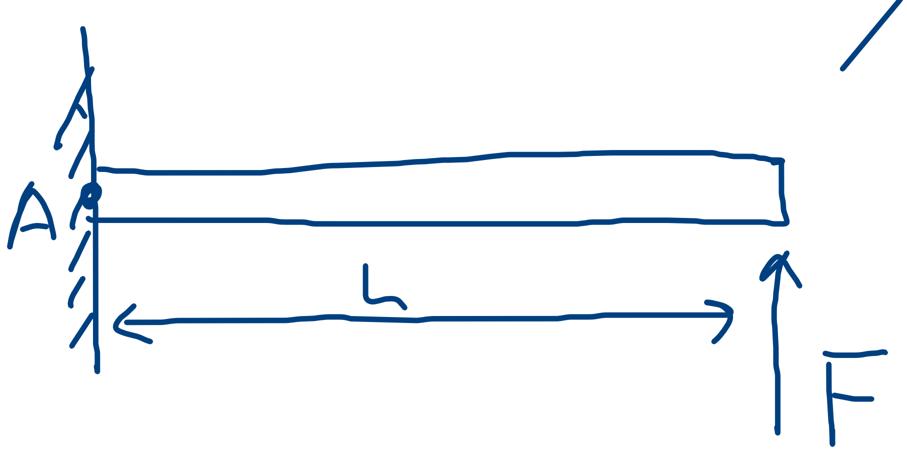
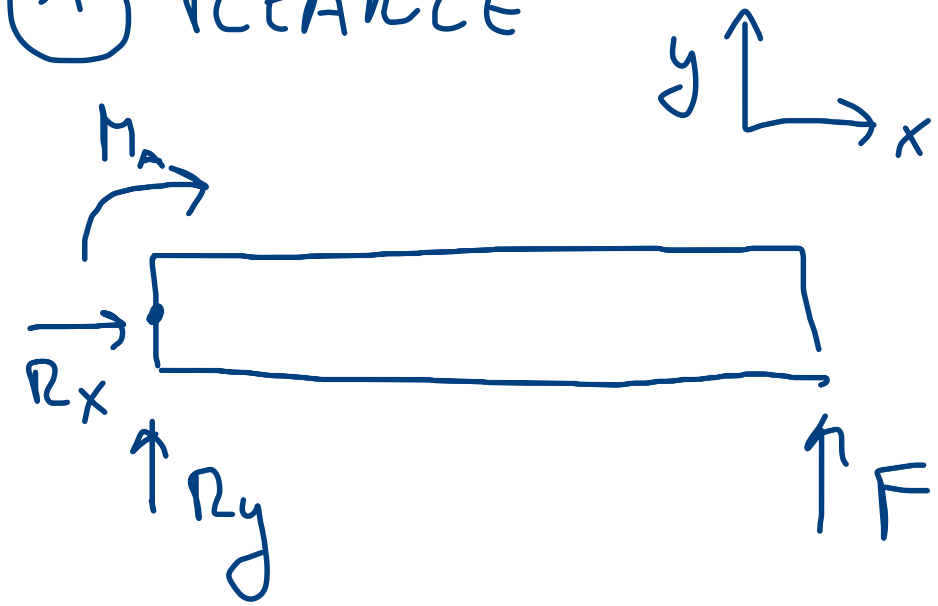
ROVINNÝ OHYB PŘÍMÝCH TENKÝCH NOSNÍKŮ

(EULER–BERNOULLI)



① REAKCE



$\rightarrow x: \quad R_x = 0$

$\uparrow y: \quad R_y + F = 0$

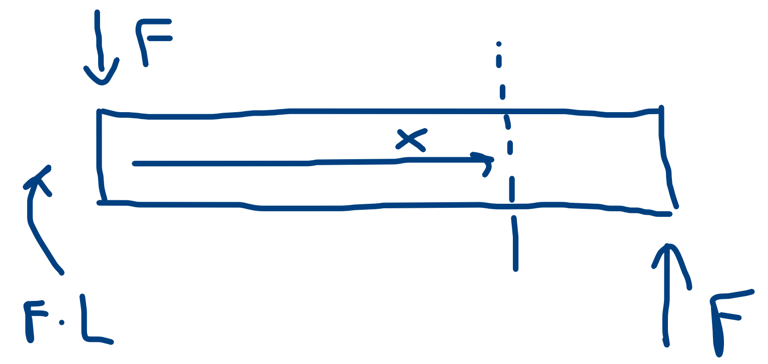
$\curvearrowleft A: \quad +F \cdot L - M_A = 0$

