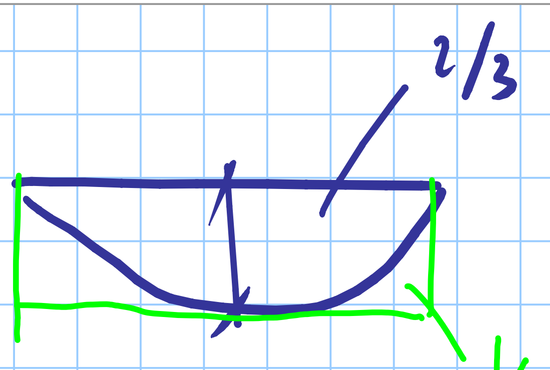
Titolo nota   04/12/2013

metodo A

M

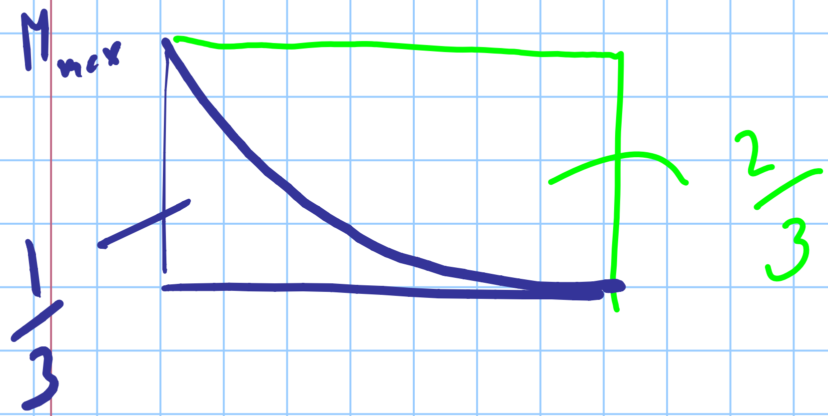


M_{max}

$$M_{eq} = 1.3\ M_m \geq 0.75\ M_{max}$$

$$M_m = \frac{2}{3} M_{max}$$

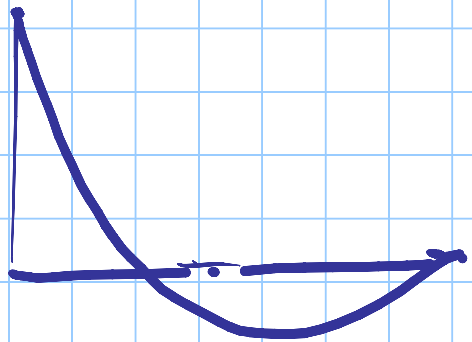
$$M_{eq} = 1.3 \times \frac{2}{3} M_{max} = 0.867\ M_{max}$$



$$M_m = \frac{1}{3} M_{max}$$

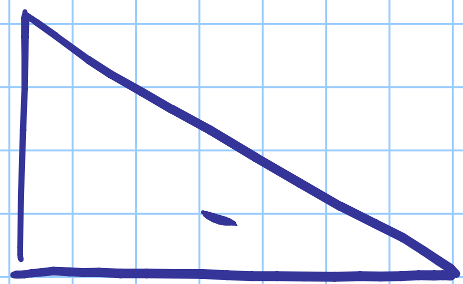
$$M_{eq} = 1.3 \times \frac{1}{3} M_{max} = \overset{0.75}{\cancel{0.433}}\ M_{max} \geq 0.75\ M_{max}$$

$M_{mit} = \frac{ql^2}{8}$



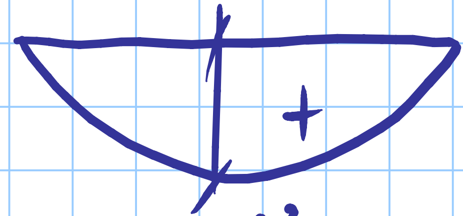
$=$

$\frac{ql^2}{8}$



$\frac{1}{2} \; \frac{ql^2}{8}$

$+$



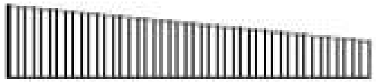
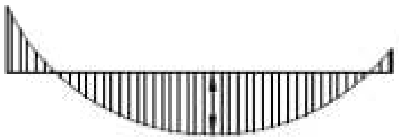
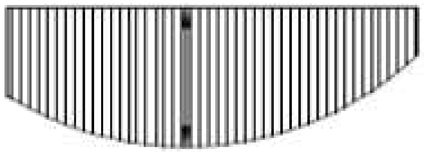
$\frac{ql^2}{8}$

