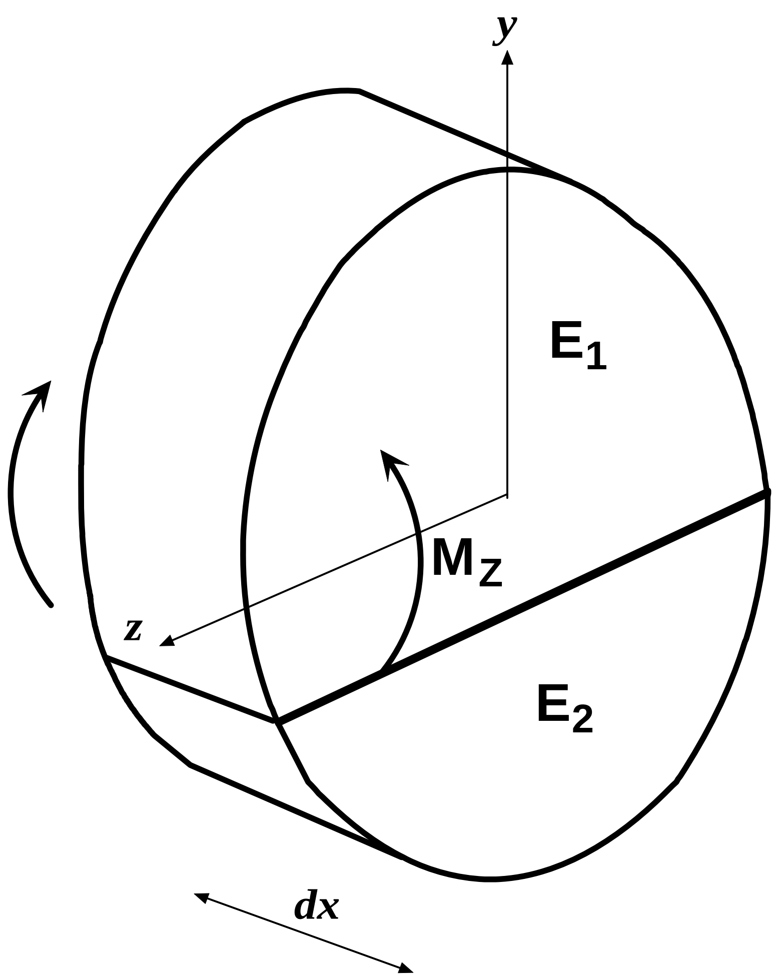
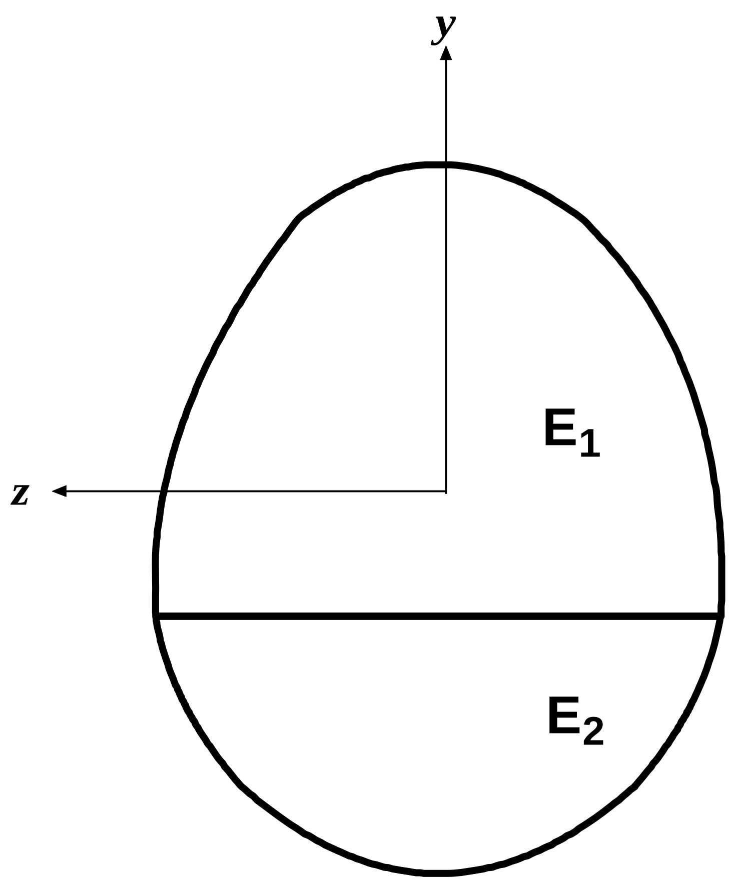