$R_x = 0$

$R_y = -F$

$M_A = F \cdot L$

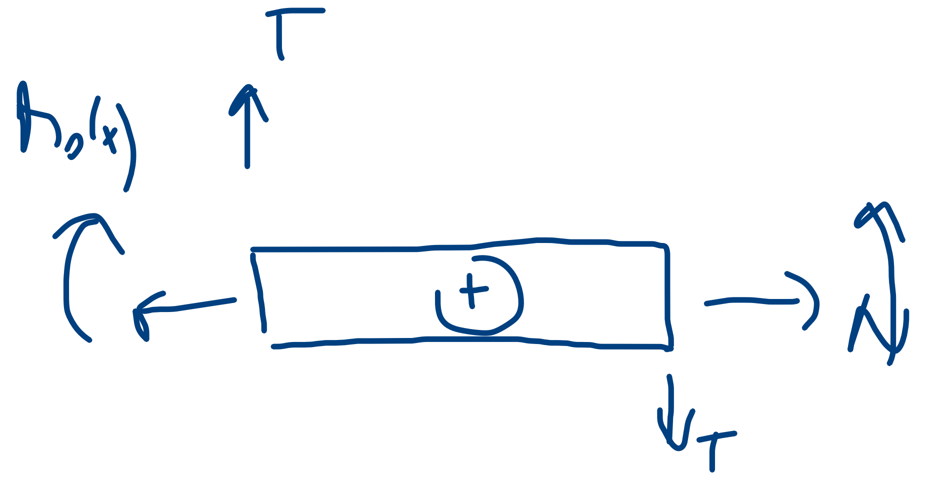
② Vnitřní statické účinky

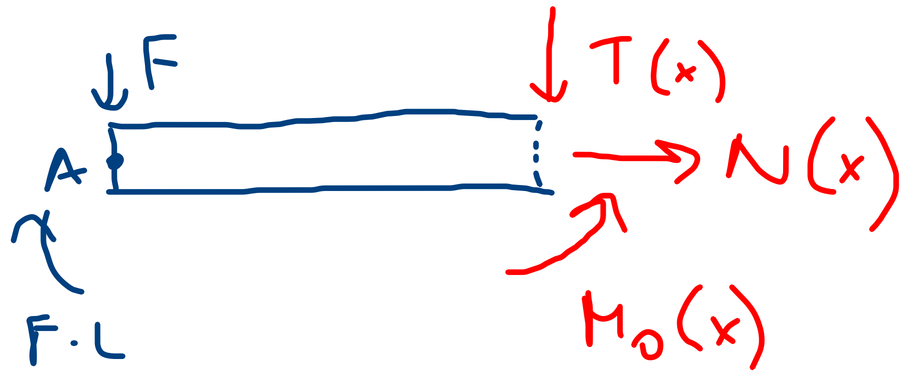


$N(x)$ .. normálová s.