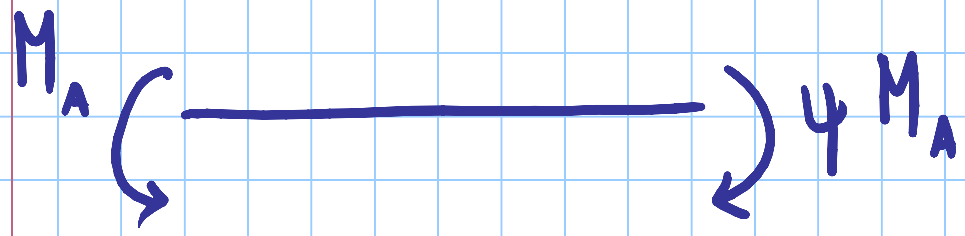
$\frac{2}{3} \; \frac{ql^2}{8}$

$$M_m = \left(\frac{2}{3} - \frac{1}{2} \right) \frac{ql^2}{8} =$$

$$= \frac{1}{6} M_{max}$$

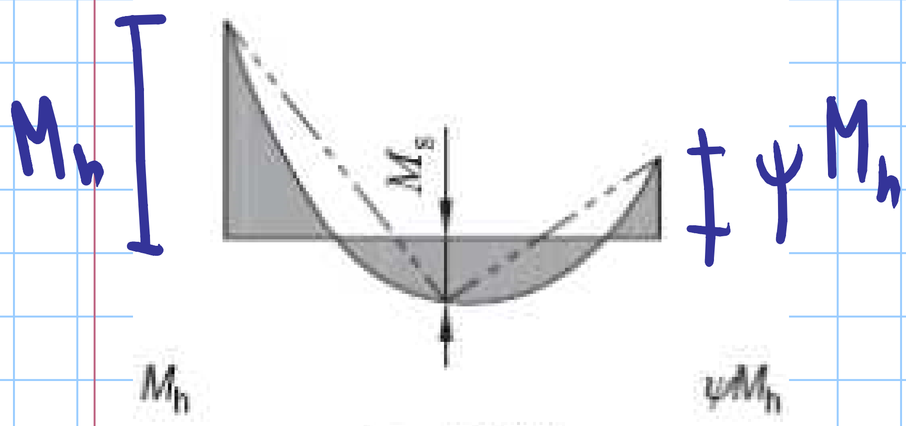
metodo B

Diagramma del momento	Intervallo		Coefficienti α_{my}, α_{mz}, α_{mLT}	
			Carico uniforme	Carico concentrato
 M_h ψM_h	$-1 \le \psi \le 1$		$0,6+0,4\psi \ge 0,4$	
 M_h ψM_h M_s	$0 \le \alpha_s \le 1$	$-1 \le \psi \le 1$	$0,2+0,8\alpha_s \ge 0,4$	$0,2+0,8\alpha_s \ge 0,4$
	$-1 \le \alpha_s < 0$	$0 \le \psi \le 1$	$0,1-0,8\alpha_s \ge 0,4$	$-0,8\alpha_s \ge 0,4$
$\alpha_s = M_s / M_h$		$-1 \le \psi \le 0$	$0,1(1-\psi)-0,8\alpha_s \ge 0,4$	$0,2(-\psi)-0,8\alpha_s \ge 0,4$
 M_h ψM_h M_s	$0 \le \alpha_h \le 1$	$-1 \le \psi \le 1$	$0,95+0,05\alpha_h$	$0,90+0,10\alpha_h$
	$-1 \le \alpha_h < 0$	$0 \le \psi \le 1$	$0,95+0,05\alpha_h$	$0,90+0,10\alpha_h$
$\alpha_h = M_h / M_s$		$-1 \le \psi \le 0$	$0,95+0,05\alpha_h(1+2\psi)$	$0,90+0,10\alpha_h(1+2\psi)$

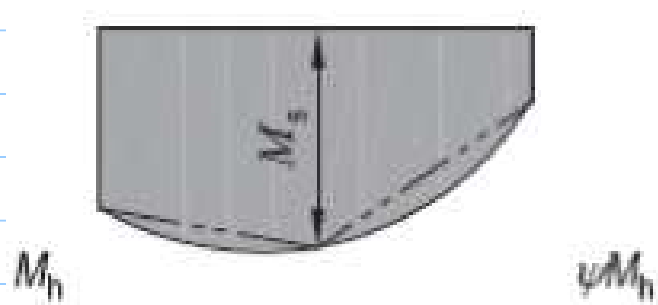


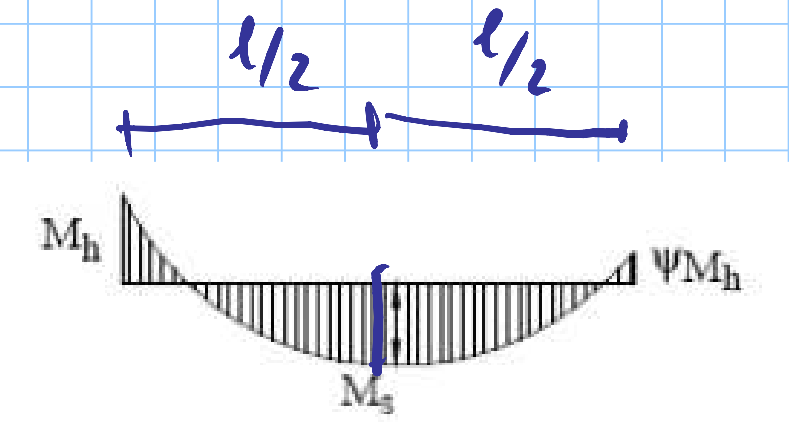
$-1 \le \psi \le 1$

$\alpha_m = 0.6 + 0.4\,\psi \ \ge 0.4$

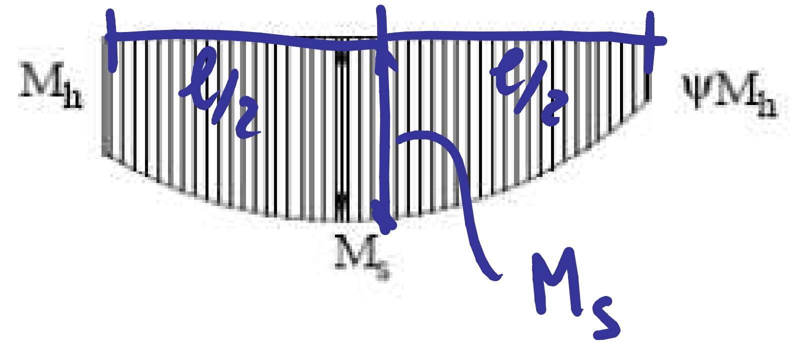


$\alpha_s = M_s/M_h$





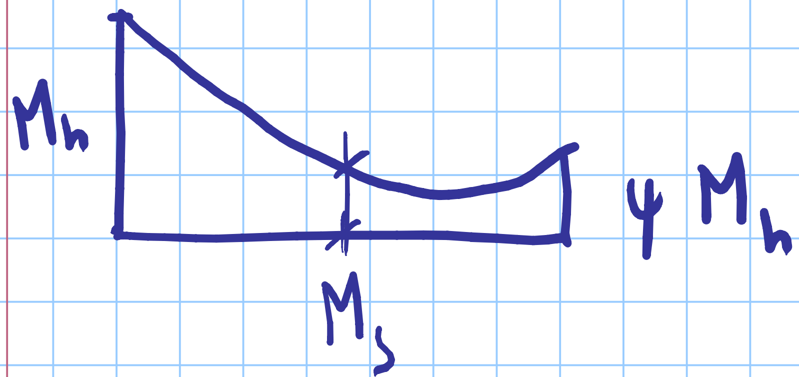
$\alpha_s = M_s/M_h$



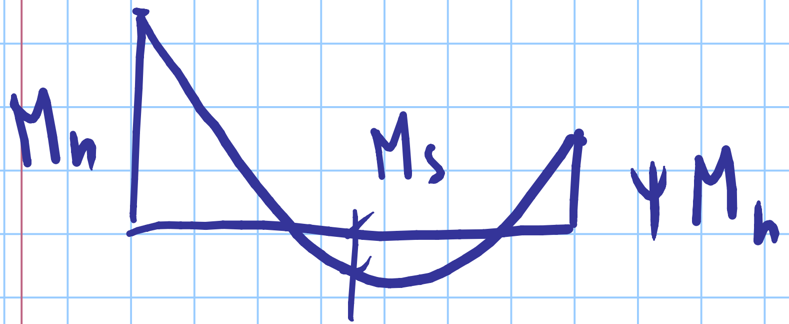
$\alpha_h = M_h/M_s$

M_s in mezzeria

$|M_h| > |M_s|$ $\qquad$ $\alpha_s = \dfrac{M_s}{M_h}$ col segno



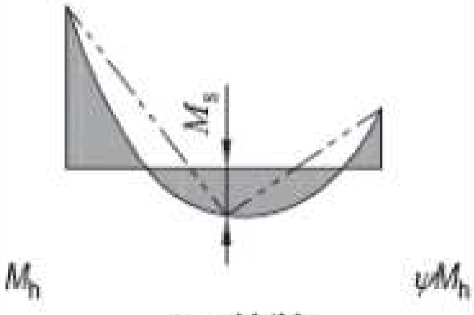
$-1 \leq \psi \leq 1$ $\qquad$ $\alpha_s > 0$



