Tensiones Rasantes

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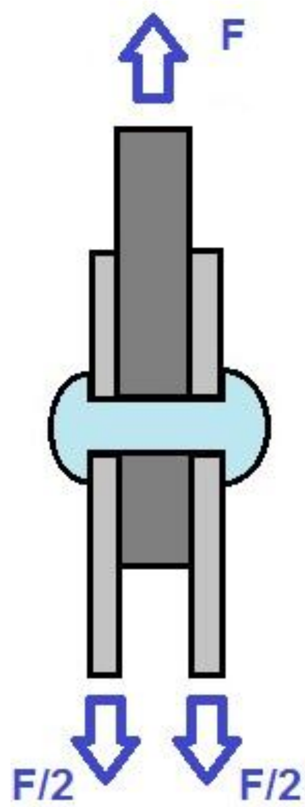
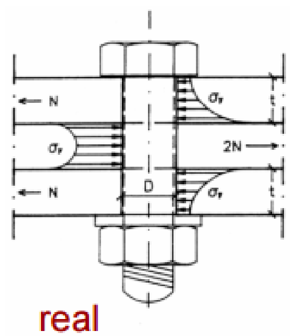
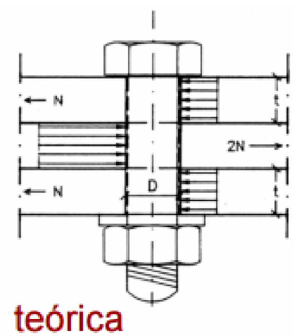
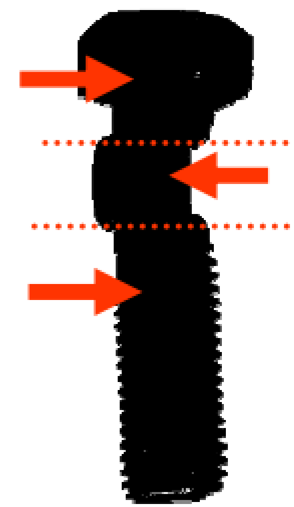
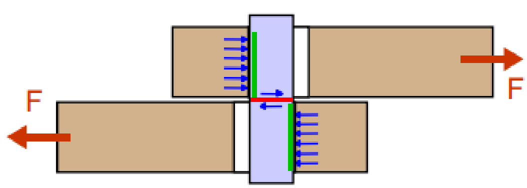
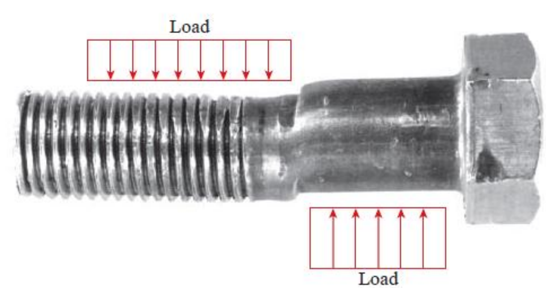




