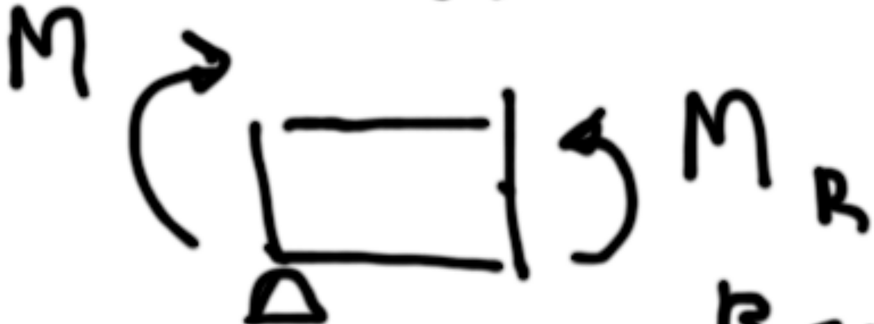
FLEXURE STRESS

FBD



Resisting Moment

from Statics

$$M_R = \int F_y \cdot y$$

internal force

$$= \int \sigma_y \, y \, dA$$

for rect. dA

$$= \int \sigma_y \, y \, b \, dy$$

Sum of moments occur around neutral axis.

$\therefore$ For rectangular section the limits of integration are

$$y = \pm d/2$$

$$M_R = \int_{-d/2}^{d/2} \sigma_y y \cdot b\,dy$$

where $\sigma_y = \sigma_{max} \dfrac{y}{c}$

Then

$$M_R = \int_{-d/2}^{d/2} \frac{\sigma_{max}}{c} y \cdot y \, b \, dy$$

$$= \frac{\sigma_{max}}{c} \int_{-d/2}^{+d/2} y^2 \, b \, dy$$

$$= \frac{\sigma_{max}}{c} \left. \frac{y^3}{3} b \right|_{-d/2}^{+d/2}$$

$$= \frac{\sigma_{max}}{c} \frac{1}{12} b d^3$$

$$= \frac{\sigma_{max}}{c} I_{Rect}$$

$$\therefore \quad \sigma_{max} = \frac{M_R c}{I}$$