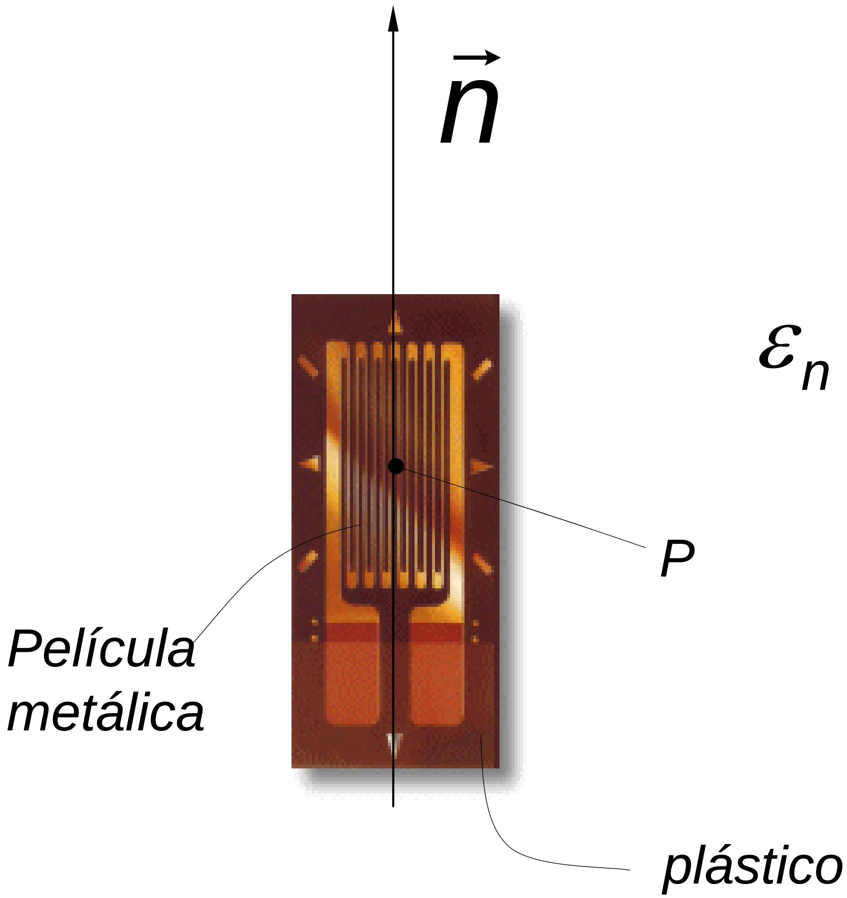
Deformación angular γ_{nt}



$$\gamma_{nt} =$$

Sensores de deformación: Galga extensométrica (strain gage/gauge)