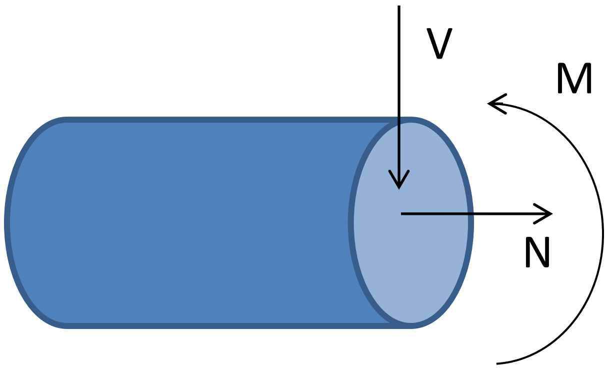


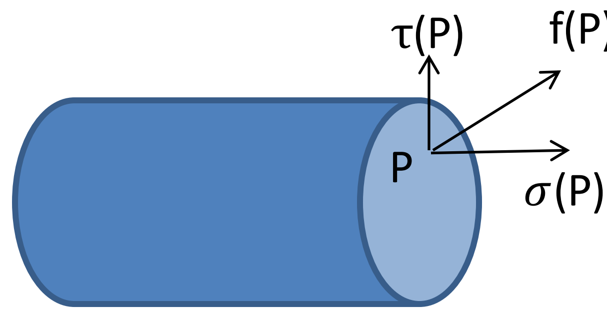


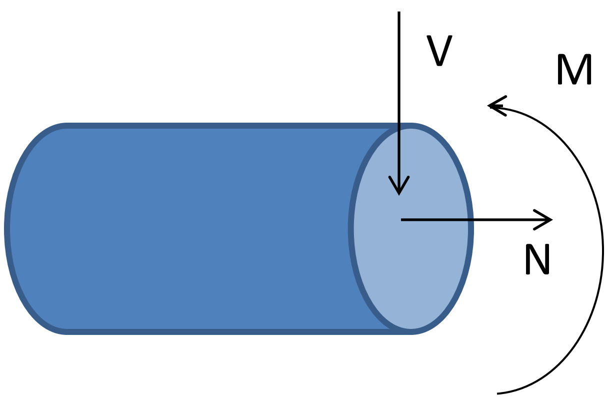


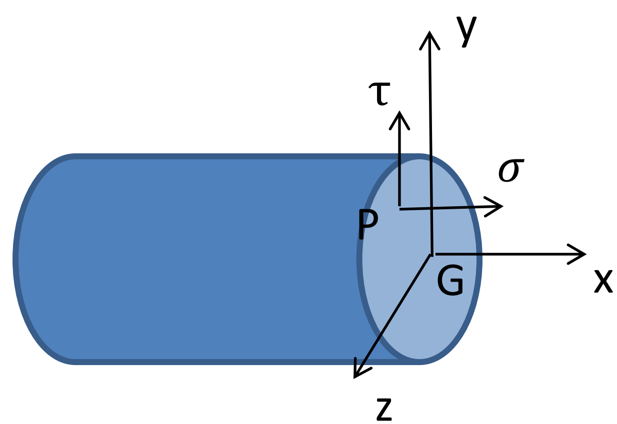


Tensiones internas



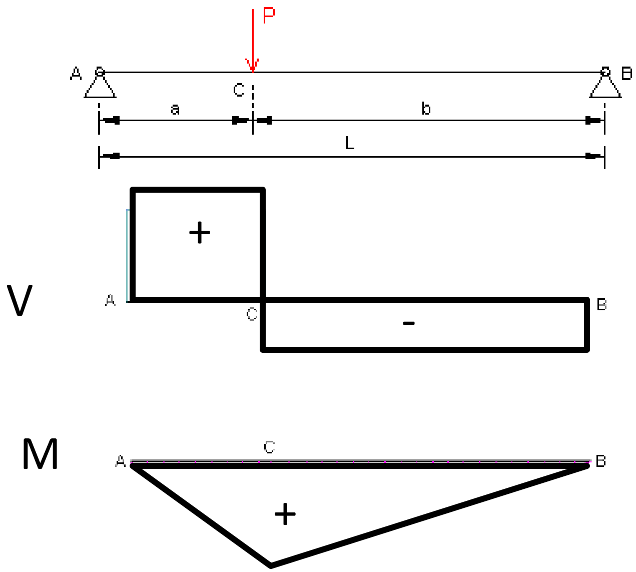


