SOLICITACIÓN POR FLEXIÓN EN RÉGIMEN ANELÁSTICO:

$$\begin{cases} \text{I)} \rightarrow \text{FLEXIÓN SIMPLE.} \\ \text{II)} \rightarrow \quad '' \quad \text{COMPUESTA} \end{cases}$$

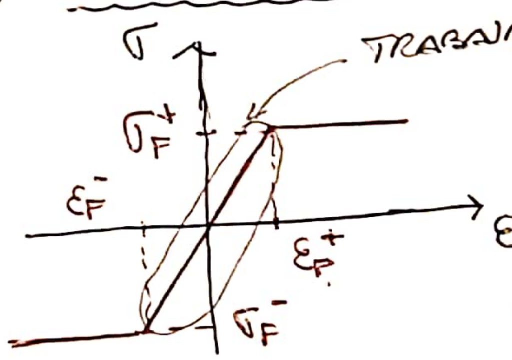
1) PARTIENDO DE LA "HBN"

$$\begin{cases} \varepsilon_{x,z} = \dfrac{z}{z_{máx}} \cdot \varepsilon_{x,máx}. \\ \varepsilon_{x,z} = \dfrac{z}{1} \cdot \bar{\varepsilon}_x \end{cases}$$

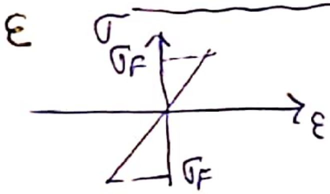
2) LAS ECS. DE EQUIVALENCIA.

$$\begin{cases} N = 0 = \int_A \sigma_x \, dA. \\ M_y = \int_A \sigma_x \cdot z \cdot dA. \end{cases}$$

3) PERÍODO ELÁSTICO:



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



4) EXPRESIÓN DE FLEXIÓN:

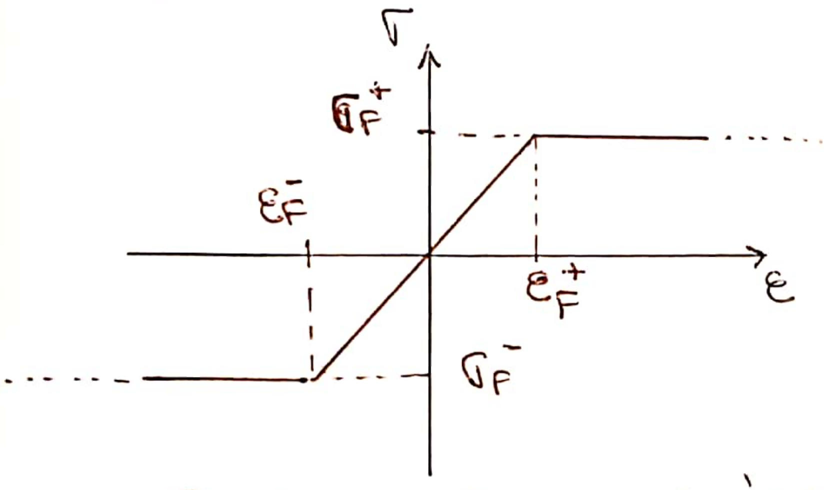
$$\sigma_x = \frac{M_y}{I_y} \cdot z.$$

$$\boxed{\text{FLEXIÓN SIMPLE RECTA}}$$

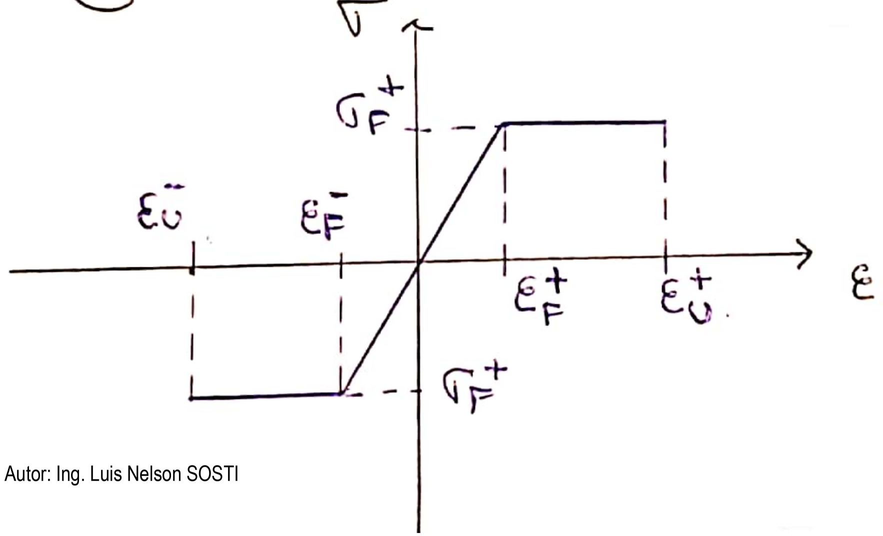
FLEXIÓN SIMPLE RECTA - ANELÁSTICO

I) TIPOS DE MATERIALES

① EPI = ELASTO-PLÁSTICO IDEAL.



② EPR = ELASTO-PLÁSTICO REAL



- $\rightarrow E_T = E_C.$
  - $\hookrightarrow E_T \neq E_C.$
- $\rightarrow \varepsilon_F^+ = \varepsilon_F^-$
  - $\hookrightarrow \varepsilon_F^+ \neq \varepsilon_F^-$
- $\rightarrow \sigma_F^+ = \sigma_F^-.$
  - $\hookrightarrow \sigma_F^+ \neq \sigma_F^-.$

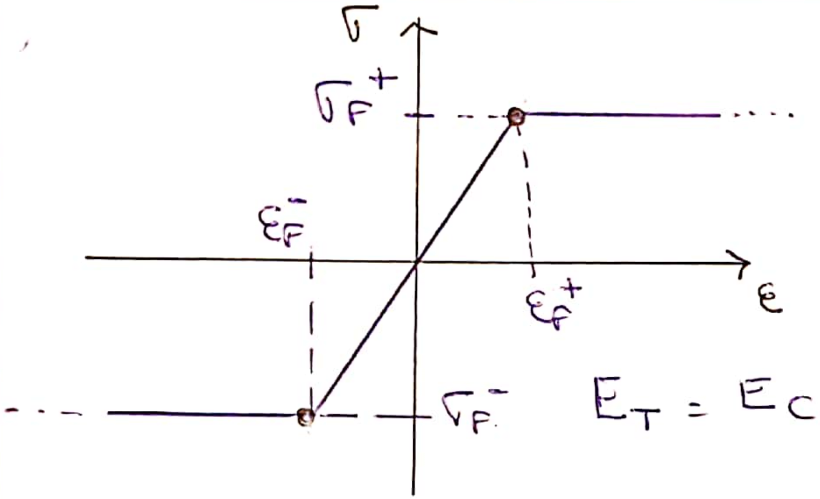
II) TIPOS DE SECCIONES:

① SECCIONES c/ 2 EJES DE SIMETRÍA

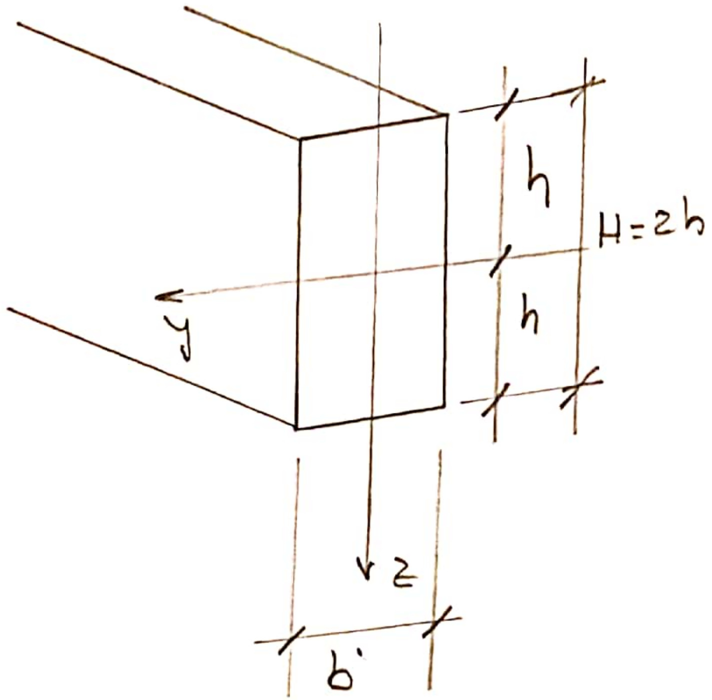
② " c/ 1 " " "

③ " CUALESQUIERA → SIN EJES DE SIMETRÍA.

SECCIÓN RECTANGULAR – MATERIAL ELASTO-PLÁSTICO IDEAL – DIAGRAMA BILINEAL



$E_T = E_C.$



- Si $\sigma_{máx} \leq \sigma_F \rightarrow \sigma_{máx} = \dfrac{M_y}{I_y} \cdot h.$

- $\sigma_{ADM} = \dfrac{\sigma_F}{CS.} \rightarrow \sigma_{máx} = \sigma_{ADM} = \dfrac{M_{y,ADM}}{I_y} \cdot h.$

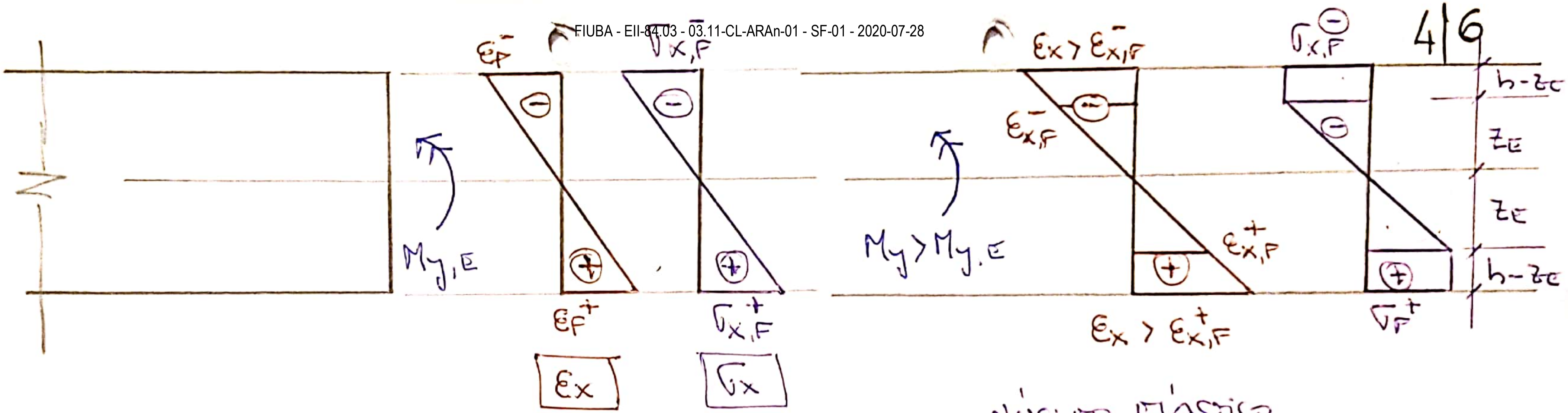
$$M_{y,ADM} = \sigma_{ADM} \cdot \frac{I_y}{h} = \sigma_{ADM} \cdot \frac{b\,8h^3}{12\,h}$$

$$\boxed{M_{y,ADM} = \frac{2}{3} b h^2 \sigma_{ADM}}$$

- $\sigma_{máx} = \sigma_F = \dfrac{M_{y,E}}{I_y} \cdot h.$

$M_{y,E}$ = MOMENTO FLEXOR ELÁSTICO.
$(M_{y,F})$.