$\alpha_s < 0$

$$|M_h| > |M_s|$$

CARICO

			UNIFORME	CONCENTR.
 $\alpha_s = M_s/M_h$	$0 \le \alpha_s \le 1$	$-1 \le \psi \le 1$	$0{,}2 + 0{,}8\,\alpha_s \ge 0{,}4$	$0{,}2 + 0{,}8\,\alpha_s \ge 0{,}4$
	$-1 \le \alpha_s < 0$	$0 \le \psi \le 1$	$0{,}1 - 0{,}8\,\alpha_s \ge 0{,}4$	$-\,0{,}8\,\alpha_s \ge 0{,}4$
		$-1 \le \psi < 0$	$0{,}1(1-\psi) - 0{,}8\,\alpha_s \ge 0{,}4$	$0{,}2\,(-\psi) - 0{,}8\,\alpha_s \ge 0{,}4$

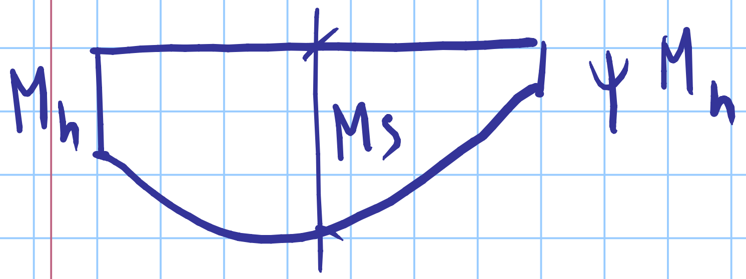
$\alpha_s > 0$

$\alpha_s < 0$

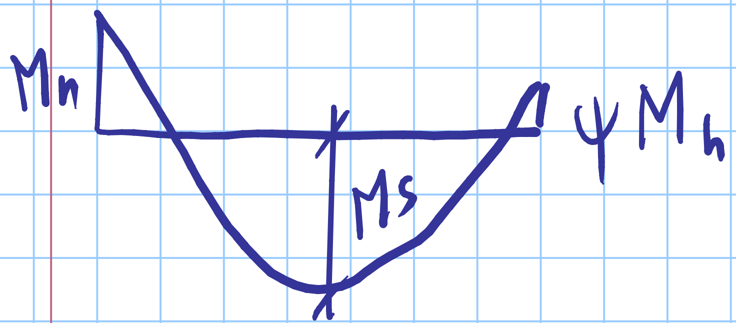
$$\alpha_s = \frac{M_s}{M_h}$$

$$|M_s| > |M_h|$$

$$\alpha_h = \frac{M_h}{M_s}$$ col segno

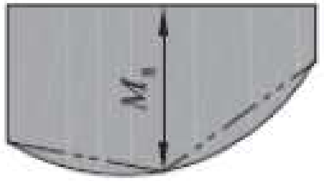


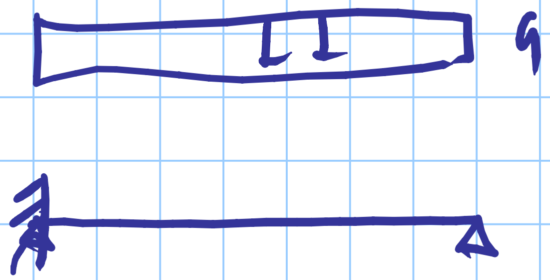
$\alpha_h > 0$



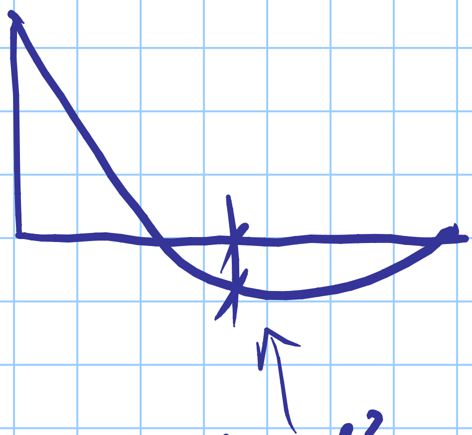
$\alpha_h < 0$

CARICO

			UNIFORME	CONCENTR.
 M_h ψM_h $\alpha_s = M_s/M_h$	$0 \le \alpha_h \le 1$	$-1 \le \psi \le 1$	$0{,}95 + 0{,}05\ \alpha_h$	$0{,}90 + 0{,}10\ \alpha_h$
	$-1 \le \alpha_h < 0$	$0 \le \psi \le 1$	$0{,}95 + 0{,}05\ \alpha_h$	$0{,}90 + 0{,}10\ \alpha_h$
		$-1 \le \psi < 0$	$0{,}95 + 0{,}05\ \alpha_h\,(1 + 2\ \psi)$	$0{,}90 + 0{,}10\ \alpha_h\,(1 + 2\ \psi)$

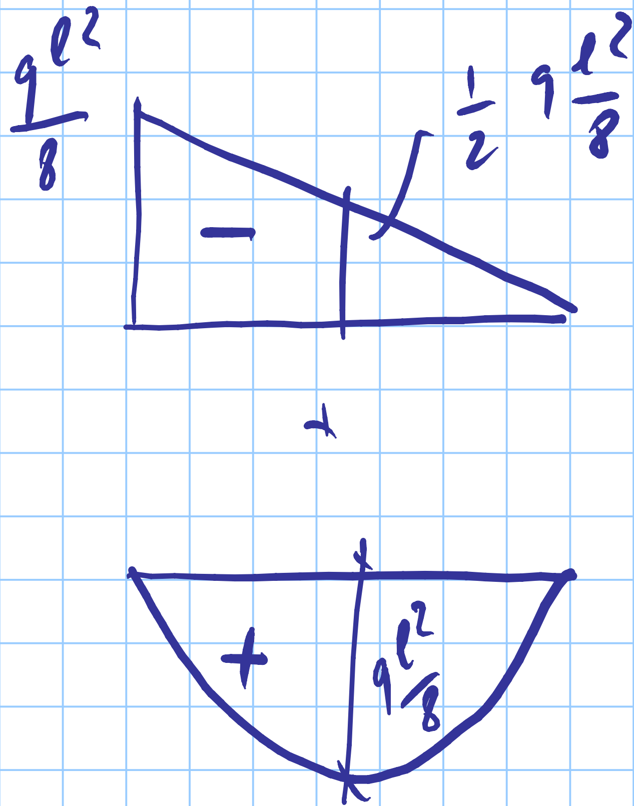


$M_h = \frac{ql^2}{8}$

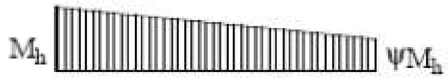
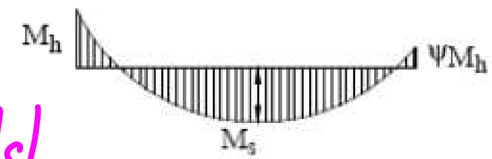
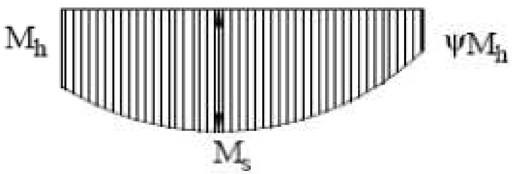