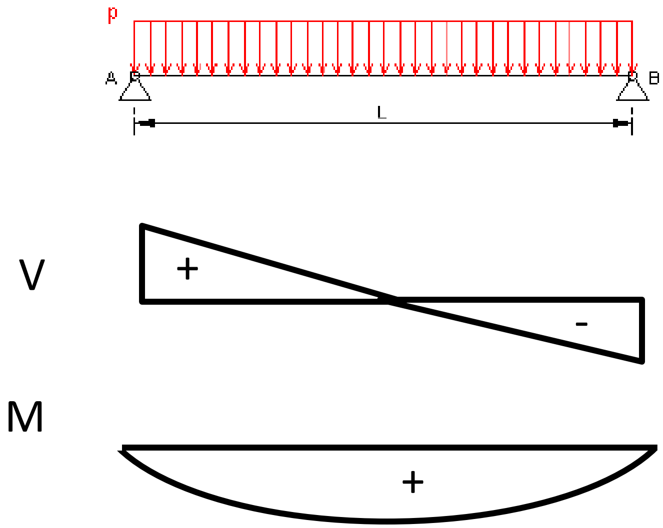




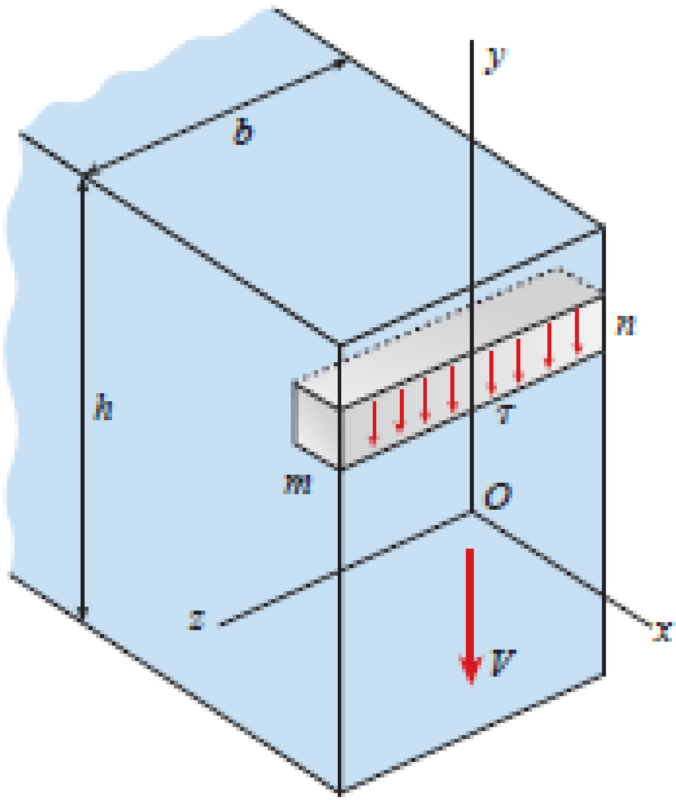
$$N = \int_{\Omega} \sigma \, d\Omega \qquad V = \int_{\Omega} -\tau \, d\Omega \qquad M = \int_{\Omega} -\sigma * y \, d\Omega$$