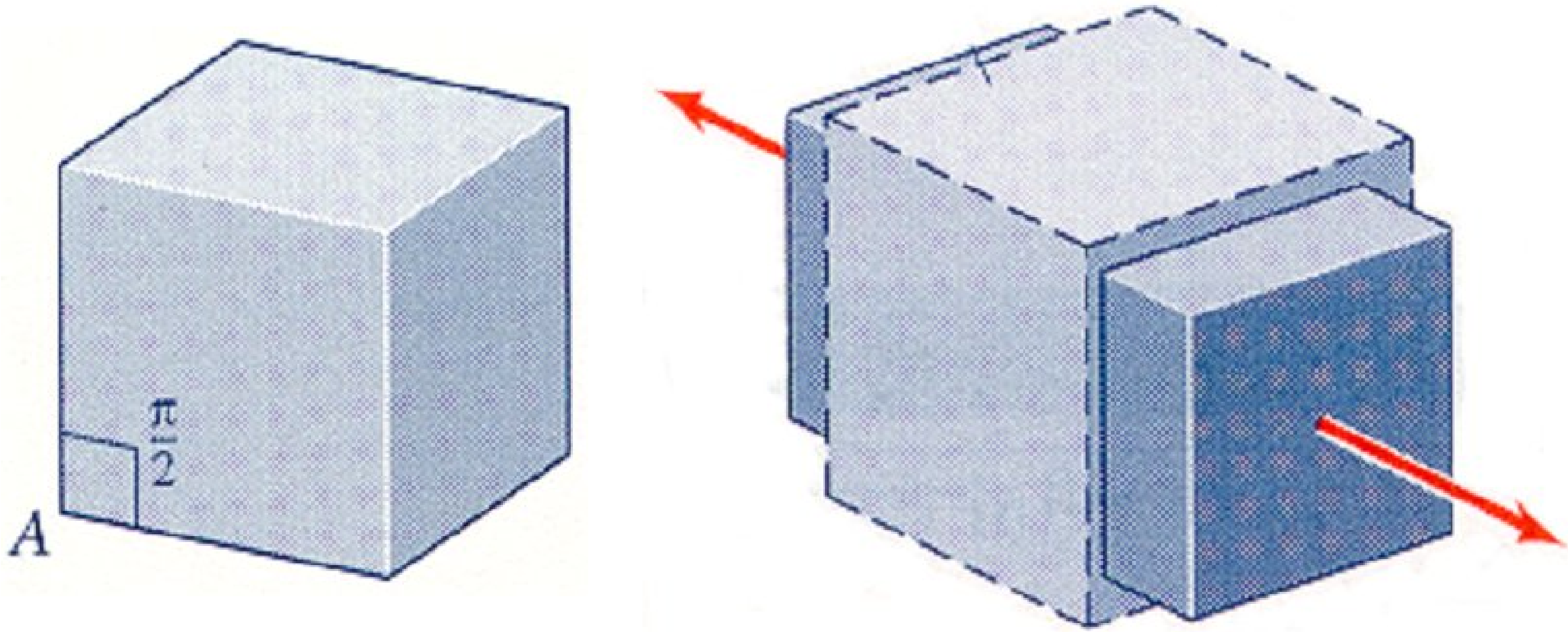
$$\varepsilon_n = \varepsilon_x \alpha^2 + \varepsilon_y \beta^2 + \varepsilon_z \gamma^2 + \gamma_{xy} \alpha\beta + \gamma_{xz} \alpha\gamma + \gamma_{yz} \beta\gamma$$

