

Scienza delle Costruzioni - Ingegneria Civile

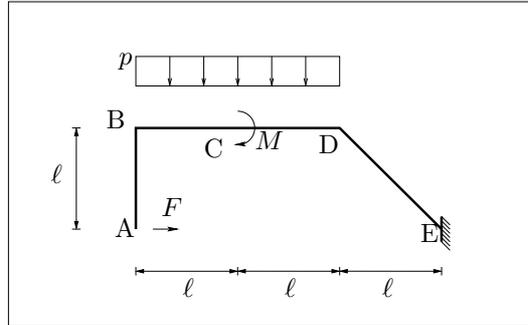
Prof. Angelo Luongo - 06/07/2009

SdC 9CFU: ES. 1, 2, 3; DURATA: 4 H

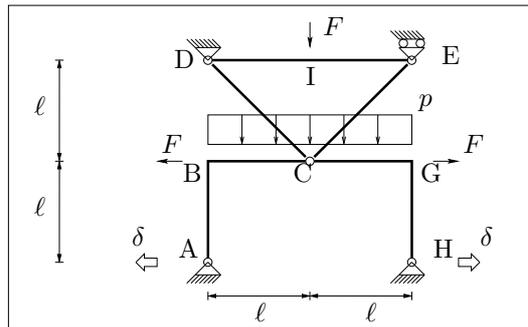
SdC I 6CFU: ES. 1, 2; DURATA: 3 H

SdC II 6CFU: ES. 3; DURATA: 2 H

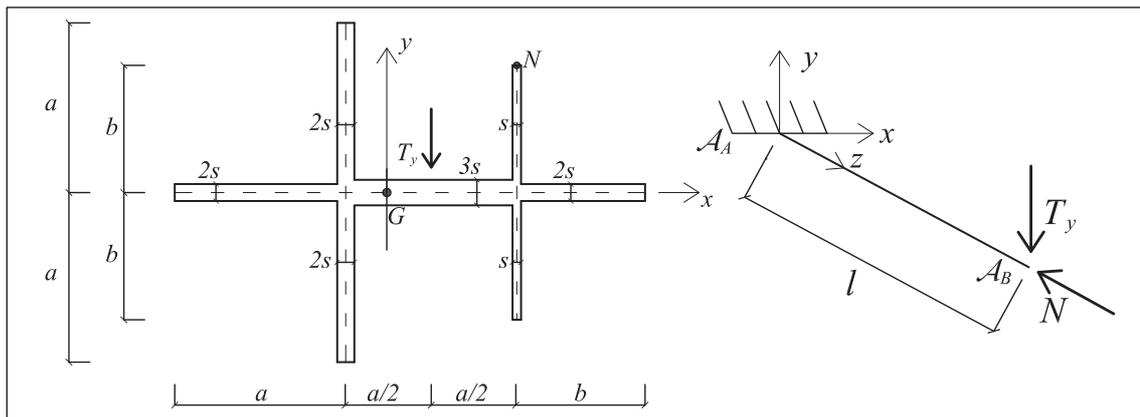
Esercizio 1: Scrivere e diagrammare le leggi di variazione delle caratteristiche di sollecitazione per la struttura in figura, nel caso in cui siano $\ell = 4$ m, $p = 20 \frac{\text{KN}}{\text{m}}$, $F = 40$ KN, $M = 20$ KNm. {Calcolare la rotazione della sezione in C, essendo $EI = 64000$ KNm²}¹.



Esercizio 2: Diagrammare le caratteristiche di sollecitazione per la struttura in figura nel caso in cui sia $\ell = 4$ m, $p = 20 \frac{\text{KN}}{\text{m}}$, $F = 40$ KN, $EI = 6.4 \times 10^4$ KNm², $E_{ADC} = E_{ACE} = 1.26 \times 10^6$ KN, altrove $EA \rightarrow +\infty$, $\delta = 5$ cm.



