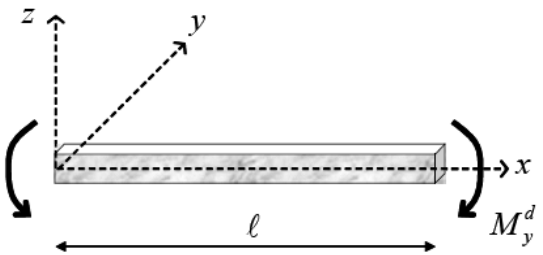
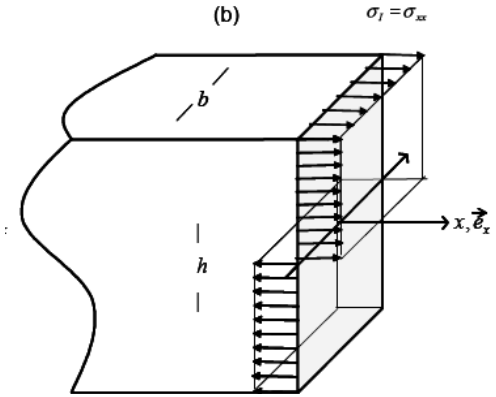
# Lecture 13- summary

Beam section strength criterion:

$$\forall x;\ \left(\overrightarrow{F}_S, \overrightarrow{\mathcal{M}}_S\right) \in D_S(x) \Leftrightarrow f\left(x, \overrightarrow{F}_S(x), \overrightarrow{\mathcal{M}}_S(x)\right) \leq 0$$




$$N_x = \int_{z=-h/2}^{z=h/2} \int_{y=-b/2}^{y=b/2} \sigma(z)\, dy\, dz \equiv 0$$

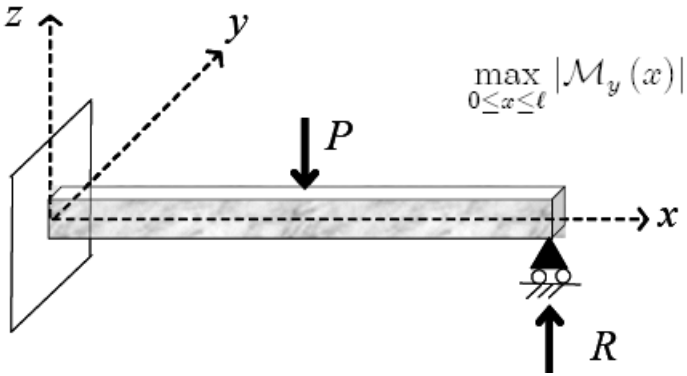
$$\mathcal{M}_y = \int_{z=-h/2}^{z=h/2} \int_{y=-b/2}^{y=b/2} z\sigma(z)\, dy\, dz \equiv \mathcal{M}_y^d$$

Compatibility with strength criterion

$$f(\boldsymbol{\sigma}'') = \max |\text{signum}(z)\,\sigma| - \sigma_0 \leq 0 \Rightarrow |\sigma| = \frac{4\left|\mathcal{M}_y''\right|}{bh^2} \leq \sigma_0$$

$$|\mathcal{M}_y|_{\lim} = M_0 = \frac{1}{4}\sigma_0 bh^2$$

**Example:** Statically indeterminate beam




$$\max_{0\leq x\leq \ell} |\mathcal{M}_y(x)| = \begin{cases} |P/2 - R|\,\ell \leq M_0 \\ |R|\,\ell/2 \leq M_0 \end{cases}$$

$$|P| \leq P_{\lim} = 6\frac{M_0}{\ell}$$