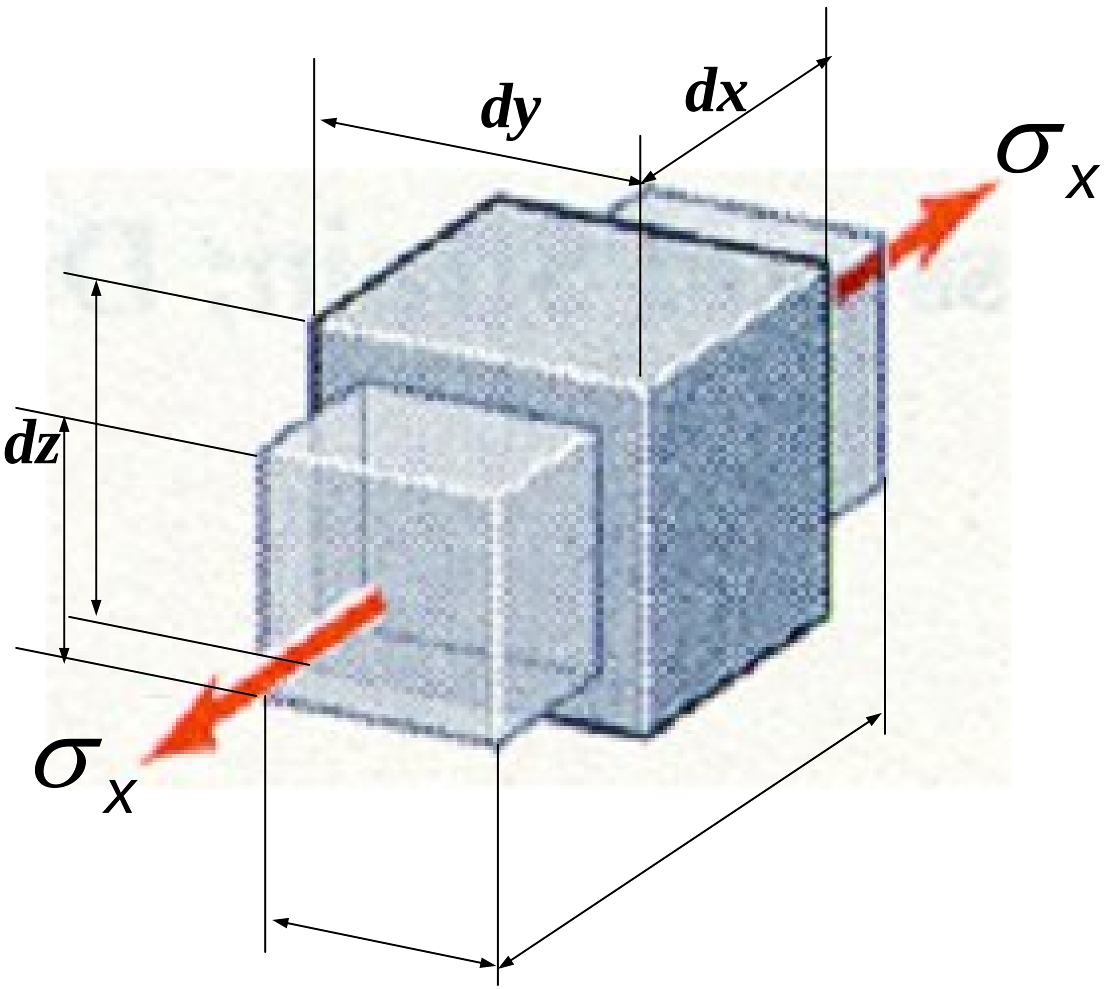


$$\varepsilon_n = \frac{\Delta dL}{dL} \cong \frac{\quad}{\quad} = K \frac{\Delta R}{R}$$

RELACIONES TENSIÓN-DEFORMACIÓN

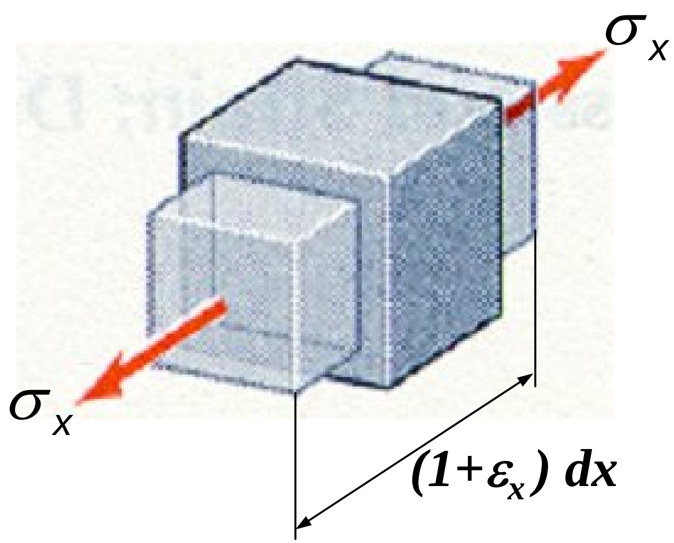
Sólido elástico:





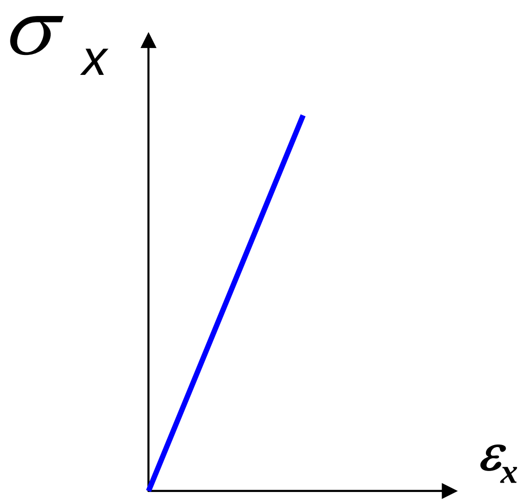
dy
dx
σ x
dz
σ x

Sólido elástico lineal: Relación lineal entre tensiones y deformaciones



$$\sigma_x = E \cdot \varepsilon_x$$

E: Módulo de elasticidad



- E siempre

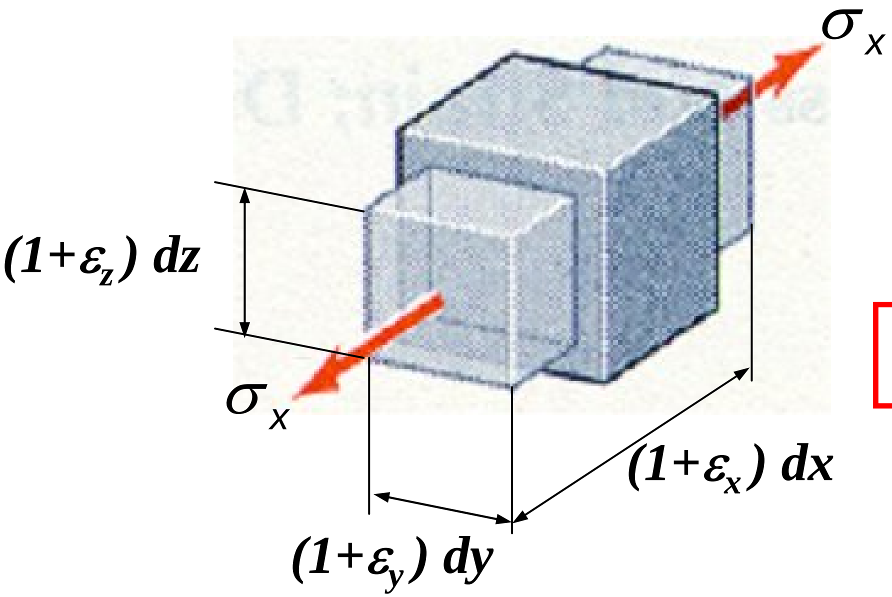
- [E]:Unidades de

-Valores:

Aceros no inoxidables: E = $2{,}1\cdot10^5$ MPa = $2\cdot10^6$ kp/cm^2

Aluminios: E = $0{,}7\cdot10^5$ MPa

Polímeros: E $\approx 10^3$ MPa



$$\varepsilon_y = \varepsilon_z = -\nu \cdot \varepsilon_x = -\frac{\nu}{E}\sigma_x$$

ν: Coeficiente de

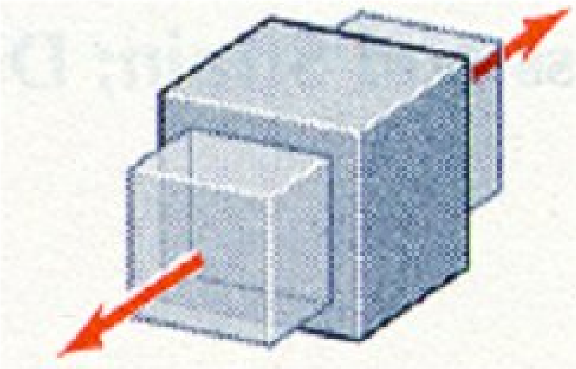
- ν casi siempre
- [ν]:

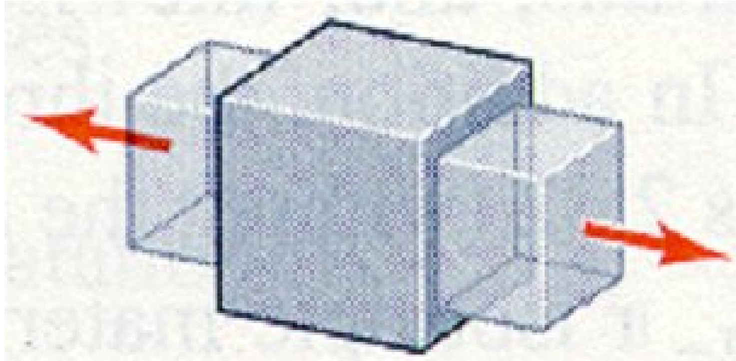
-Valores: ν Casi siempre está entre (en mat. ing. Entre 0,25 y 0,35)

