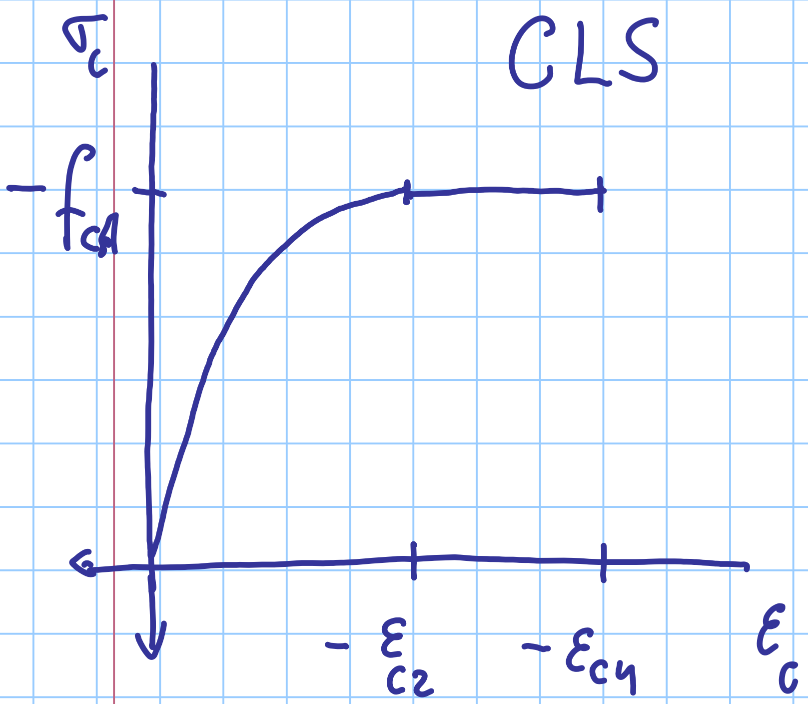
FLESSIONE – 3° MODELLO DI COMPORTAMENTO

Titolo nota — 14/04/2015

CLS



$\eta = 0$ 1 $7/4$

-2×10^{-3} -3.5×10^{-3}

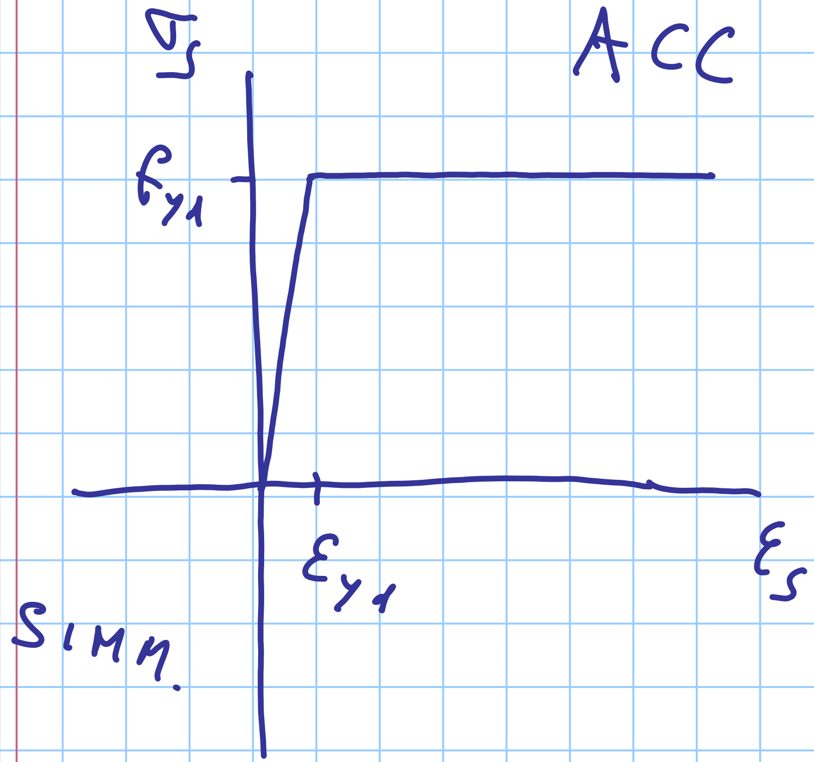
$$\eta = -\frac{\varepsilon_c}{\varepsilon_{c2}}$$