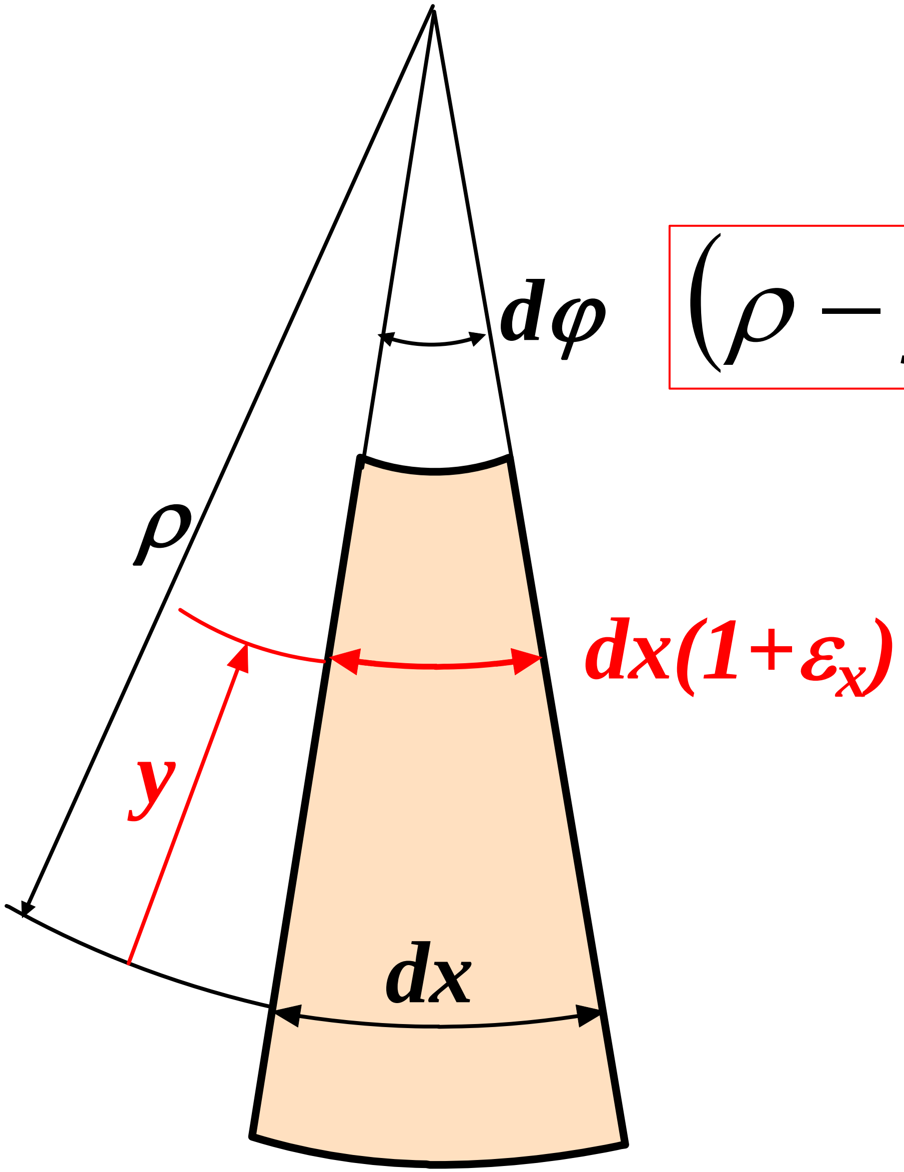
FLEXIÓN SIMÉTRICA EN SECCIONES COMPUESTAS