$M_s = \frac{1}{2}\,\frac{ql^2}{8}$

=



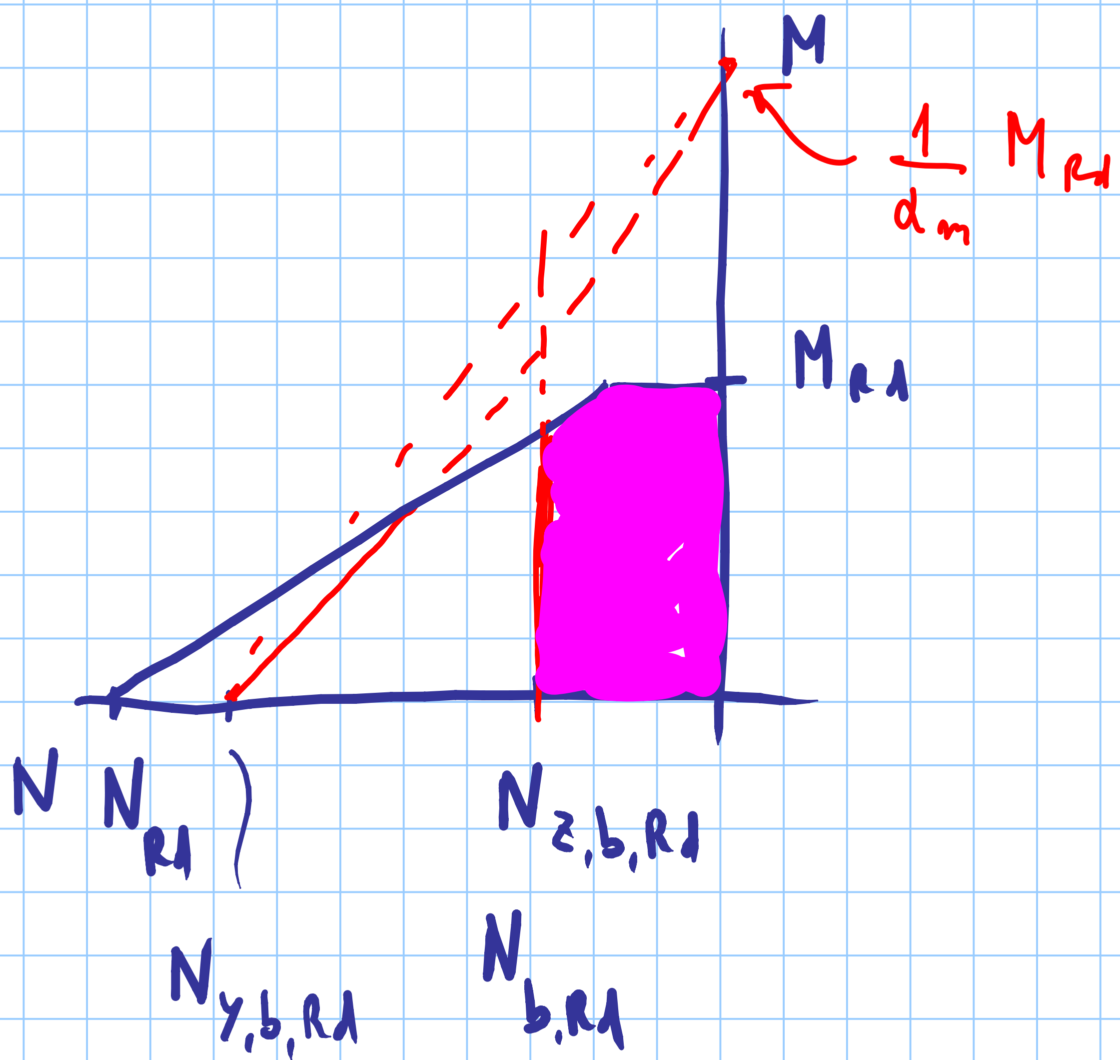
$|M_h| > |M_s|$ $\qquad \alpha_s = -0{,}5$ $\qquad \psi = 0$

Diagramma del momento	Intervallo		Coefficienti α_{my}, α_{mz}, α_{mLT}	
			Carico uniforme	Carico concentrato
	$-1 \le \psi \le 1$		$0,6+0,4\psi \ge 0,4$	
	$0 \le \alpha_s \le 1$	$-1 \le \psi \le 1$	$0,2+0,8\alpha_s \ge 0,4$	$0,2+0,8\alpha_s \ge 0,4$
	$-1 \le \alpha_s < 0$	$0 \le \psi \le 1$	$0,1-0,8\alpha_s \ge 0,4$	$-0,8\alpha_s \ge 0,4$
$\alpha_s = M_s/M_h$		$-1 \le \psi \le 0$	$0,1(1-\psi)-0,8\alpha_s \ge 0,4$	$0,2(-\psi)-0,8\alpha_s \ge 0,4$
	$0 \le \alpha_h \le 1$	$-1 \le \psi \le 1$	$0,95+0,05\alpha_h$	$0,90+0,10\alpha_h$
	$-1 \le \alpha_h < 0$	$0 \le \psi \le 1$	$0,95+0,05\alpha_h$	$0,90+0,10\alpha_h$
$\alpha_h = M_h/M_s$		$-1 \le \psi \le 0$	$0,95+0,05\alpha_h(1+2\psi)$	$0,90+0,10\alpha_h(1+2\psi)$