$T(x)$ .. posouvající síla

$M_o(x)$ .. ohybový moment



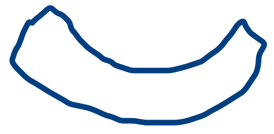


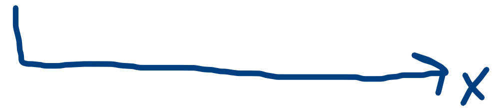
$N(x)$ ⊕ TAH

$\rightarrow x: \; N(x) = 0$

$T(x)$ ⊕ 

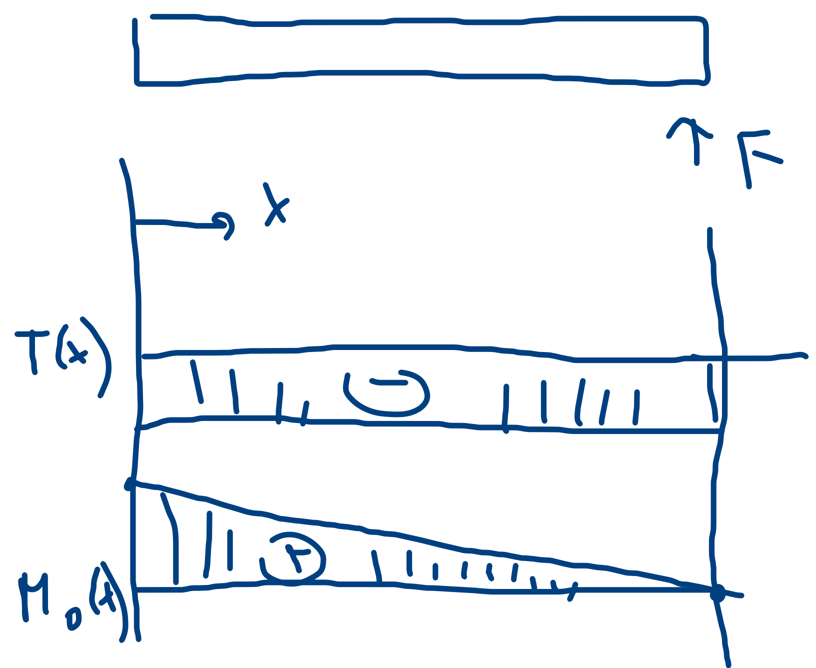
$\uparrow y: \; -F - T(x) = 0 \;\rightarrow\; T(x) = -F$