FLEXIÓN SIMÉTRICA PURA (un solo material):



$$\rho \, d\varphi = dx$$

$$(\rho - y)\, d\varphi = dx(1 + \varepsilon_x)$$

$$\frac{(\rho - y)}{\rho} = 1 + \varepsilon_x$$

$$\varepsilon_x = \frac{-y}{\rho}$$

$$\varepsilon_x = \frac{-y}{\rho} \Longrightarrow \sigma_x = \frac{-E}{\rho} y$$

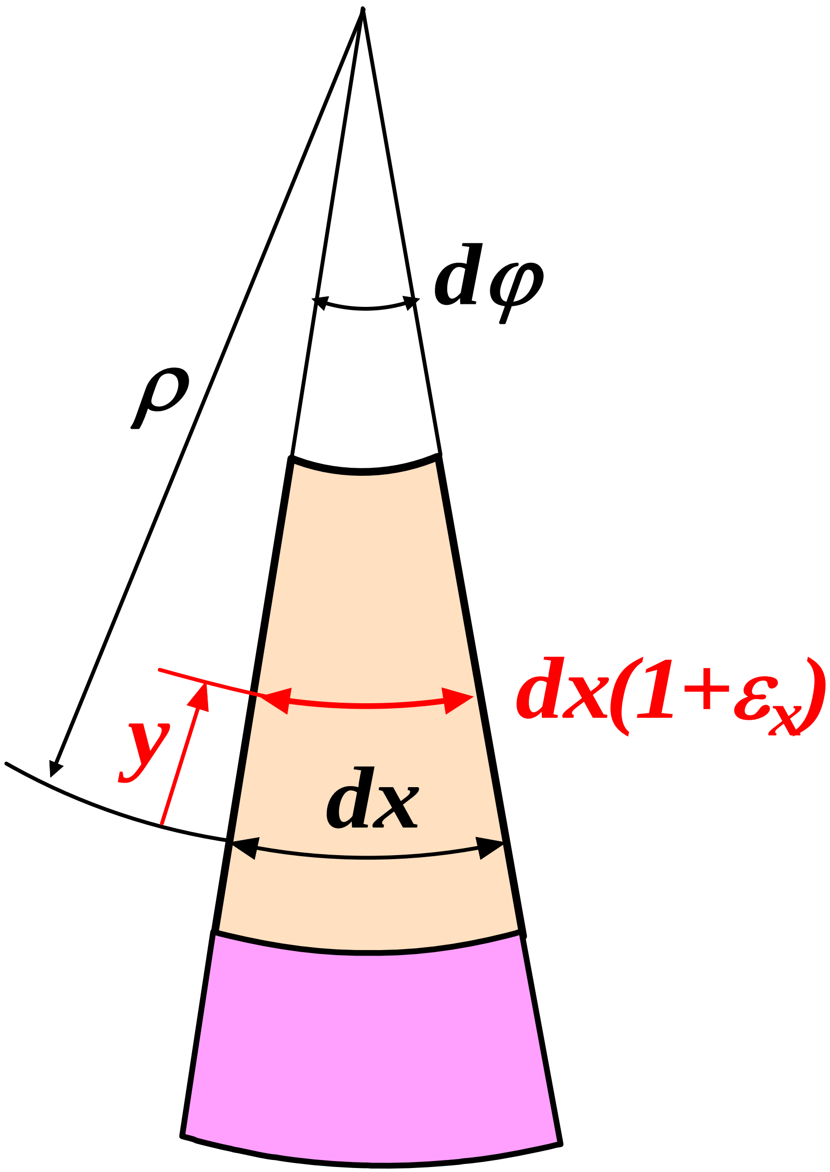
$$\sum Fx = 0 \quad \rightarrow \quad \iint_A \sigma_x dA = 0 \quad \rightarrow \quad \frac{-E}{\rho} \iint_A y dA = 0$$

z pasa por el centro de gravedad de la sección.

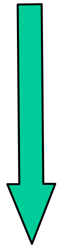
$$\sum M_{(z)} = M_z \quad \rightarrow \quad \iint_A -\sigma_x \cdot y \cdot dA = M_z \quad \rightarrow \quad \frac{E}{\rho} \iint_A y^2 dA = M_z$$

$$M_z = \frac{EI_z}{\rho} \rightarrow \quad \boxed{\frac{1}{\rho} = \frac{M_z}{EI_z}} \longrightarrow \boxed{\sigma_x = -\frac{M_z}{I_z} y}$$

Ley de Navier



$$\varepsilon_x = \frac{-y}{\rho}$$



Equilibrio de fuerzas según ***x*** :

$$\sum Fx = 0 \quad \rightarrow \quad \iint_A \sigma_x dA = 0 \quad \rightarrow$$

Posición de ***z*** :

$$n = \frac{E_2}{E_1} \quad \rightarrow \quad \iint_{A_1} ydA + \quad \iint_{A_2} ydA = 0 \quad \rightarrow$$

$$\rightarrow \iint_{A_1} ydA + \iint_{A_2} yd(nA) = 0$$

Equilibrio de pares según ***z*** :