$|M_h| > |M_s|$

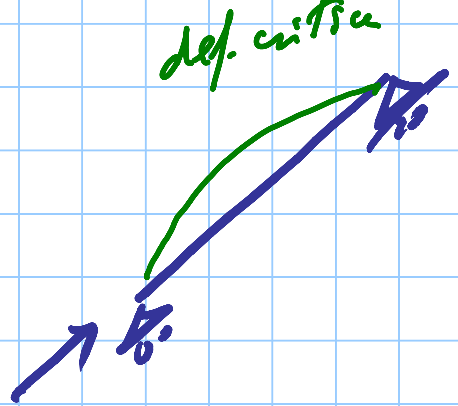
$0.1 - 0.8\alpha_s \ge 0.4$

$0.1 - 0.8 \times (-0.5) = 0.5$

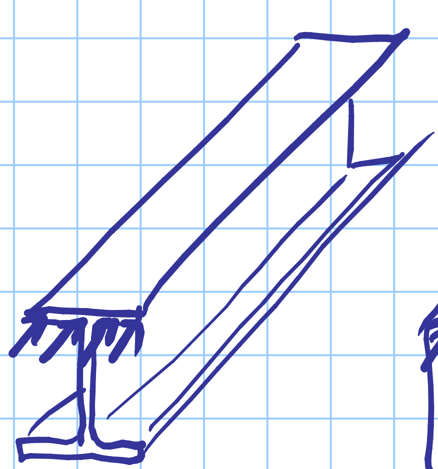


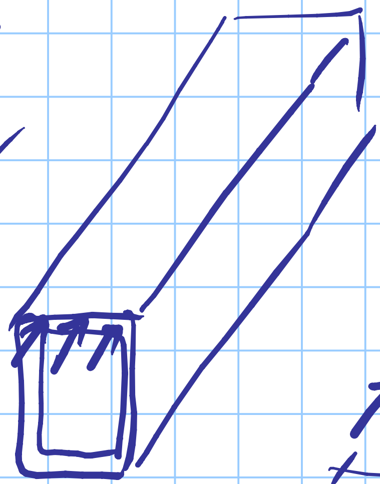
M
$\frac{1}{\alpha_m} M_{Rd}$
M_{Rd}
N
N_{Rd}
$N_{z,b,Rd}$
$N_{y,b,Rd}$
$N_{b,Rd}$