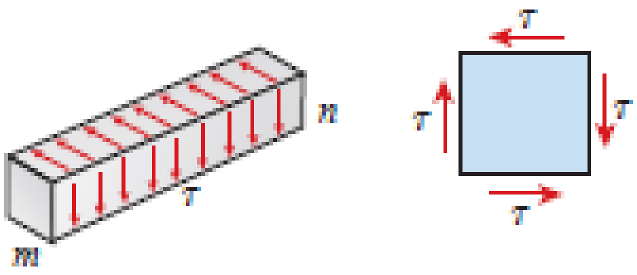
Tensiones internas



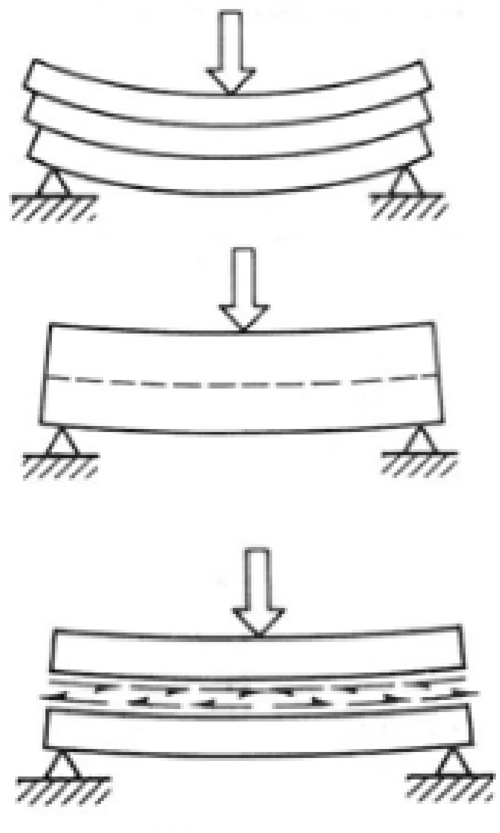


Tensiones rasantes en Vigas





Rasantes en vigas



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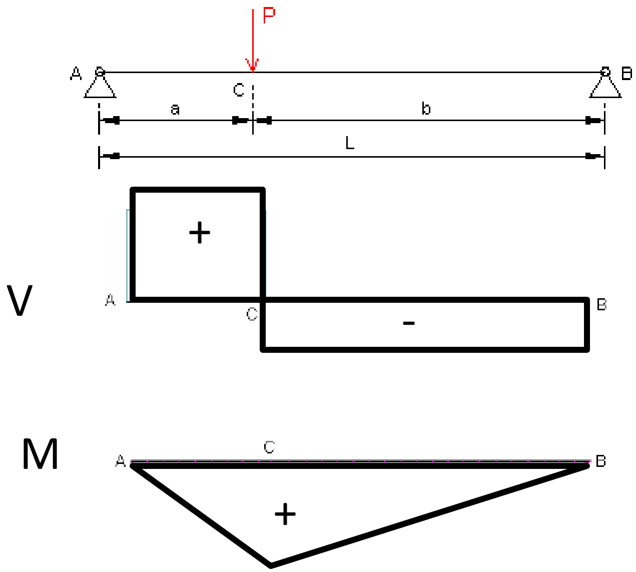
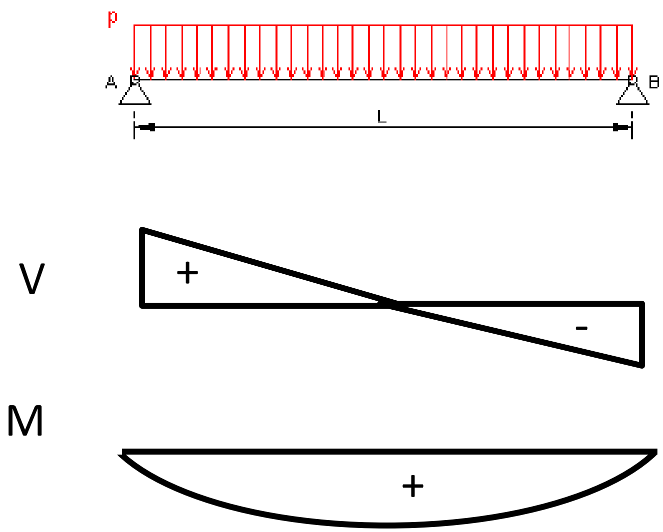
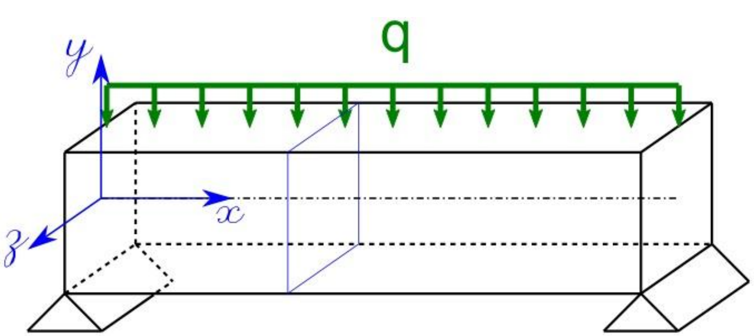
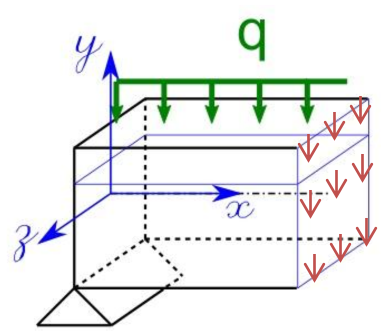