$$0 \leq \eta \leq 1 \qquad -\varepsilon_{c2} \leq \varepsilon_c \leq 0$$

$$\sigma_c = -\eta(2-\eta)\, f_{cd}$$

$$1 < \eta < \frac{7}{4}$$

$$\sigma_c = -f_{cd}$$

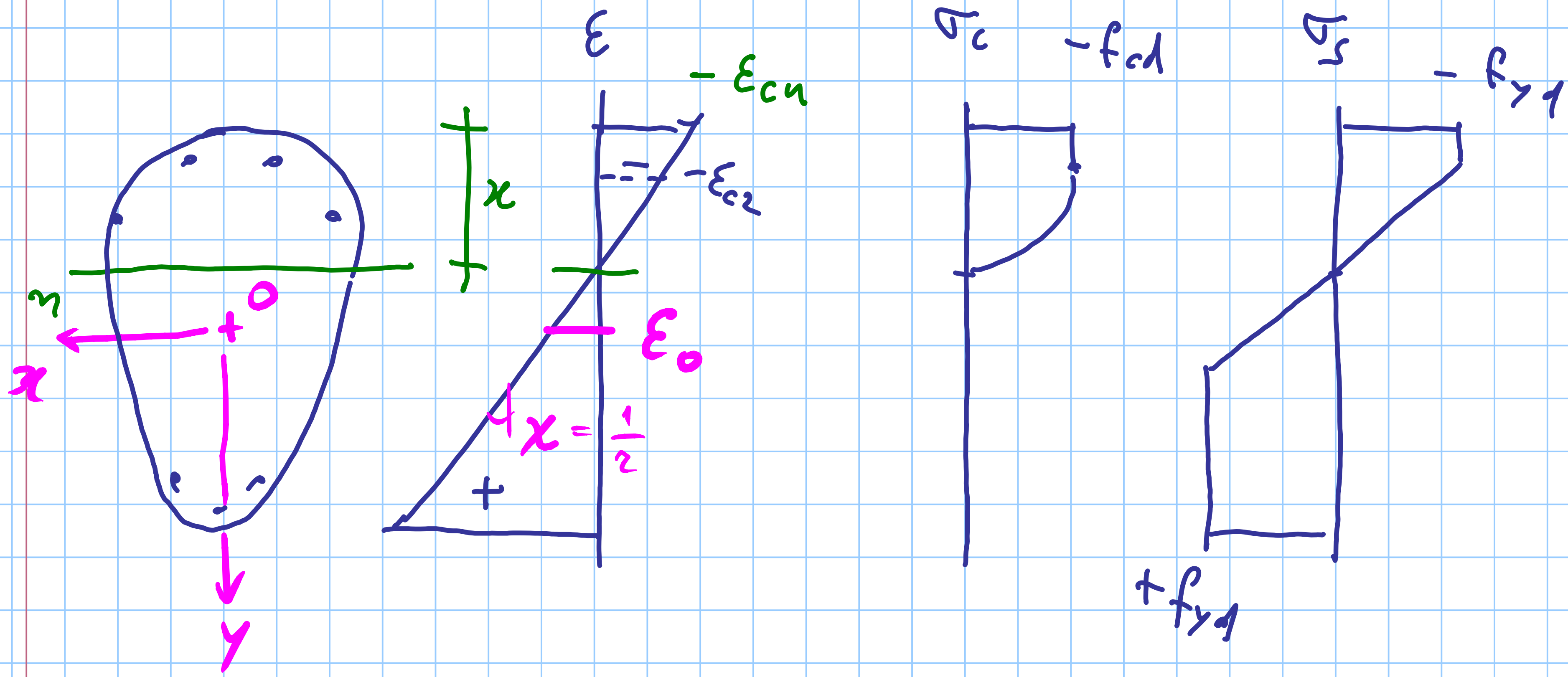


$$-\varepsilon_{yd} \le \varepsilon_s \le +\varepsilon_{yd}$$

$$\sigma_s = E\,\varepsilon_s$$

$$\varepsilon_s > \varepsilon_{yd} \qquad \sigma_s = f_{yd}$$

$$\varepsilon_s < -\varepsilon_{yd} \qquad \sigma_s = -f_{yd}$$



$$\varepsilon_s = \varepsilon_c = \varepsilon_0 + \chi y$$

$$\eta = -\frac{\varepsilon_c}{\varepsilon_{c2}} = -\frac{\varepsilon_0 + \chi y}{\varepsilon_{c2}}$$