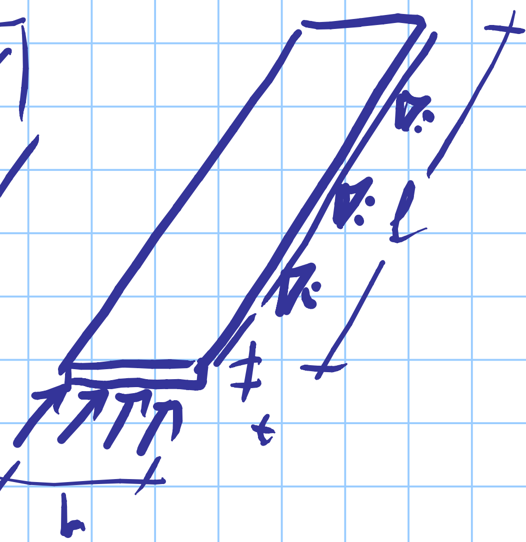
INSTABILITÀ LOCALE



ASTA

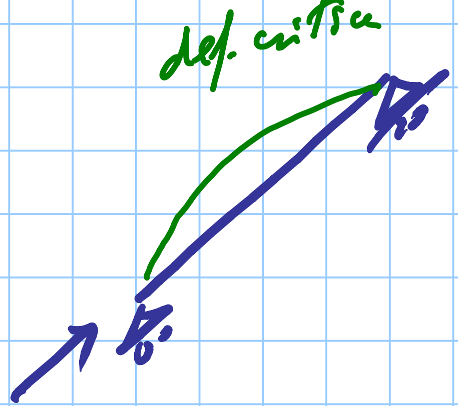




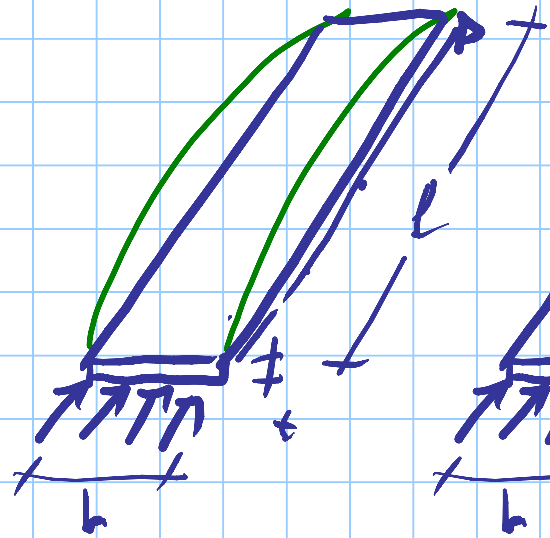


LASTRA

$t \ll b \ll l$

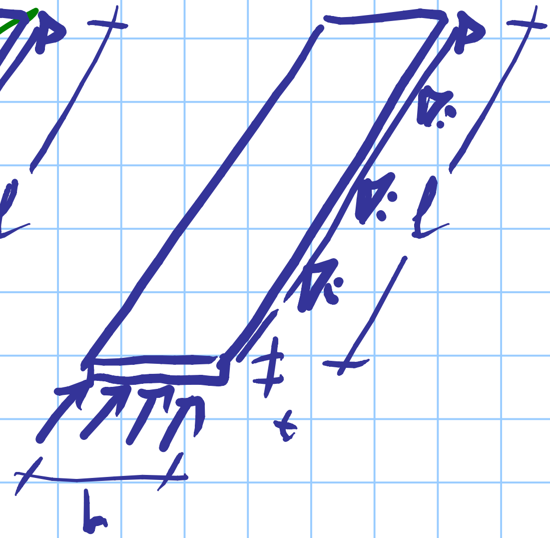


ASTA

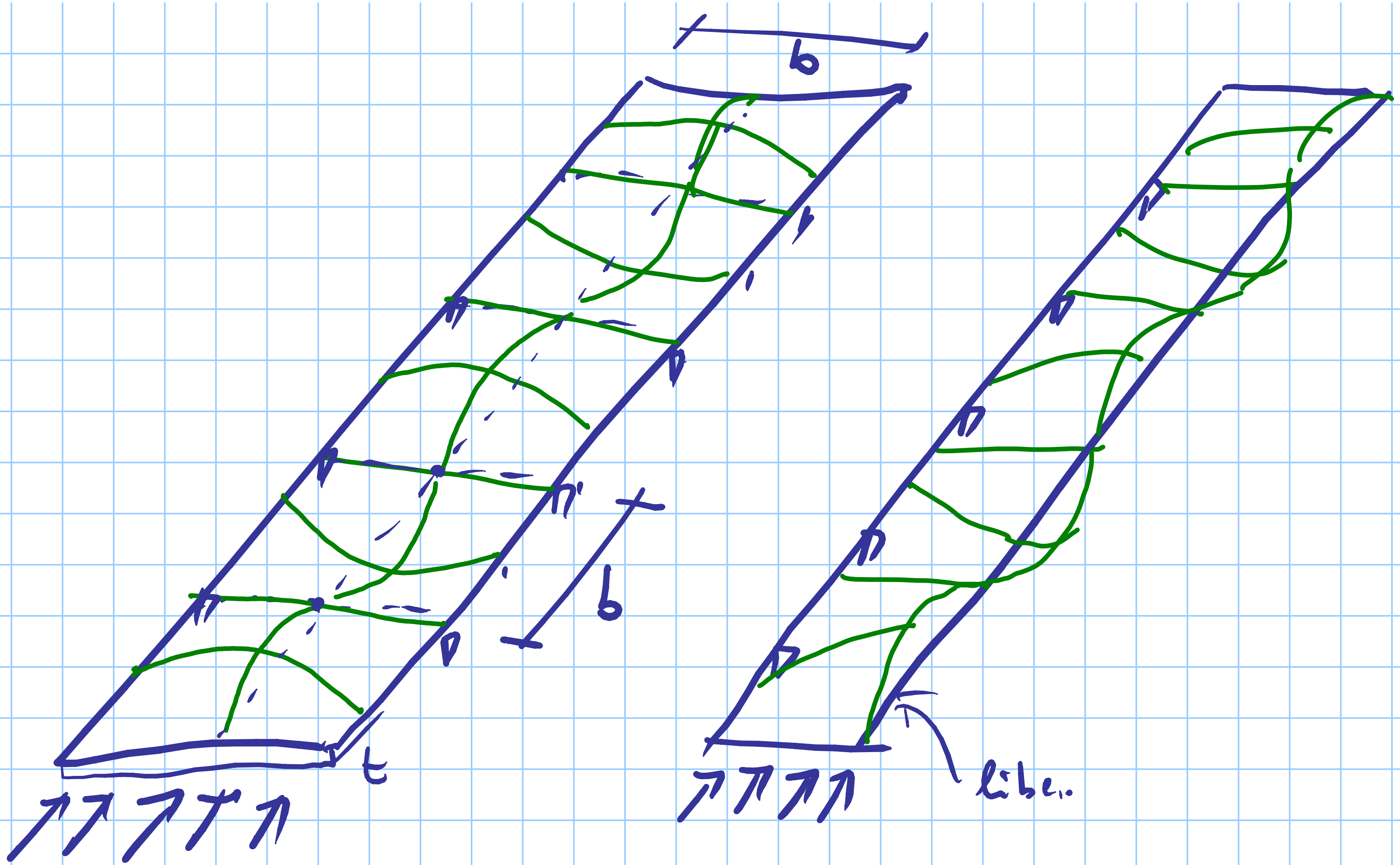


LASTRA

senza vincoli longit.



LASTRA



$N = \int \sigma \, dA$

ASTA

$$N_{cr} = \frac{\pi^2 E I}{l_0^2}$$

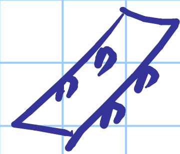
$$\sigma_{cr} = \frac{\pi^2 E}{\lambda^2}$$

$$\lambda = \frac{l_0}{i}$$

LASTRA

$k = 4$

pm



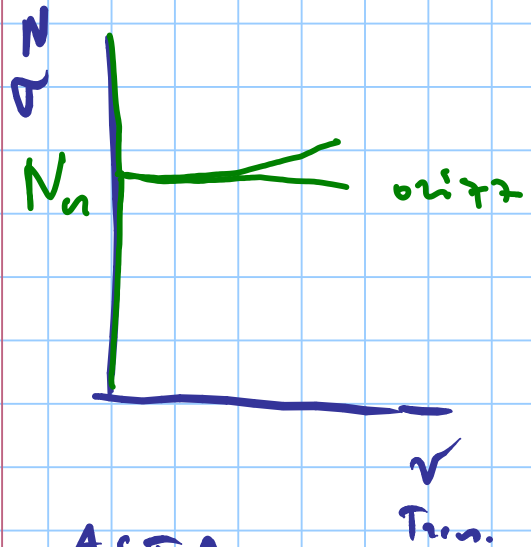
$$N_{cr} = \frac{k \pi^2 E I}{(1-\nu^2) b^2}$$

$k = 0.43$

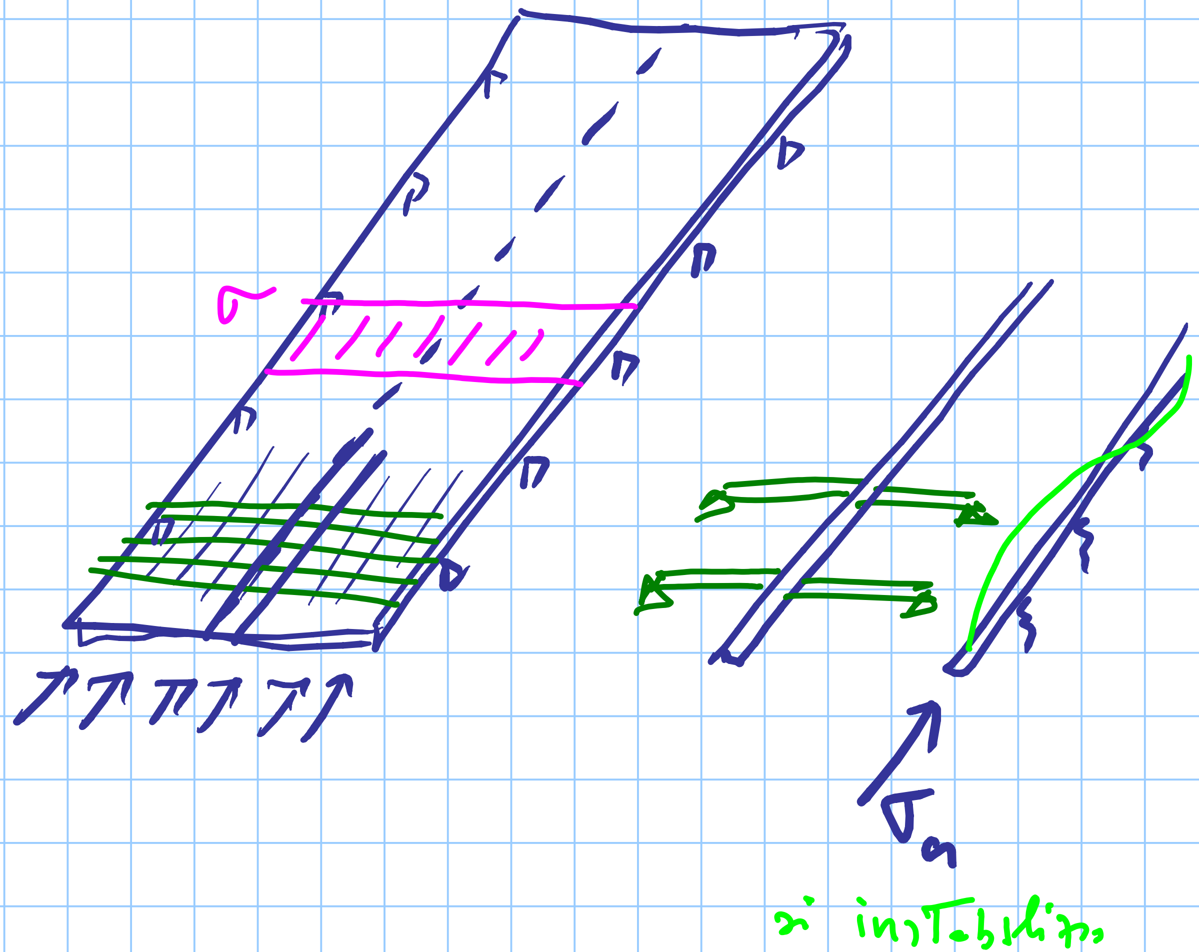
$$\sigma_{cr} = \frac{k \pi^2 E}{12(1-\nu^2)\left(\frac{b}{t}\right)^2}$$