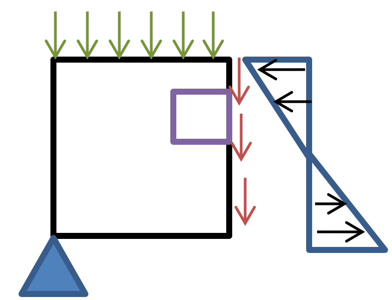


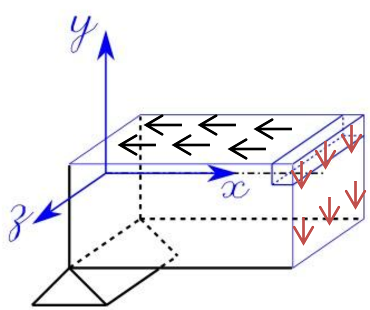
Reciprocidad de las Tensiones Rasantes

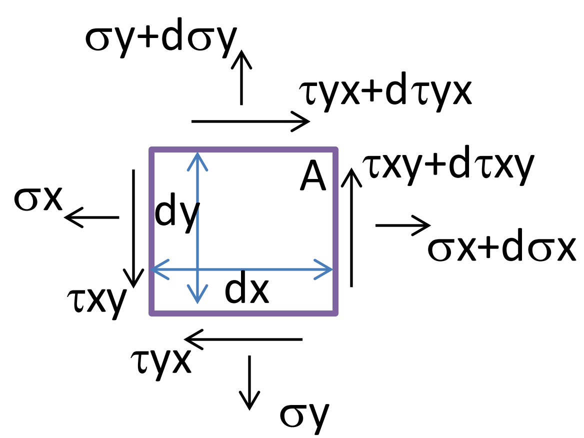
Hipótesis :
Las tensiones son **uniformes en todo el ancho** de la viga.