$M_o(x)$ ⊕ 

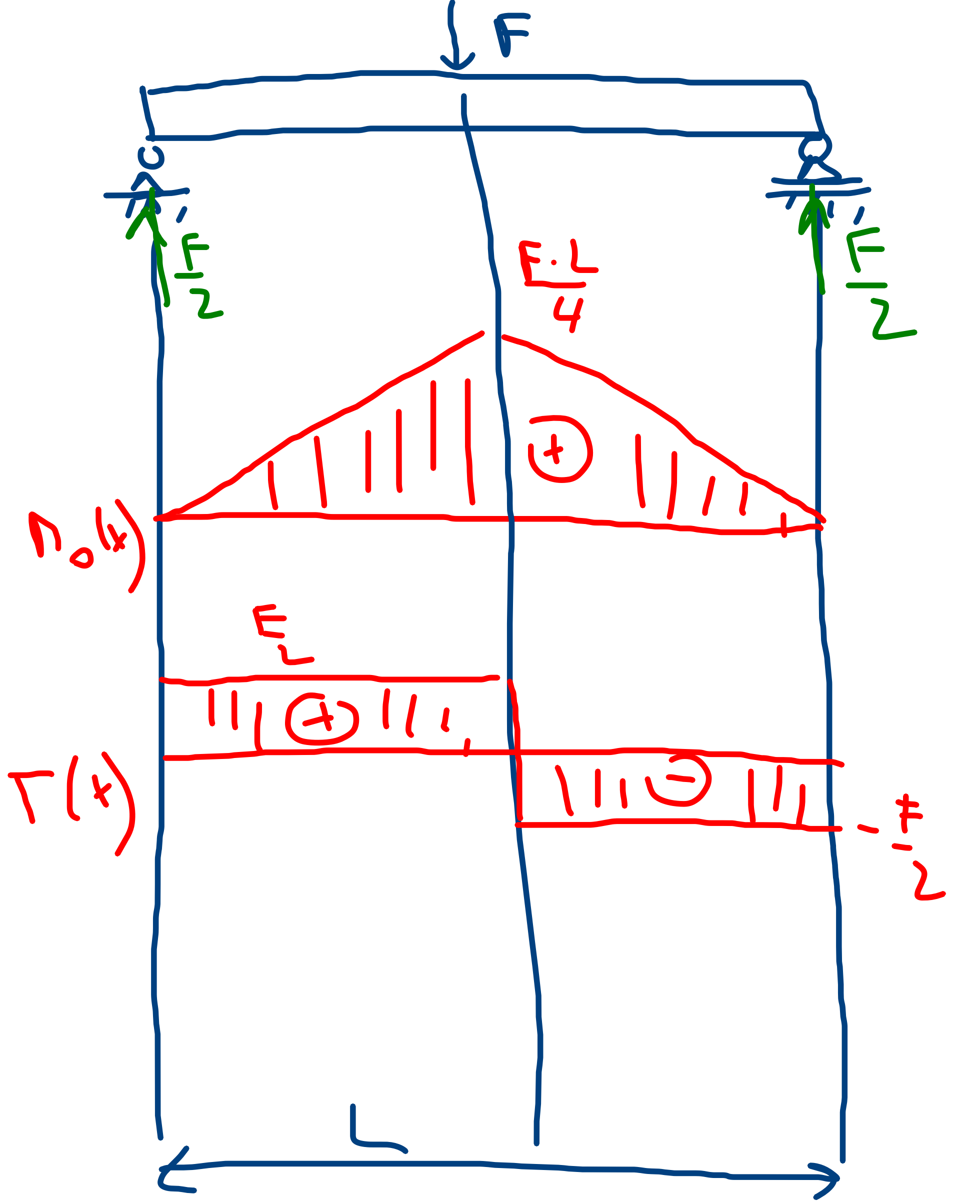


$\curvearrowleft A: \; -F\cdot L \overbrace{- T(x)\cdot x}^{F\cdot x} + M_o(x) = 0$