$$I = \frac{b t^3}{12} \qquad A = bt \qquad \frac{I}{A} = \frac{t^2}{12}$$

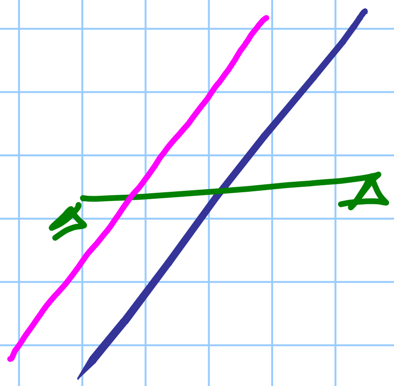
COMPORTAMENTO POST CRITICO



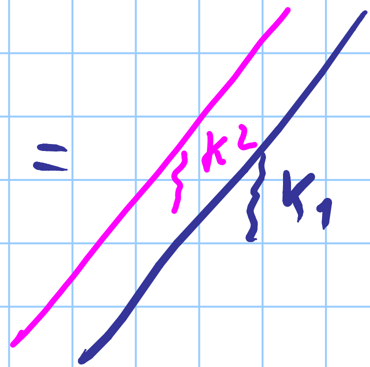
ASTA

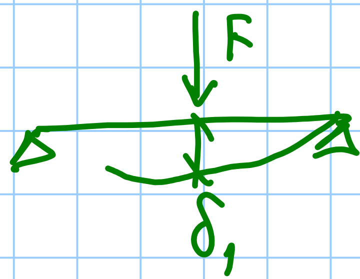


$$\text{RIGIDEZZA} = \frac{\text{AZIONE}}{\text{COMP. DI MOVIMENTO}}$$

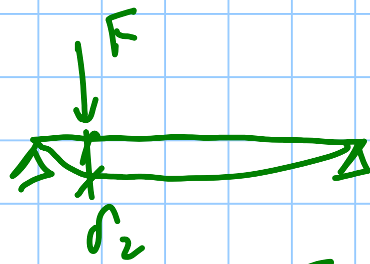


=

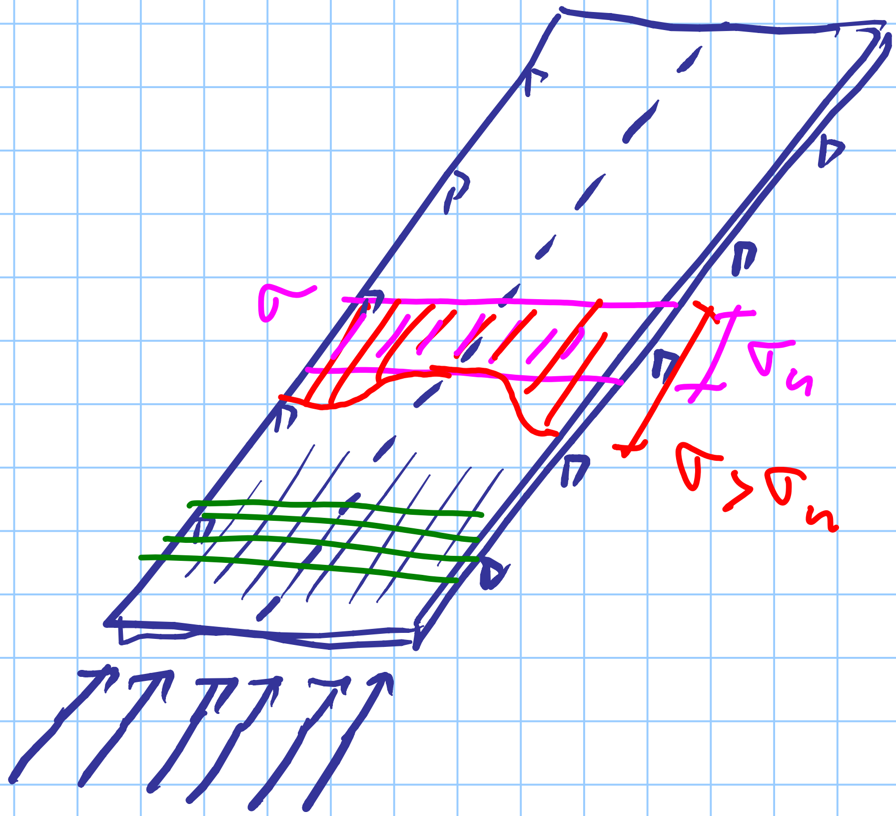




$$K_1 = \frac{F}{\delta_1}$$

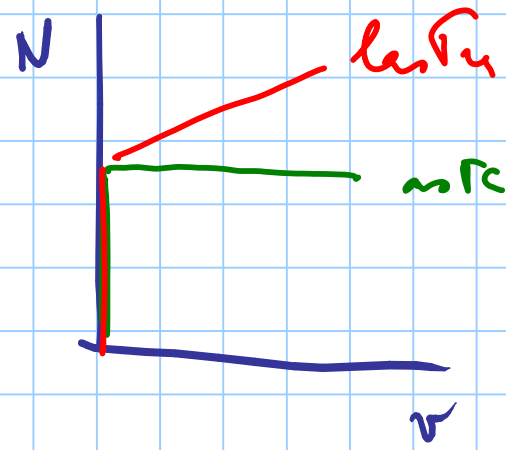


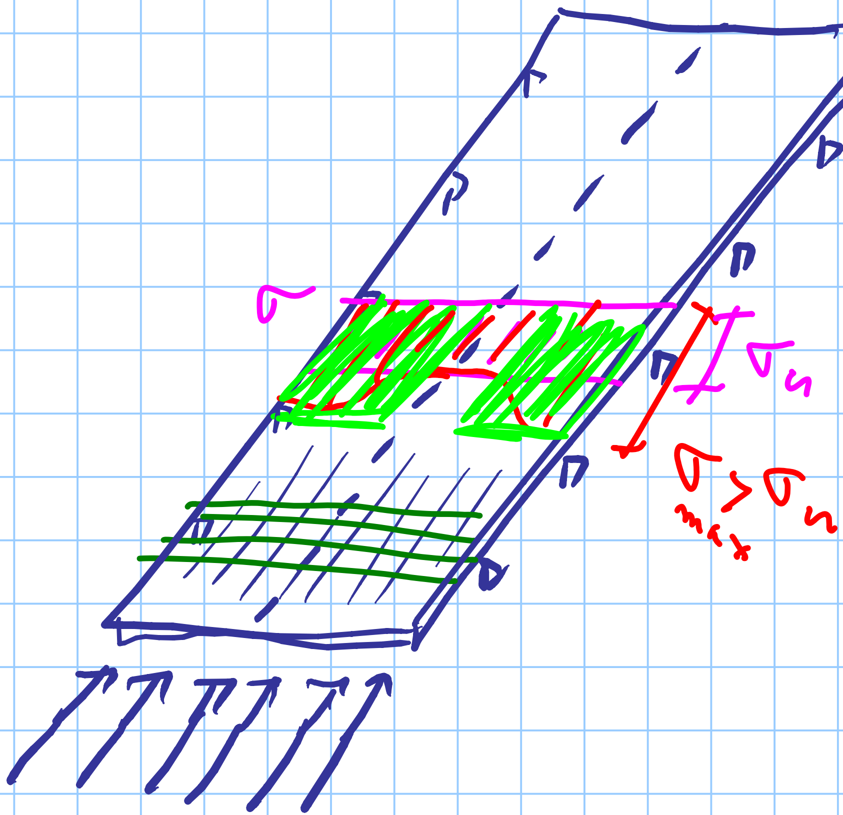
$$K_2 = \frac{F}{\delta_2}$$



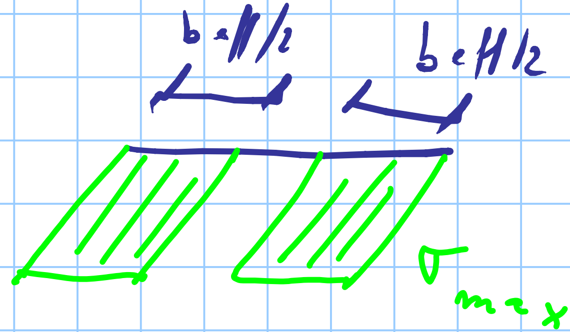
POST-CRITICO

$\sigma > \sigma_u$





VON KARMAN



b_{eff}

larghezza efficace

(EFFECTIVE)

$$\sigma_{cr} = \frac{K \pi^2 E}{12(1-\nu^2)\left(\frac{b}{t}\right)^2}$$

IN CAMPO ELASTICO

fino alla instabilità

$$\sigma_{max} > \sigma_{cr}$$

f_y

$$\sigma_{max} = \frac{K \pi^2 E}{12(1-\nu^2)\left(\frac{b_{eff}}{t}\right)^2}$$

f_y

POST-CRITICO

fino a f_y

$$\bar{\lambda}_p = \sqrt{\frac{f_y}{\sigma_{cr}}} = \frac{b}{b_{eff}}$$

PLATE = lastra

$$\sigma_{cr} = \frac{k\,\pi^2\,E}{12(1-\nu^2)\left(\frac{b}{t}\right)^2} \qquad\qquad \varepsilon = \sqrt{\frac{235}{f_y}}$$

$$\bar{\lambda}_p = \sqrt{\frac{f_y}{\sigma_{cr}}} = \sqrt{\frac{f_y\;12\,(1-\nu^2)\left(b/t\right)^2}{k\,\pi^2 E}} =$$

$$= \frac{b/t}{\sqrt{k}}\;\frac{1}{\sqrt{\dfrac{\pi^2\,E\;235}{12\,(1-\nu^2)\,f_y\;235}}} = \frac{b/t}{\varepsilon\,\sqrt{k}}\;\frac{1}{\sqrt{\dfrac{\pi^2\,E}{12\,(1-\nu^2)\,235}}}$$