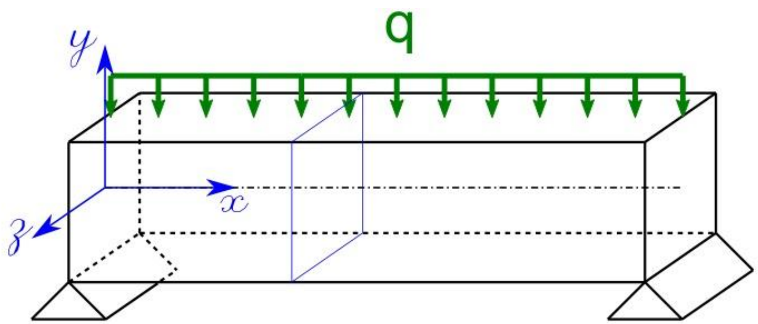












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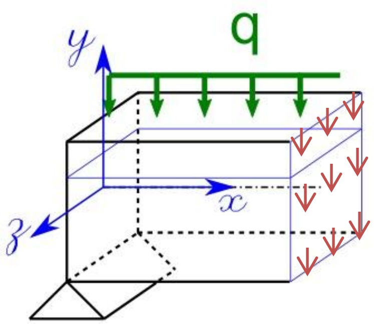
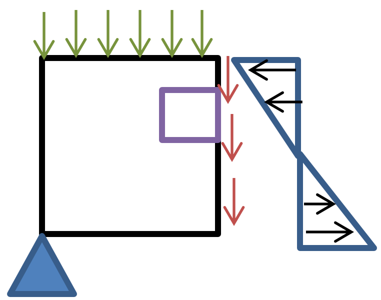
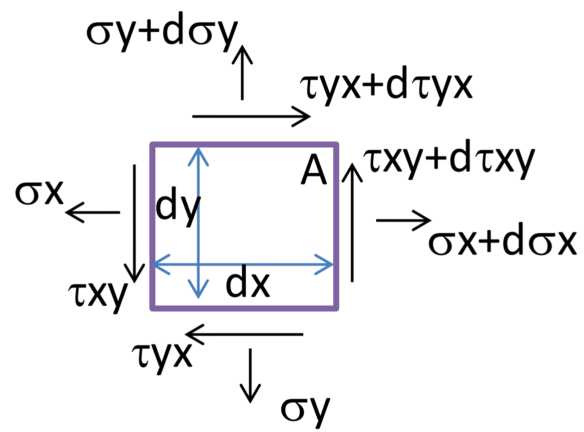
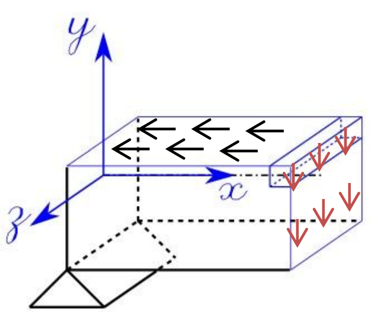


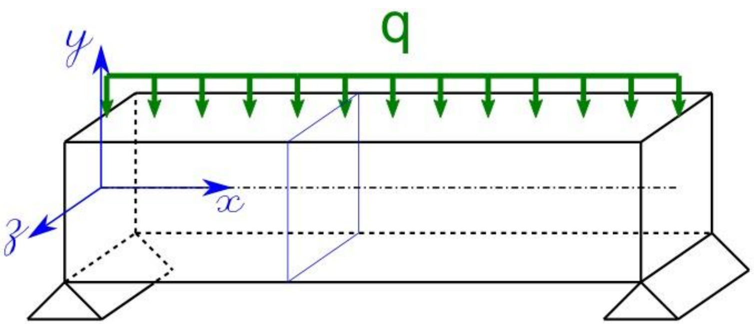






Sum(MA)=0

$\sigma x.dy.dy/2-(\sigma x+d\sigma x).dy.dy/2+ \ldots$



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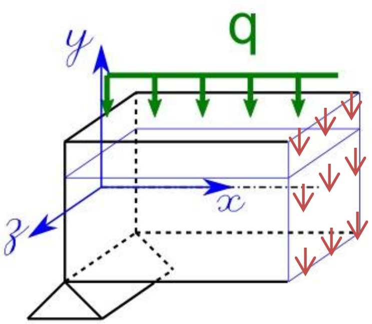
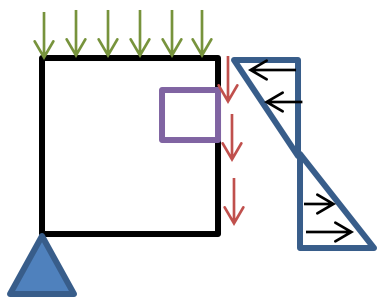
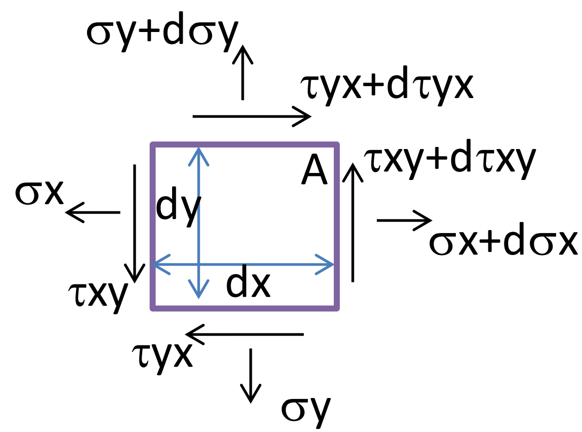
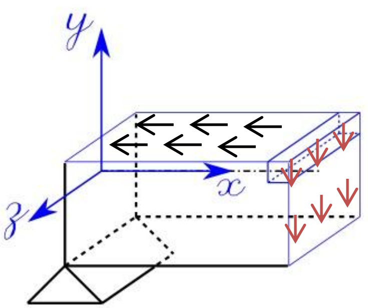