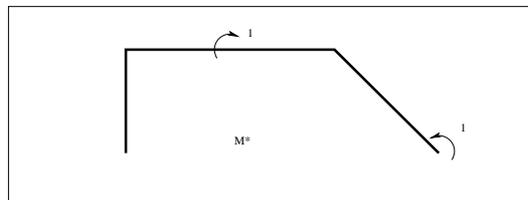
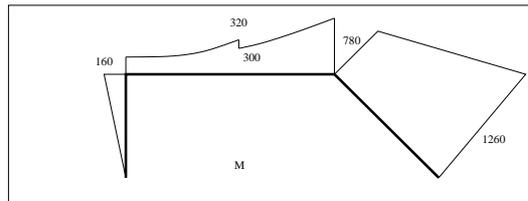
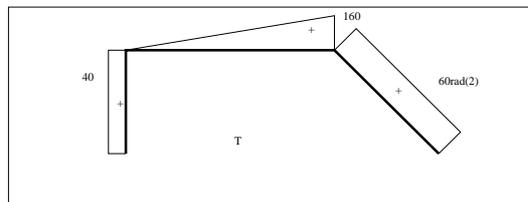
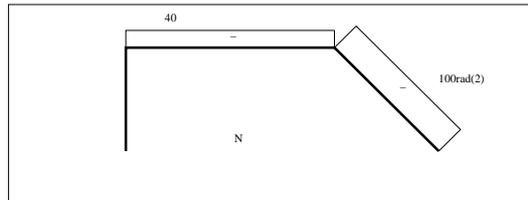
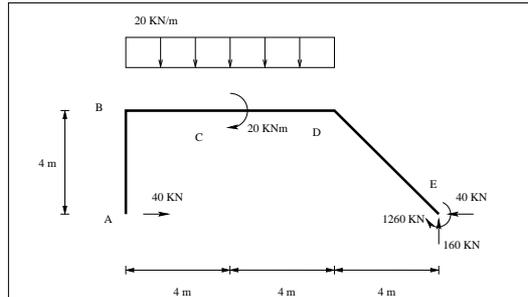
Esercizio 3: Si verifichi, nella sezione di incastro, un solido di DSV avente la sezione rappresentata in figura, soggetto in A_B ad una forza di taglio $T_y = 200$ KN e ad una forza normale $N = 120$ KN. Si diagrammi l'andamento delle tensioni normali e delle tensioni tangenziali per la sezione in figura. Siano $a = 20$ cm, $b = 15$ cm, $s = 1$ cm, $l = 3$ m, $\sigma_{amm} = 200 \frac{\text{N}}{\text{mm}^2}$. Si calcoli la σ_{id} , nel punto più sollecitato, utilizzando il criterio di resistenza di Von Mises. {Si costruisca il cerchio di Mohr nel punto più sollecitato e si calcolino le tensioni principali}².



¹Domanda riservata agli studenti SdC I 6cfu

²Domanda riservata agli studenti SdC II 6cfu

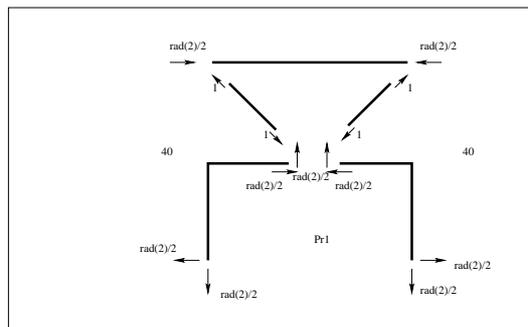
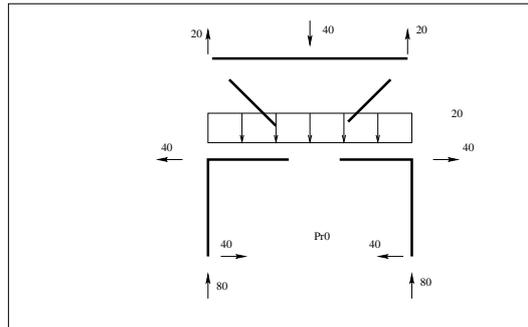
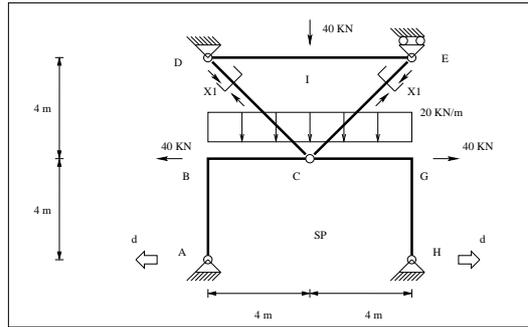
Esercizio 1:



| | N | T | M | M* |
|----|----------------|--------------|----------------------|----|
| AB | 0 | 40 | $-40x$ | 0 |
| BC | -40 | $20x$ | $-160 - 10x^2$ | 0 |
| CD | -40 | $80 + 20x$ | $-300 - 80x - 10x^2$ | 1 |
| ED | $-100\sqrt{2}$ | $60\sqrt{2}$ | $1260 - 60\sqrt{2}x$ | -1 |

$$1\varphi_C = \frac{1}{EI} \int_{\mathcal{D}} MM^* dx = -0.122 rad$$

Esercizio 2:



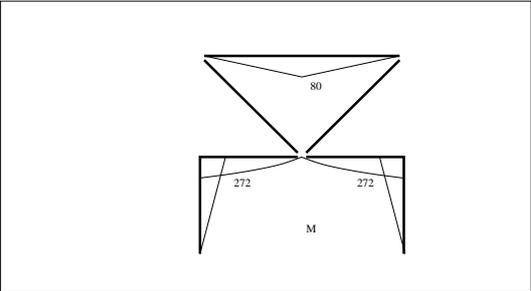
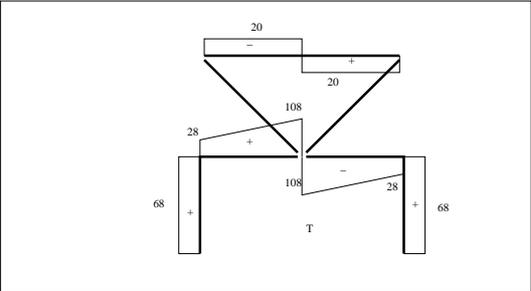
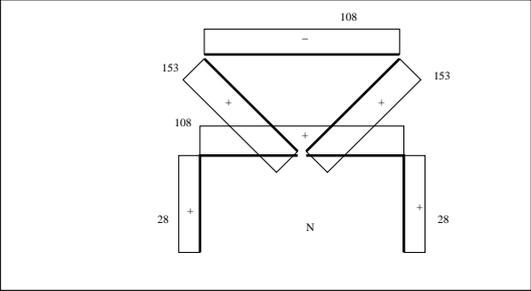
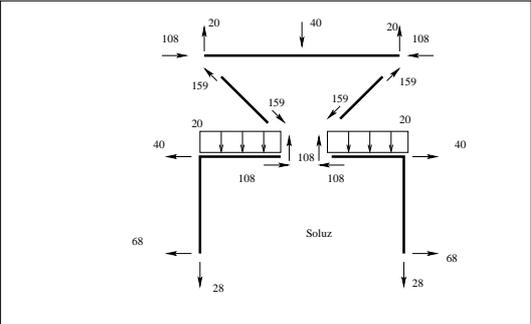
| | M_0 | M'_1 | N'_1 |
|----|----------------------|---------------------|--------|
| AB | $-40x$ | $\sqrt{2}/2x$ | tr |
| BC | $-160 + 80x - 10x^2$ | $\sqrt{2}/2(4 - x)$ | tr |
| DI | $20x$ | 0 | tr |
| DC | 0 | 0 | 1 |

$$\eta_{11} = \frac{128}{3EI} + \frac{8\sqrt{2}}{EA} \simeq \frac{128}{3EI}$$

$$\eta_{10} = \frac{7\sqrt{2}}{300EI}$$

$$\bar{\eta}_1 = -\frac{\sqrt{2}}{20}$$

$$\chi_1 = 153 \text{ kN}$$

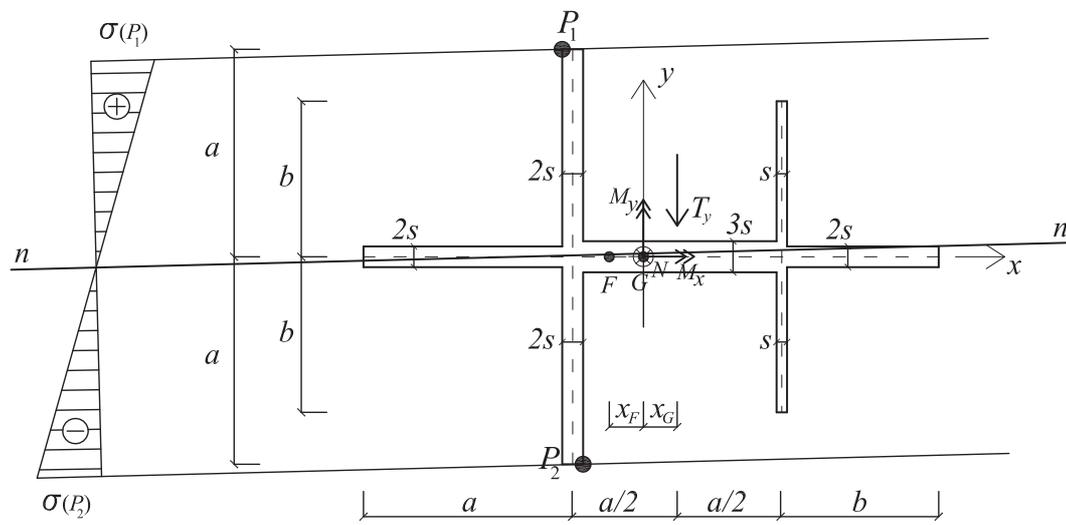


Esercizio 3:

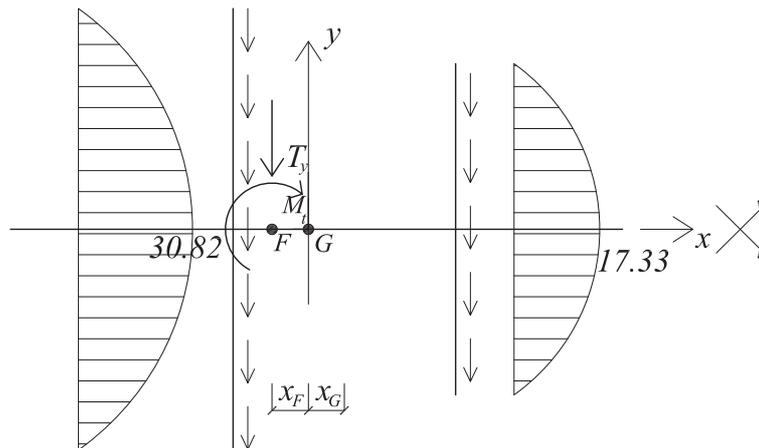
$$\begin{aligned}
 A &= 23250 \text{ mm}^2 \\
 x_G &= 32.27 \text{ mm} \\
 x_F &= 32.72 \text{ mm} \\
 I_x &= 12.98 \cdot 10^7 \text{ mm}^4 \\
 I_y &= 36.95 \cdot 10^7 \text{ mm}^4 \\
 N &= -120 \cdot 10^3 \text{ N} \\
 T_y &= -200 \cdot 10^3 \text{ N} \\
 M_x &= 58.2 \cdot 10^7 \text{ N} \cdot \text{mm} \\
 M_y &= 1.59 \cdot 10^7 \text{ N} \cdot \text{mm}
 \end{aligned}$$

PRESSO-FLESSIONE

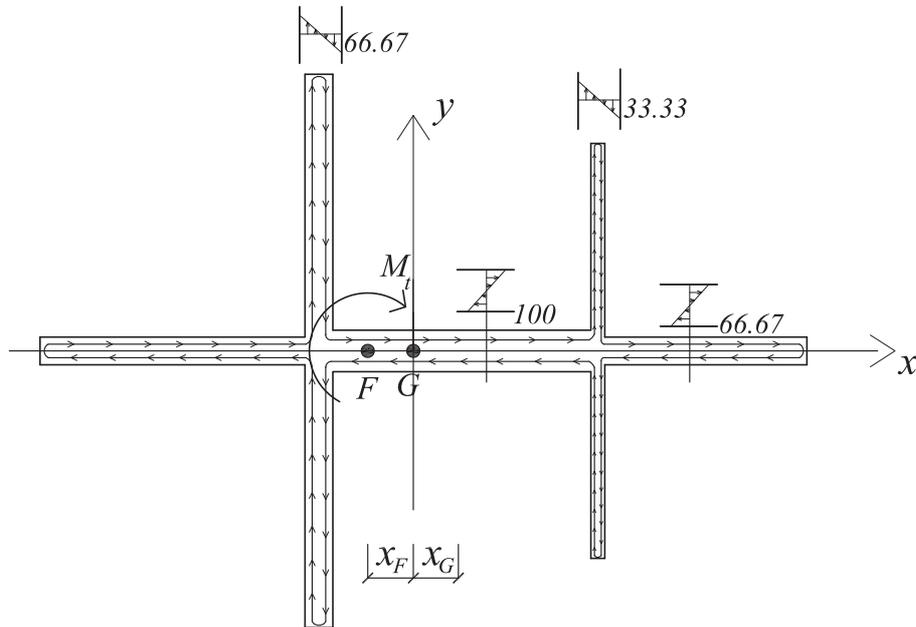
$$\begin{aligned}
 \sigma(P_1) &= 894.9 \frac{\text{N}}{\text{mm}^2} \\
 \sigma(P_2) &= -899.4 \frac{\text{N}}{\text{mm}^2}
 \end{aligned}$$



TAGLIO



TORSIONE
 $M_t = -1.3 \cdot 10^7 \text{ N} \cdot \text{mm}$



VERIFICHE DI RESISTENZA, RAPPRESENTAZIONE DI MOHR, TENSIONI PRINCIPALI

Il punto piú sollecitato é $P_2 : (-57.72; -200)$.

$\sigma_{id}(P_2) = 906.78 \frac{\text{N}}{\text{mm}^2} > \sigma_{amm}$, SEZIONE NON VERIFICATA

$X := (0; 66.67)$, $Y := (-899.4; -66.67)$

$\sigma_I = 4.91 \frac{\text{N}}{\text{mm}^2}$

$\sigma_{II} = -904.31 \frac{\text{N}}{\text{mm}^2}$