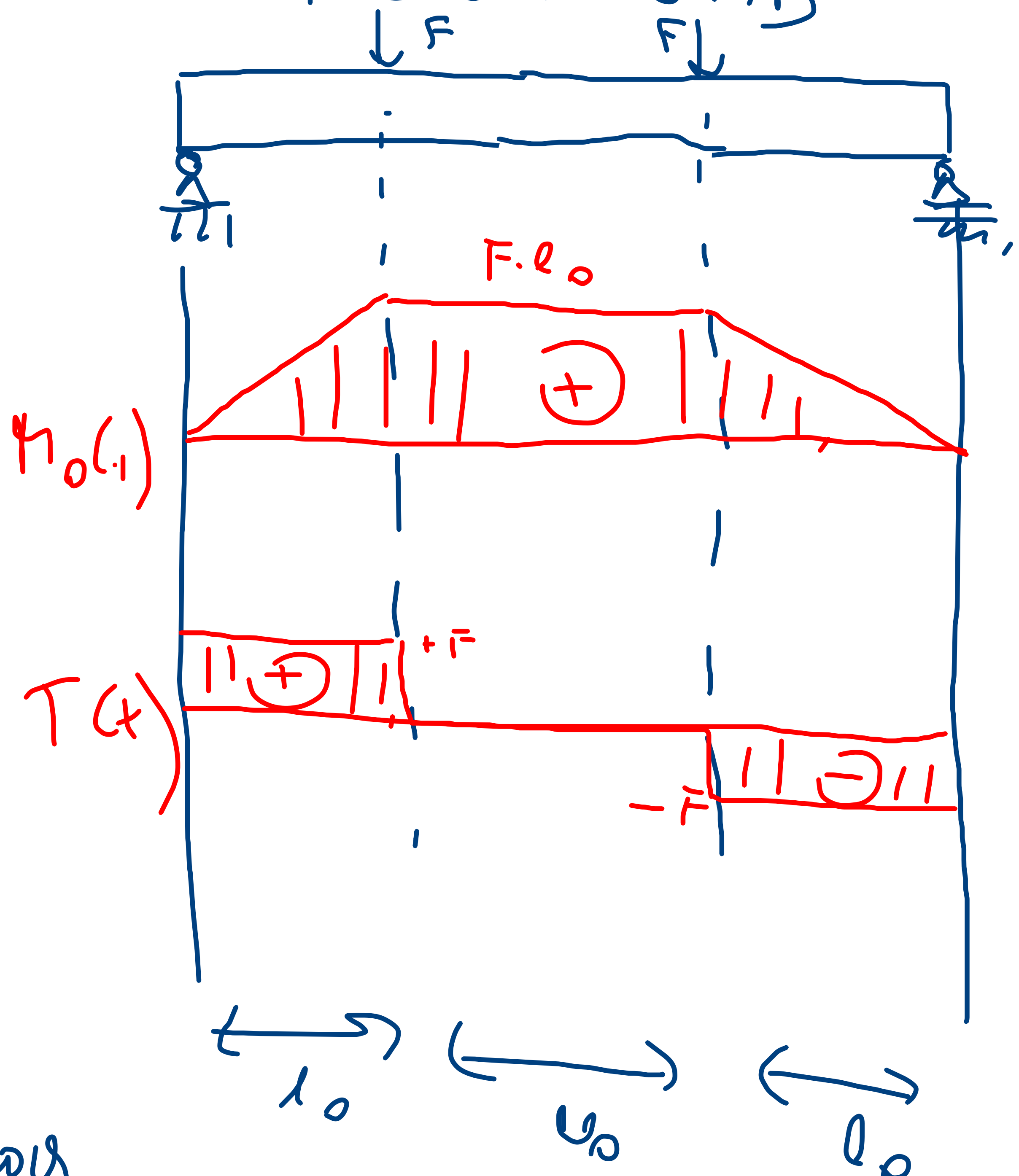
$\rightarrow M_o(x) = F\cdot(L-x)$



3-BODOVÝ OHYB



4 BODOVÝ OHYB



$$\boxed{T(x) = \frac{dM_o(x)}{dx} \qquad q(x) = -\frac{dT(x)}{dx}}$$

SCHWEDLEROVY VĚTY

$\rightarrow T(x) = -\int T(x)\,dx$

$M_o(x) = \int T(x)\,dx$

<u>čistý ohyb</u>

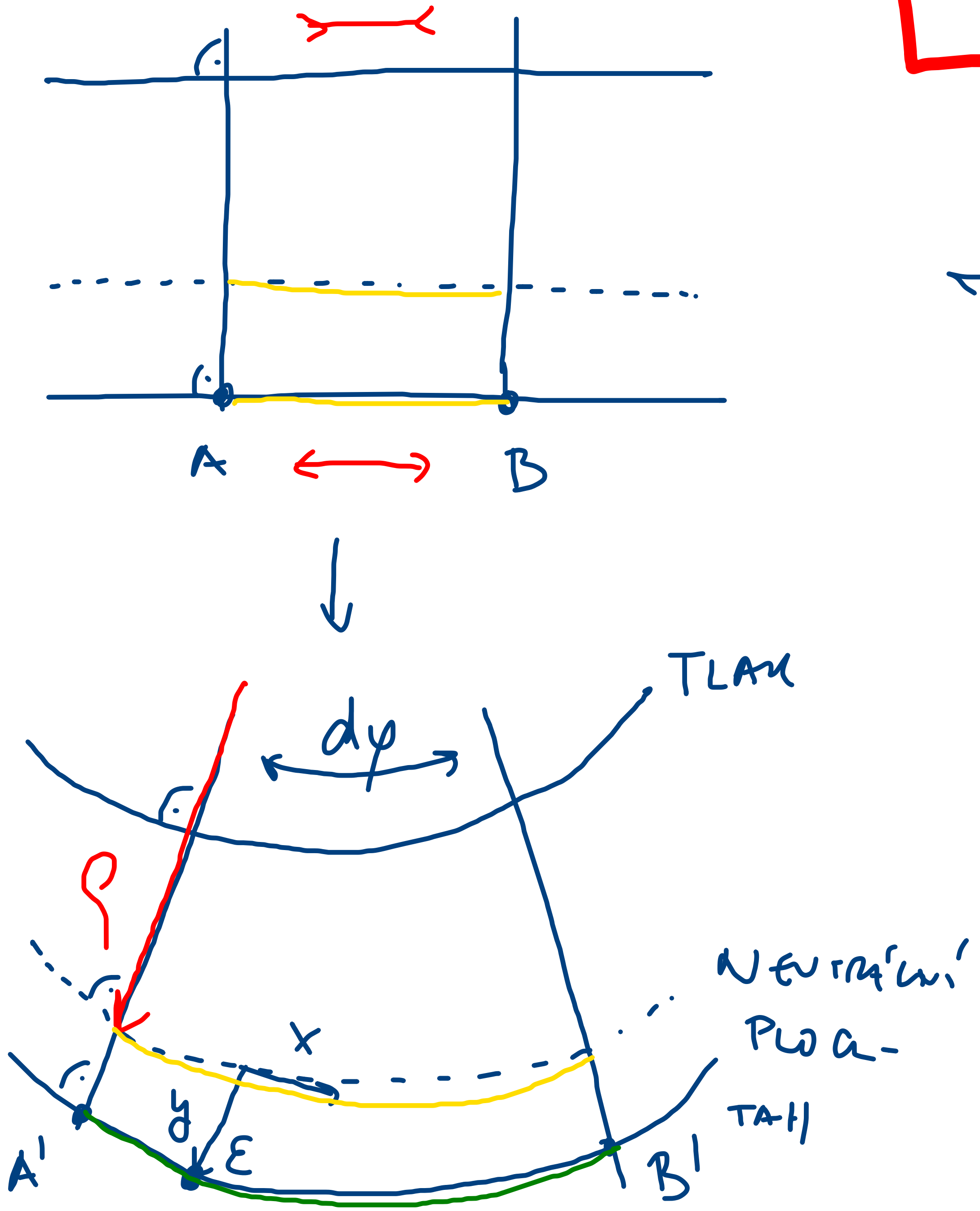
3) NAPĚTÍ A DEFORMACE

$N(x) = 0$

$T(x) = -F$ ... ZANEDBÁME

$\boxed{M_o(x) = F \cdot (L - x)}$

$\varepsilon = \frac{\Delta L}{L}$ .. DEFORMACE
POMĚRNÉ PRODLOUŽENÍ



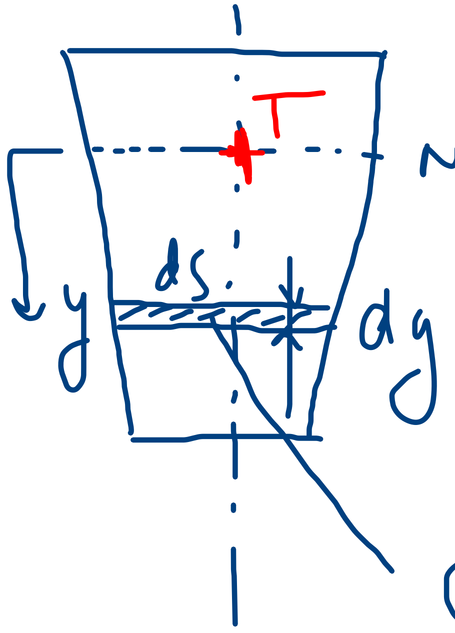