Sum(MA)=0

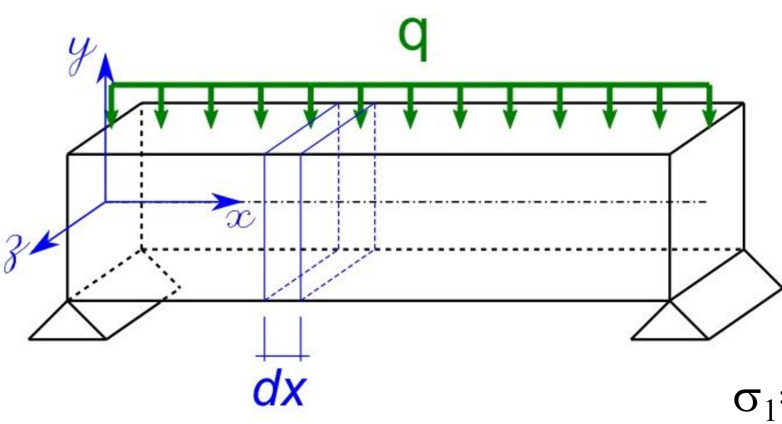
$\sigma x.dy.dy/2-(\sigma x+d\sigma x).dy.dy/2+ (\sigma y+d\sigma y).dx.dx/2-\sigma y.dx.dx/2$
$+ \tau yx.dx.dy-\tau xy.dx.dy=0$ despreciando terminos de 3er orden

$\tau yx.dx.dy-\tau xy.dx.dy=0$

$\rightarrow \tau yx=\tau xy$

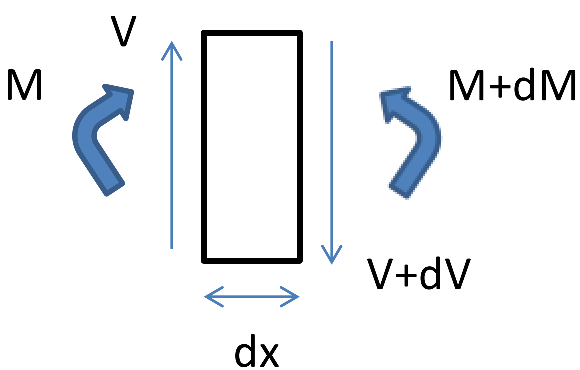
Se concluye que las **tensiones rasantes** sobre **caras adyacentes** de un elemento infinitesimal **son iguales en magnitud**, y tienen sentidos tales que **ambos** esfuerzos se dirigen **hacia el vértice** común, **o ambos esfuerzos se alejan de él**.