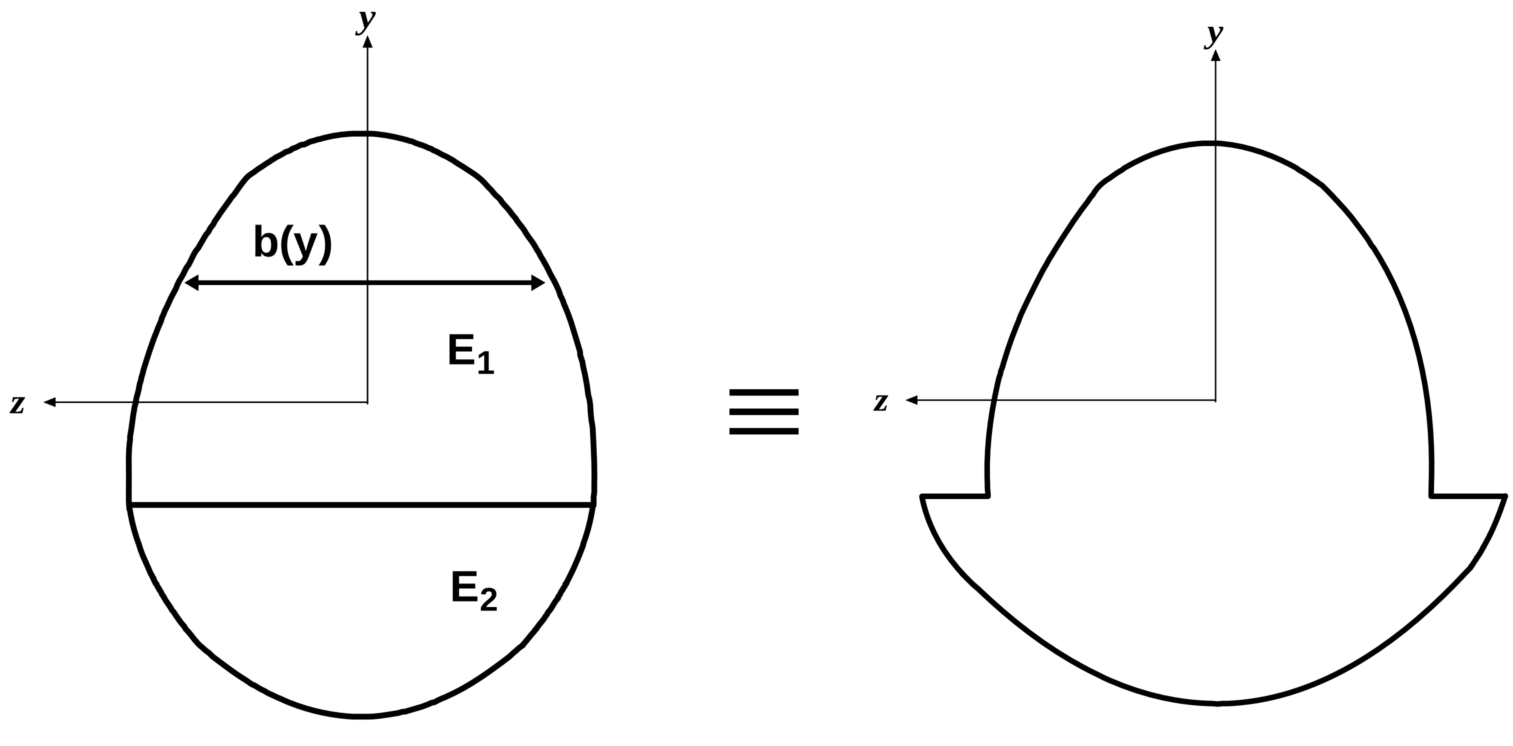
$$\sum M_{(Z)} = M_z \quad \rightarrow \quad \iint_{A_1} -\sigma_{x1} \cdot y \cdot dA + \iint_{A_2} -\sigma_{x2} \cdot y \cdot dA = M_z$$

$$\frac{E_1}{\rho} \iint_{A_1} y^2 dA + \frac{E_2}{\rho} \iint_{A_2} y^2 dA = M_z \quad \rightarrow \quad \frac{1}{\rho} = \frac{M_z}{\qquad\qquad\qquad\qquad}$$

Interpretación práctica: Sección transformada

$$\iint_{A_1} y\,dA + n\iint_{A_2} y\,dA = 0 \quad \equiv$$

$$I_{Z1} + n \cdot I_{Z2} = \qquad \equiv \iint_{A_1} y^2 dA + \iint_{A_2} y^2 d(nA)$$



$$\sigma_{x1} =$$

$$\sigma_{x2} =$$