$$\sigma_c = -\eta(2-\eta)\, f_{cd}$$

$$\sigma_c = \frac{\varepsilon_0 + \chi y}{\varepsilon_{c2}} \left(2 + \frac{\varepsilon_0 + \chi y}{\varepsilon_{c2}} \right) f_{cd} =$$

$$= \left(\frac{\varepsilon_0}{\varepsilon_{c2}} + \frac{\chi}{\varepsilon_{c2}}\, y \right) \left(2 + \frac{\varepsilon_0}{\varepsilon_{c2}} + \frac{\chi}{\varepsilon_{c2}}\, y \right) f_{cd} =$$

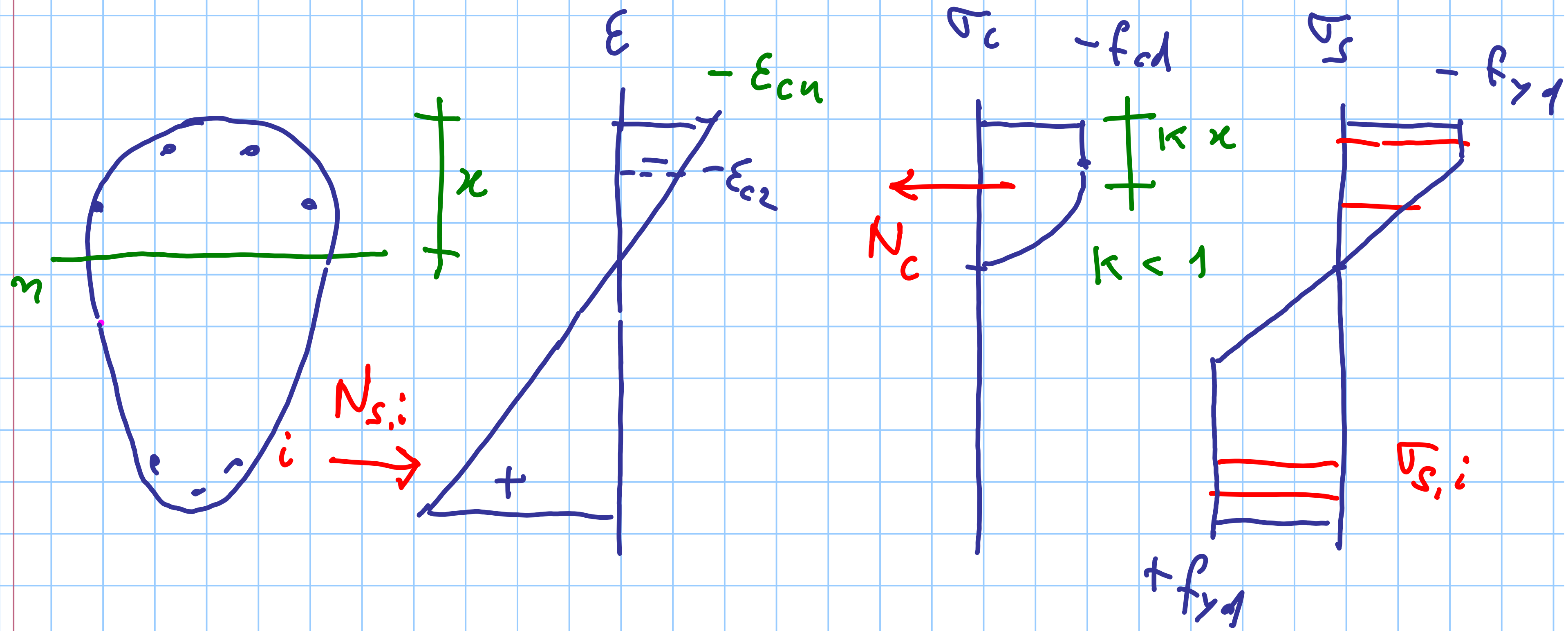
$$= \left[\frac{\varepsilon_0}{\varepsilon_{c2}} \left(2 + \frac{\varepsilon_0}{\varepsilon_{c2}} \right) + 2\frac{\chi}{\varepsilon_{c2}} \left(1 + \frac{\varepsilon_0}{\varepsilon_{c2}} \right) y + \frac{\chi^2}{\varepsilon_{c2}^2}\, y^2 \right] f_{cd}$$