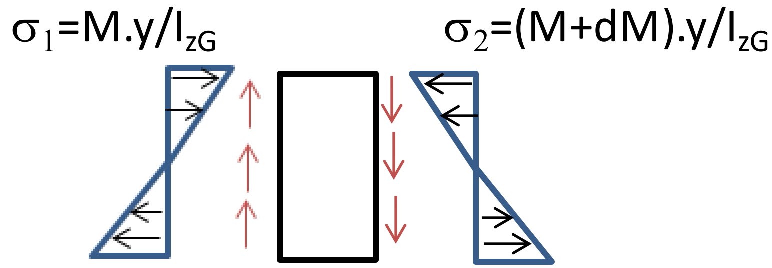
Jourawski

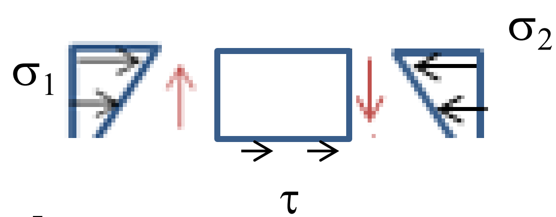


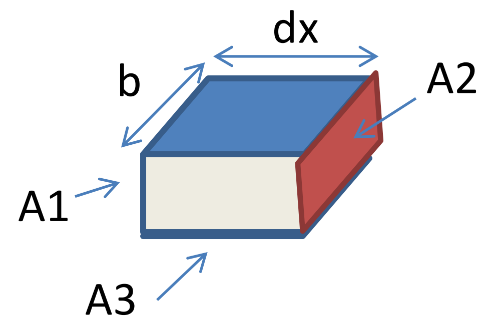
Fórmula de Jourawski:

$$\tau = \frac{V.\mu}{I_{zG}.b}$$









Suma(FH)= $\int_{A1} \sigma_1 dA + \int_{A3} \tau dA - \int_{A2} \sigma_2 dA = 0$

$$\int_{A1} \frac{My}{I_{ZG}} dA + \tau.b.dx - \int_{A2} \frac{(M+dM)y}{I_{ZG}} dA = 0$$

$$\int_{A1} \frac{My}{I} dA + \tau.b.dx - \int_{A2} \frac{(M + dM)y}{I} dA = 0$$

$$\tau.b.dx - \int_{A2} \frac{(dM)y}{I} dA = 0$$

$$\tau.b.dx - \frac{(dM)}{I} \int_{A2} ydA = 0 \qquad \tau = \frac{dM}{dx.b.I} \int_{A2} ydA$$

$$\frac{dM}{dx} = V \qquad \mu = \int_{A2} ydA$$

$$\tau = \frac{V.\mu}{b.I_{ZG}}$$

Ejemplo

Definición:
Flujo cortante

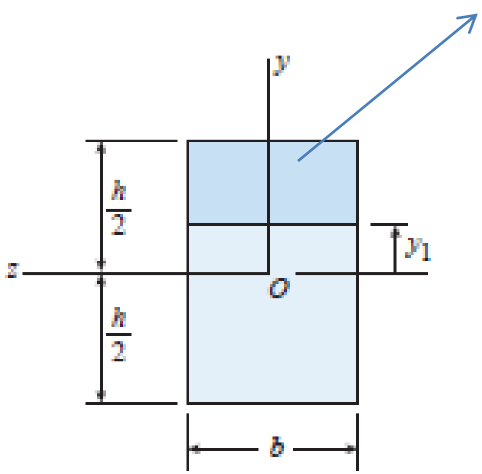
$$q = \frac{V.\mu}{I}$$

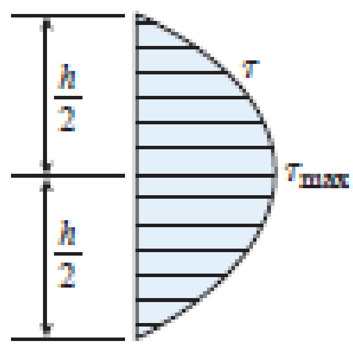
El flujo cortante es la fuerza cortante horizontal por unidad de longitud en la dirección del eje de la barra.

Esta definición es más general. Para determinar **q** no es necesario imponer que las tensiones rasantes sean uniformes en el ancho de la sección

$$\mu:\ b\left(\frac{h}{2}-y_1\right)\left(y_1+\frac{h/2-y_1}{2}\right)=\frac{b}{2}\left(\frac{h^2}{4}-y_1^2\right)$$

$$\int y\,dA=\int_{y_1}^{h/2} yb\,dy=\frac{b}{2}\left(\frac{h^2}{4}-y_1^2\right)$$





$$\tau_{max}=\frac{Vh^2}{8I}=\frac{3V}{2A}$$

Ancho variable / Ej.: PNI