$$\boxed{\varepsilon_x(y) = \frac{|A'B'| - |AB|}{|AB|} = \frac{\cancel{d\varphi}(\rho + y) - \cancel{d\varphi} \cdot \rho}{\cancel{d\varphi} \cdot \rho} = \frac{y}{\rho}}$$

→ HOOKE: $\sigma = E \cdot \varepsilon$

$$\rightarrow \boxed{\sigma_x(y) = E \cdot \frac{y}{\rho}}$$

1) $\rho = ?$

2) SOUŘADNICE NEUTRÁLNÍ PLOCHY



NEUTRÁLNÍ PLOCHA

$$dF = \sigma(y)\,dS = \frac{E}{\rho}\,y\,dS \leftarrow \sigma(y) = \frac{E}{\rho}\cdot y$$

$$\sigma(y) = \frac{E}{\rho}\cdot y$$

$$\int dF = \int \frac{E}{\rho}\,y\,dS$$

$$0 = N(x) = \frac{E}{\rho}\underbrace{\int y\,dS}_{0}$$

$\Rightarrow$ NEUTRÁLNÍ PLOCHA JE V TĚŽIŠTI

$$\underbrace{\int \sigma(y)\cdot y\cdot dS}_{M_o(x)} = \int \frac{E}{\rho}\,y^2\,dS$$