$$\sigma_c = -\left(t_0 + t_1 y + t_2 y^2\right) f_{cd}$$

$$t_0 = -\frac{\varepsilon_0}{\varepsilon_{c2}}\left(2 + \frac{\varepsilon_0}{\varepsilon_{c2}}\right)$$

$$t_1 = -2\frac{\chi}{\varepsilon_{c2}}\left(1 + \frac{\varepsilon_0}{\varepsilon_{c2}}\right)$$

$$t_2 = -\frac{\chi^2}{\varepsilon_{c2}^2}$$



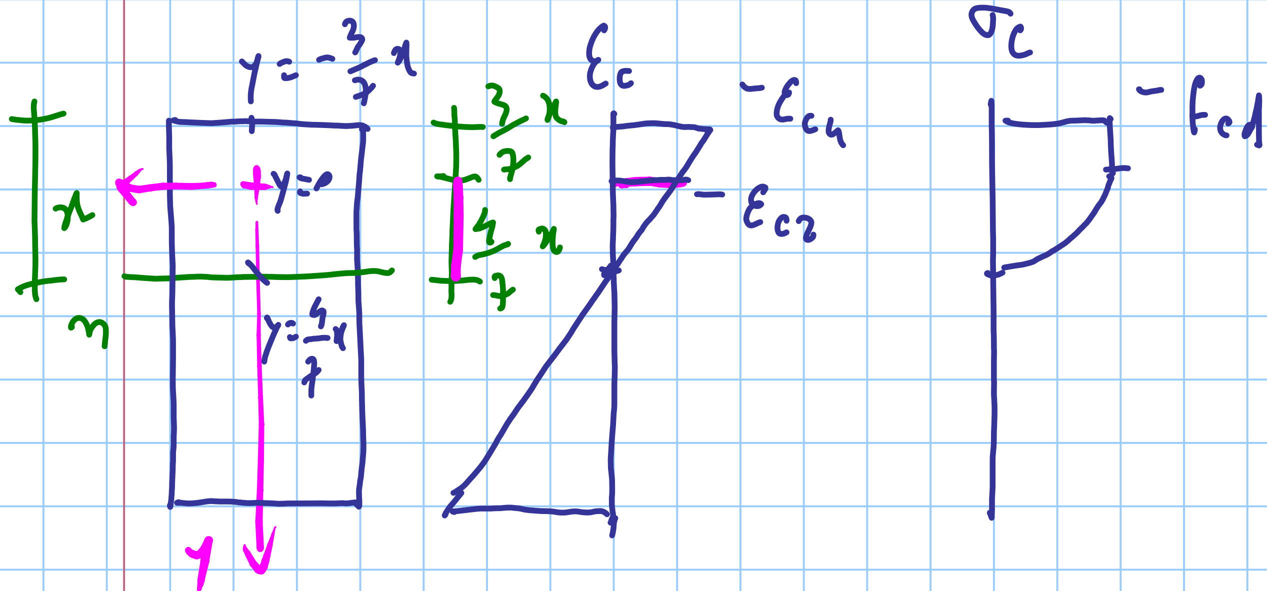
$$N = \int \sigma \, dA$$

$$N_{s,i} = A_{s,i} \cdot \sigma_{s,i}$$

$$M = \int \sigma \, y \, dA$$

$$N_c = \int \sigma_c \, dA_c$$

$$N_c = -\beta\, A_{c,compr}\, f_{cd} \qquad \beta \le 1$$



$b = cost$

$$\varepsilon_0 = -\varepsilon_{c2}$$

$$x = \frac{\varepsilon_{c2}}{\frac{4}{7}x}$$

$$t_0 = -\frac{\varepsilon_0}{\varepsilon_{c2}}\left(2+\frac{\varepsilon_0}{\varepsilon_{c2}}\right) = 1$$