$$\boxed{M_{y,E} = \frac{2}{3} b h^2 \sigma_F}$$



$$\sigma_{x,F} = \frac{M_{y,E}}{I_y} \cdot h = \frac{M_{y,E}}{I_y / h} = \frac{M_{y,E}}{S_y}$$

MÓDULO ELÁSTICO.

$$\boxed{M_{y,E} = S_y \cdot \sigma_{x,F}}$$

$$M_y > M_{y,E}$$

- NÚCLEO ELÁSTICO

$$-z_E \leq z \leq +z_E$$

- ZONA PLÁSTICA

$$(h - z_E).$$

I $\quad z_E < z \leq h.$

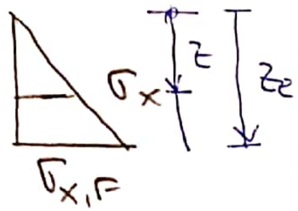
II $\quad -h \leq z < z_E.$

ECS DE EQUIVALENCIA:

$$M_y = \int_A \sigma_x \cdot z \cdot dA = \int_{-h}^{h} \sigma_x \cdot z \cdot \underbrace{b \cdot dz}_{dA}$$

$$M_y = 2\left[\int_0^{z_E} \sigma_x \cdot z \cdot b \cdot dz + \int_{z_E}^{h} \sigma_x \cdot z \cdot b\, dz\right]$$

$$0 \le z \le z_E \rightarrow \frac{\sigma_x}{z} = \frac{\sigma_{x,F}}{z_E}$$



$$\sigma_x = \sigma_{x,F} \cdot \frac{z}{z_E}$$

$$z_E \le z \le h \rightarrow \sigma_x = \sigma_F$$

$$M_y = 2\left[\int_0^{z_E} \sigma_{x,F} \cdot \frac{z}{z_E} \cdot z\, b\, dz + \int_{z_E}^{h} \sigma_{x,F} \cdot z\, b\, dz\right]$$

$$M_y = 2\left[\frac{\sigma_{x,F}\, b}{z_E} \int_0^{z_E} z^2\, dz + \sigma_{x,F}\, b \int_{z_E}^{h} z\, dz\right]$$

$$M_y = 2\left[\sigma_{x,F} \frac{b}{z_E} \cdot \frac{z^3}{3}\Big|_0^{z_E} + \sigma_{x,F}\, b \cdot \frac{z^2}{2}\Big|_{z_E}^{h}\right] =$$

$$M_y = 2\left[\sigma_{x,F} \frac{b}{z_E} \cdot \frac{z_E^3}{3} + \sigma_{x,F} \cdot b \cdot \left[\frac{h^2}{2} - \frac{z_E^2}{2}\right]\right] =$$

$$M_y = \frac{2}{3} b z_E^2 \sigma_{x,F} + b(h^2 - z_E^2)\sigma_{x,F}$$

$$M_y = \frac{2}{3} b z_E^2 \sigma_{x,F} + b h^2 \sigma_{x,F} - b z_E^2 \sigma_{x,F}.$$

$$\boxed{M_y = b h^2 \sigma_{x,F} - \frac{1}{3} b z_E^2 \sigma_{x,F}}$$

$$\boxed{M_y = b h^2 \sigma_{x,F} \left[1 - \frac{1}{3} \frac{z_E^2}{h^2} \right]}$$

$$M_{y,E} = \frac{2}{3} b h^2 \sigma_{x,F}$$

$$\frac{3}{2} M_{y,E} = b h^2 \sigma_{x,F}$$

$$\boxed{M_y = \frac{3}{2} M_{y,E} \left(1 - \frac{1}{3} \frac{z_E^2}{h^2} \right)}$$

SECCIÓN PARCIALMENTE

PLASTIFICADA