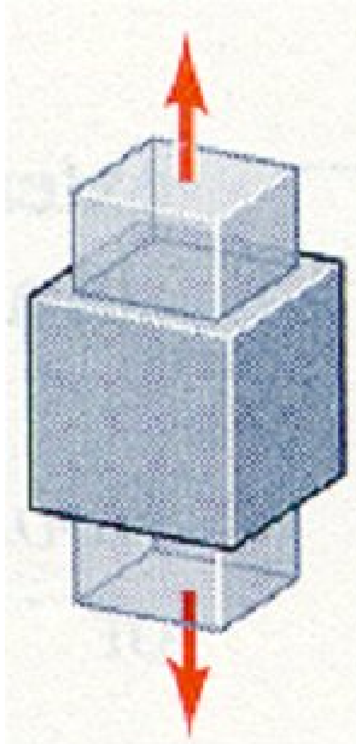
Aceros: ν = 0,33

Aluminios: ν = 0,34

Polímeros: ν ≈ 0,35



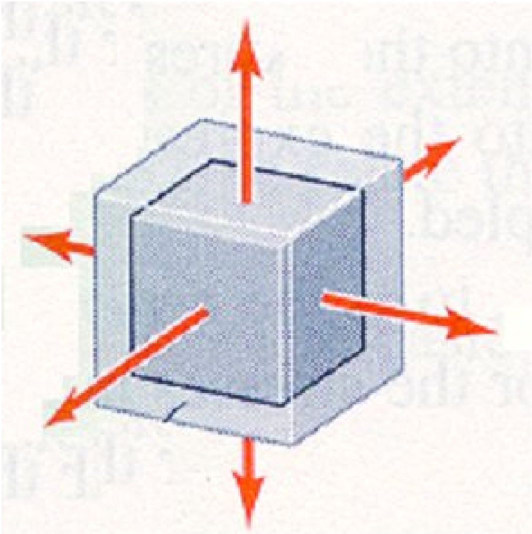




$$\varepsilon_x = \frac{1}{E}\sigma_x$$

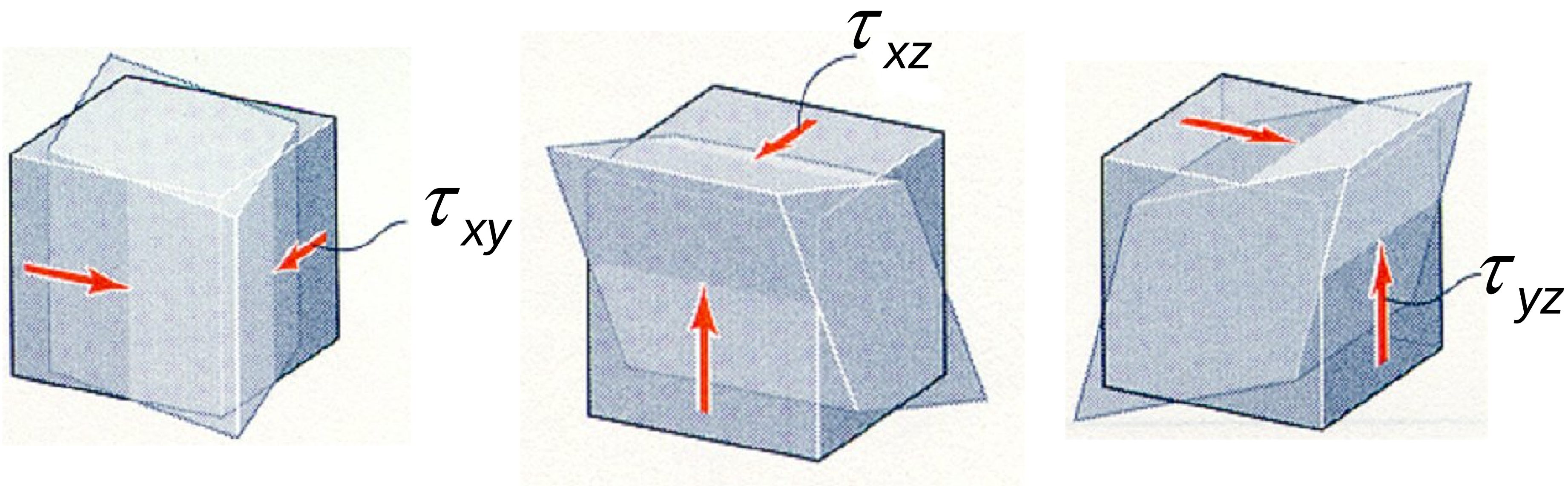
$$\varepsilon_y = -\frac{\nu}{E}\sigma_x$$

$$\varepsilon_z = -\frac{\nu}{E}\sigma_x$$



$$\begin{cases} \varepsilon_x = \dfrac{1}{E}\left[\sigma_x - \nu\left(\sigma_y + \sigma_z\right)\right] \\ \varepsilon_y = \dfrac{1}{E}\left[\sigma_y - \nu\left(\sigma_x + \sigma_z\right)\right] \\ \varepsilon_z = \dfrac{1}{E}\left[\sigma_z - \nu\left(\sigma_x + \sigma_y\right)\right] \end{cases}$$

Leyes de Hooke (1ª parte)



$$\tau_{xy} = G \cdot \gamma_{xy} \qquad \tau_{xz} = G \cdot \gamma_{xz} \qquad \tau_{yz} = G \cdot \gamma_{yz}$$

Leyes de Hooke (2ª parte)

$$G = \frac{E}{2 \cdot (1 + \nu)}$$

G: Módulo de cortadura
o de elasticidad transversal