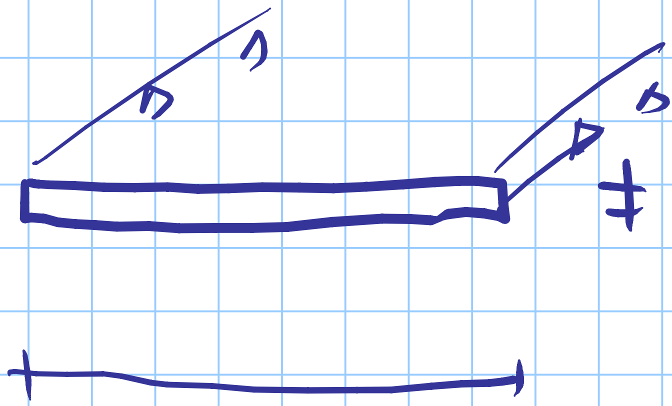
28.4

$$\bar{\lambda}_p = \frac{b/t}{28.4\ \varepsilon \sqrt{k}}$$

$\varepsilon = 1$ pour S235

$\varepsilon = 0.924$ pour S275

$\varepsilon = 0.814$ pour S355



$t = 8$ mm

S 275

$k = 4$

$b = 400$ mm

$\frac{b}{t} = 50$

$$\sigma_a = \frac{k\,\pi^2 E}{12(1-\nu^2)\left(\frac{b}{t}\right)^2} = \frac{4 \times 3.14^2 \times 210000}{12(1-0.3^2) \times 50^2} = 303.7 \text{ MPa}$$

$$\bar{\lambda}_p = \sqrt{\frac{f_y}{\sigma_a}} = \sqrt{\frac{275}{303.7}} = 0.952$$

$$\bar{\lambda}_p = \frac{b/t}{28.4\,\varepsilon\sqrt{k}} = \frac{50}{28.4 \times 0.924 \times 2} = 0.952$$

per lastra perfetta

$$\bar{\lambda}_p = \frac{b}{b_{eff}}$$

$$b_{eff} = b \cdot \frac{1}{\bar{\lambda}_p} > b$$

tutta efficace

$$b_{eff} = b \, \frac{\bar{\lambda}_p - 0.22}{\bar{\lambda}_p^2}$$ con imperfezioni

$$b_{eff} = b \, \frac{0.952 - 0.22}{0.952^2} = 0.808 \, b = 323 \text{ mm}$$

$$N_{Rd} = b_{eff} \, t \, \frac{f_y}{\gamma_{M0}} = 677 \text{ KN}$$

se non ci fosse inst. loc. $400 \times 8 \times \frac{275}{1.05} = 838$ KN se invece $b = 800$ mm $\quad \frac{b}{t} = 100$

$$\bar{\lambda}_p = \frac{100}{28.4\,\varepsilon\sqrt{k}} = 1.904$$

perfetta $\quad b_{eff} = b\,\frac{1}{\bar{\lambda}_p} = 0.525\ b$

imperf. $\quad b_{eff} = b\,\frac{\bar{\lambda}_p - 0.22}{\bar{\lambda}_p^2} = \frac{1.904 - 0.22}{1.904^2} = 0.465\,b$

x inveca $b = 160$ mm $\frac{b}{2} = 20$

$\bar{\lambda}_p = 0.381$

$$\frac{0.381 - 0.22}{0.381^2} = 1.109 > 1 \qquad b_{eff} = b$$