$$t_1 = -2\,\frac{\chi}{\varepsilon_{c2}}\left(1+\frac{\varepsilon_0}{\varepsilon_{c2}}\right) = 0$$

$$t_2 = -\frac{\chi^2}{\varepsilon_{c2}^2} = -\frac{49}{16\,\chi^2}$$

$$\sigma_c = -f_{cd}\left(t_0 + t_1\,y + t_2\,y^2\right)$$ nel tr.to parabolico

$$N_c = \int_{\text{comp}} \sigma_c \, dA_c = -\int_{y=0}^{y=\frac{4}{7}x} f_{cd}\left(1 - \frac{49}{16x^2} y^2\right) b \, dy + $$

$$- \int_{y=-\frac{3}{7}x}^{y=0} f_{cd} \, b \, dy$$

$$dA_c = b \, dy$$

$$N_c = -f_{cd} \, b \left[\left| y - \frac{49}{16x^2} \cdot \frac{y^3}{3} \right|_0^{\frac{4}{7}x} + \left| y \right|_{-\frac{3}{7}x}^{0} \right] =$$

$$= -f_{cd} \, b \left[\frac{4}{7}x - \frac{\cancel{49}}{\cancel{16} \times 3 \, \cancel{x^2}} \left(\frac{4}{7}x\right)^{\cancel{3}} + \frac{3}{7}x \right]$$

$$N_c = -f_{cd}\, b \left[\frac{4}{7}x - \frac{4}{21}x + \frac{3}{7}x \right] =$$