$$M_o(x) = \frac{E}{\rho}\underbrace{\int_S y^2\,dS}_{J_y}$$

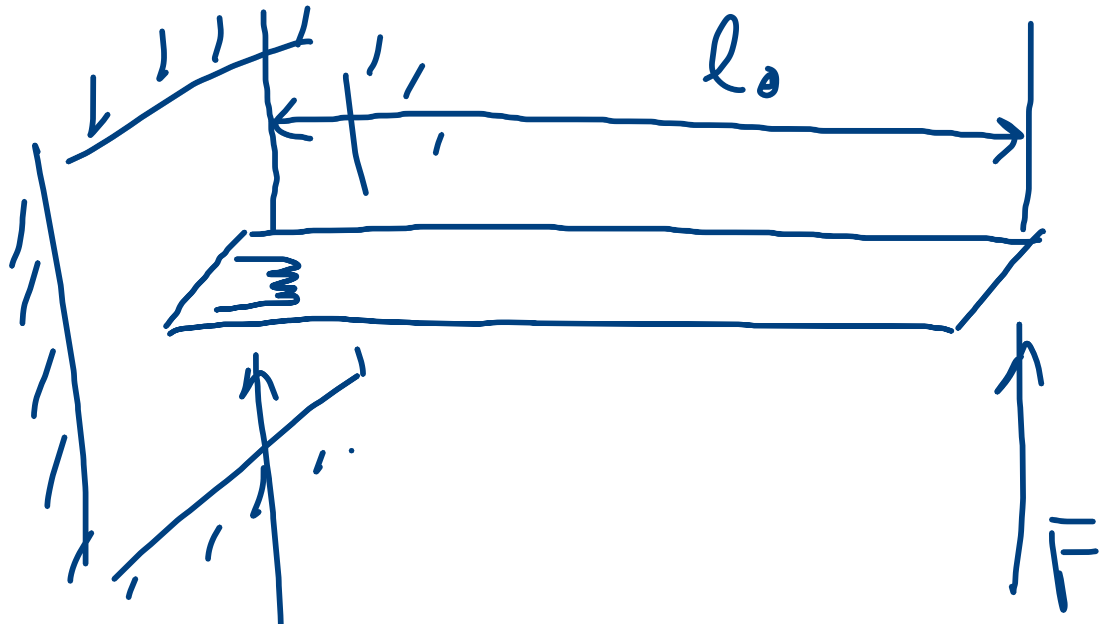
$$M_o(x) = \frac{E}{\rho}\,J_y$$

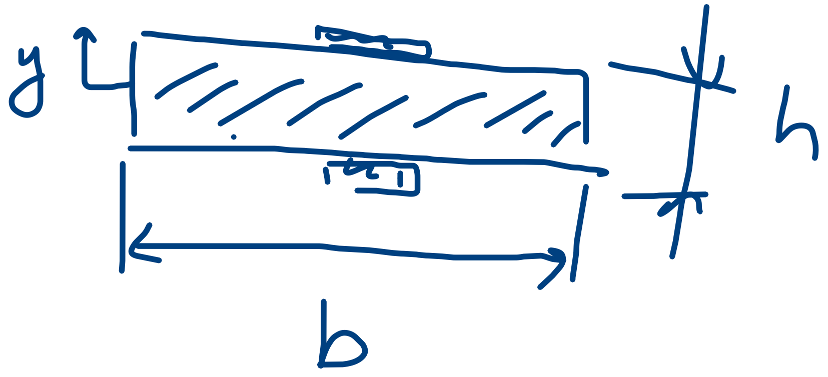
$$\Rightarrow \frac{1}{\rho} = \frac{M_o}{E J_y}$$

$$\boxed{\varepsilon_x(y) = \frac{M_o}{E\cdot J_y}\cdot y}$$

$$\boxed{\sigma_x(y) = \frac{M_o}{J_y}\cdot y}$$

J_y … KVADRATICKÝ MOMENT SETRVAČNOSTI PRŮŘEZU $\quad [J_y] = m^4$





$$\varepsilon = \frac{M_b}{E \cdot J_y} \cdot y$$

$$\downarrow$$

$$y = \pm \frac{h}{2}$$

$$J_y = \frac{1}{12} b h^3$$

$$M_b(x) = F \cdot (l_0 - x)$$

$$\varepsilon = k \cdot F$$

$$\hookrightarrow \frac{\Delta U_G}{U_C} = \frac{k_D}{4}\left(\overset{+\varepsilon}{\varepsilon_1} - \overset{-\varepsilon}{\varepsilon_2}\right) = \frac{k_D}{2} \cdot \varepsilon$$