$$= -f_{cd}\, b\, x\, \frac{17}{21}$$

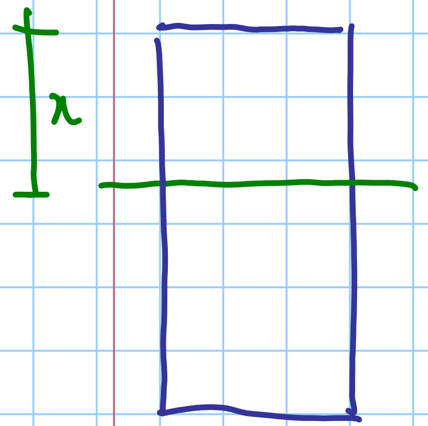
per sezione rettangolare

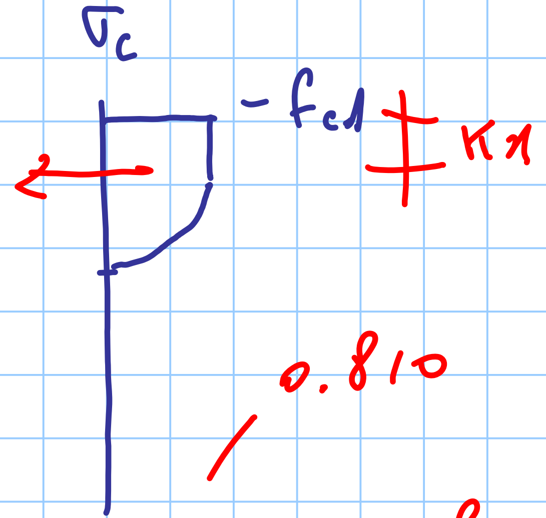
$$N_c = -\beta A_c f_{cd}$$

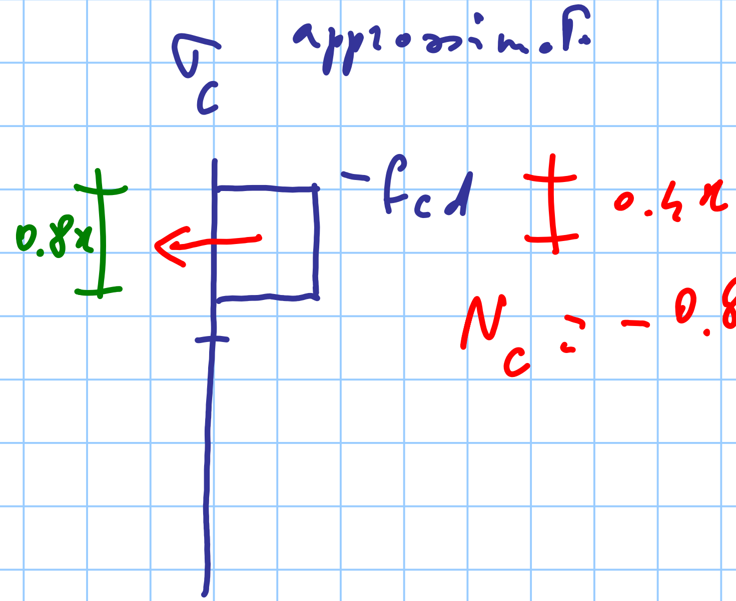
$$A_c = b\,x$$

$$\beta = \frac{17}{21} = 0.810$$

$$M_c = \int_{compr} \sigma_c \, y \, dA_c$$







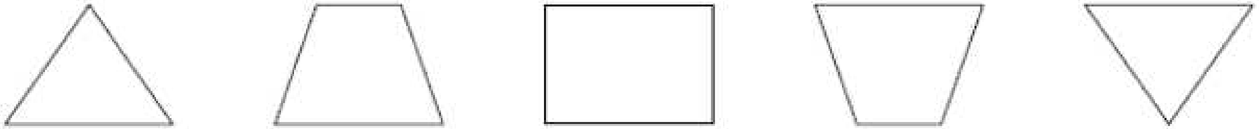
$$N_c = -0.8\, b\, x\, f_{cd}$$

0.810

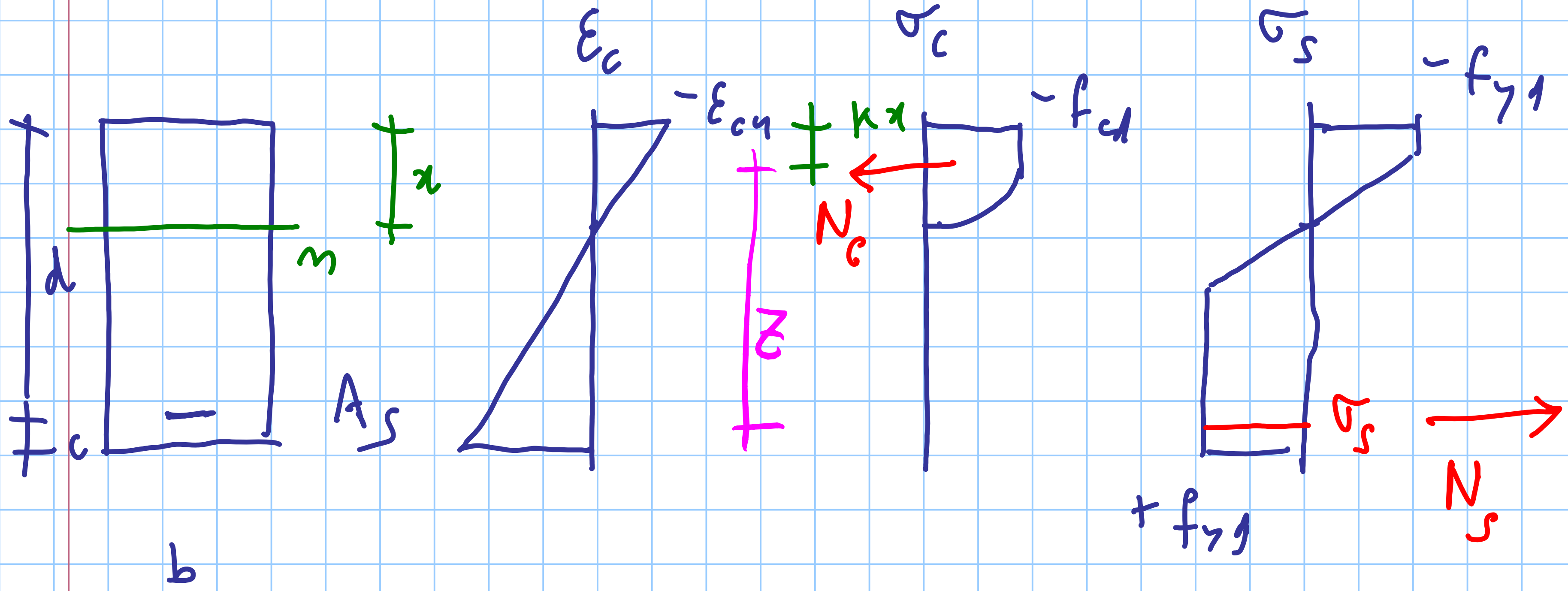
$$N_c = -\beta \, b \, x \, f_{cd}$$

$$\kappa = 0.416$$

Tab. 2. Valori di β e κ ottenuti con diagramma costante applicato sull'80% della sezione compressa



	$b_1 = b_0$	$b_1 = b_0 / 2$	$b_1 = 0$	$b_1 = -b_0$	$b_0 = 0$
β	0.640	0.747	0.800	0.853	0.960
errore	–4.97 %	–2.29 %	–1.18 %	–0.18 %	+1.53 %
κ	0.533	0.438	0.400	0.367	0.311
errore	–6.00 %	–4.85 %	–3.84 %	–2.53 %	+0.97 %



$$N_c = -\beta\, b\, x\, f_{cd}$$

$$N_s = A_s\, f_{yd}$$

$$N = 0$$

$$N_c + N_s = 0$$

$$-\beta\, b\, x\, f_{cd} + A_s\, f_{yd} = 0$$

$$x = \frac{A_s f_{yd}}{\beta \, b \, f_{cd}}$$

M_{Rd} si deve calcolare rispetto ad O

ma qui abbiamo $N = 0$ e possiamo calcolarlo rispetto a un punto qualsiasi

$$M_{Rd} = N_s \, z$$

$\searrow$ braccio della coppia interna

sezione 30×50 $A_s = 3\phi 20 = 9.42\ cm^2$

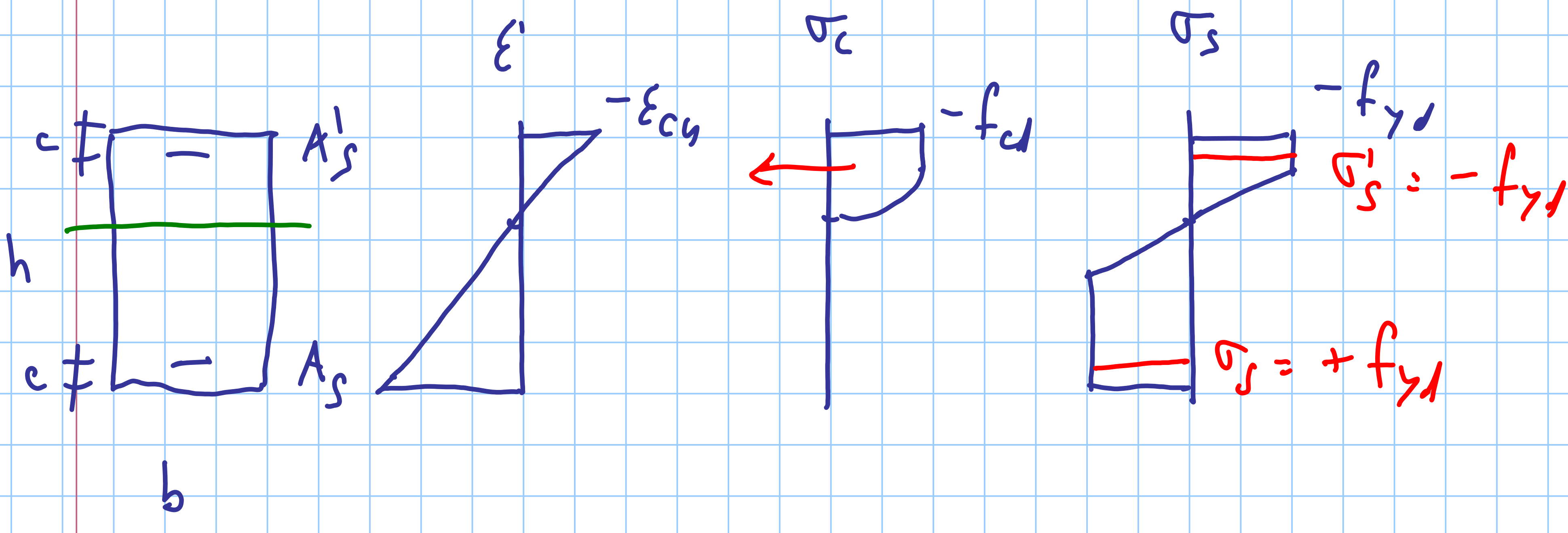
C25/30 B450 C $c = 4\ cm$

$$x = \frac{A_s\, f_{yd}}{\beta\, b\, f_{cd}} = \frac{9.42 \times 391{,}2}{0.81 \times 30 \times 14.17} = 10.70\ cm$$

$$z = d - k\,x = 46 - 0.416 \times 10.70 = 41.55\ cm$$

$$M_{Rd} = 9.42 \times 391.2 \times 10^{-1} \times 41.55 \times 10^{-2} =$$

$$= 153.1\ KNm$$

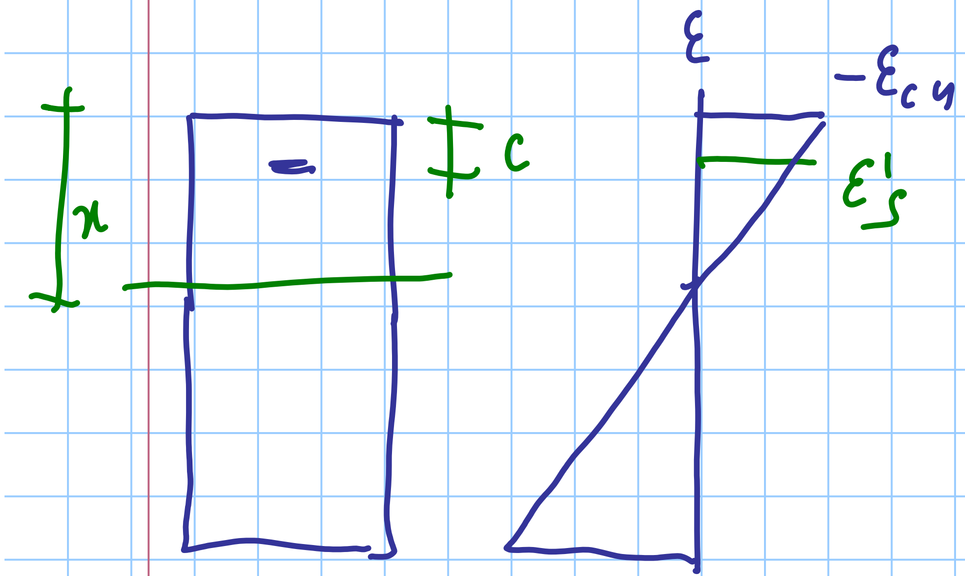


30×50 $\quad A_s = 3\phi 20 = 9.42\ cm^2$ $\quad A'_s = 2\phi 14 = 3.08\ cm^2$

$$N_c + N_s + N'_s = 0 \qquad -\beta b x f_{cd} + A_s f_{yd} - A'_s f_{yd} = 0$$

$$x = \frac{(A_s - A'_s)\, f_{yd}}{\beta\, b\, f_{cd}}$$

$$x = \frac{(9.42 - 3.08)\, 391.2}{0.81 \times 30 \times 14.17} = 7.20 \text{ cm}$$



$$\frac{\varepsilon'_s}{x - c} = \frac{-\varepsilon_{cu}}{x}$$

$$\varepsilon'_s = -\frac{x - c}{x}\, \varepsilon_{cu}$$

$$\varepsilon'_s = -\frac{7.20 - 4.00}{7.20}\, 3.5 \times 10^{-3} = -1.56 \times 10^{-3}$$

NON SNERVATO

$$\sigma'_s = E_s\, \varepsilon'_s = -\frac{x-c}{x} E_s\, \varepsilon_{cu}$$

$$-\beta\, b\, x\, f_{cd} + A_s f_{yd} - A'_s \frac{x-c}{x} E_s\, \varepsilon_{cu} = 0$$

$$-\beta\, b\, f_{cd}\, x^2 + A_s f_{yd}\, x - A'_s (x-c) E_c\, \varepsilon_{cu} = 0$$

2° gr.A ...... $\longrightarrow x \longrightarrow M_{Rd}$