

# Scienza delle Costruzioni - Ingegneria Civile

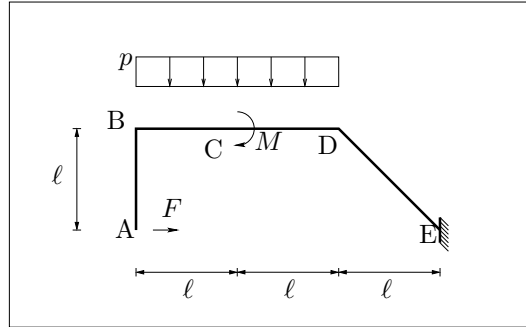
Prof. Angelo Luongo - 06/07/2009

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

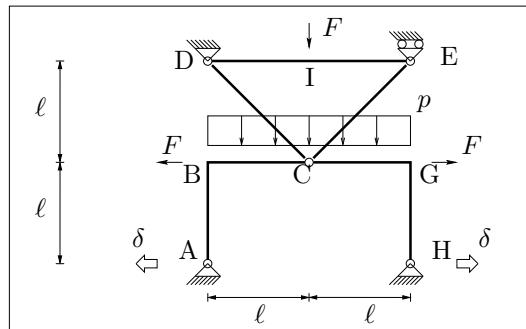
SdC I 6CFU: ES. 1, 2; DURATA: 3 H

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

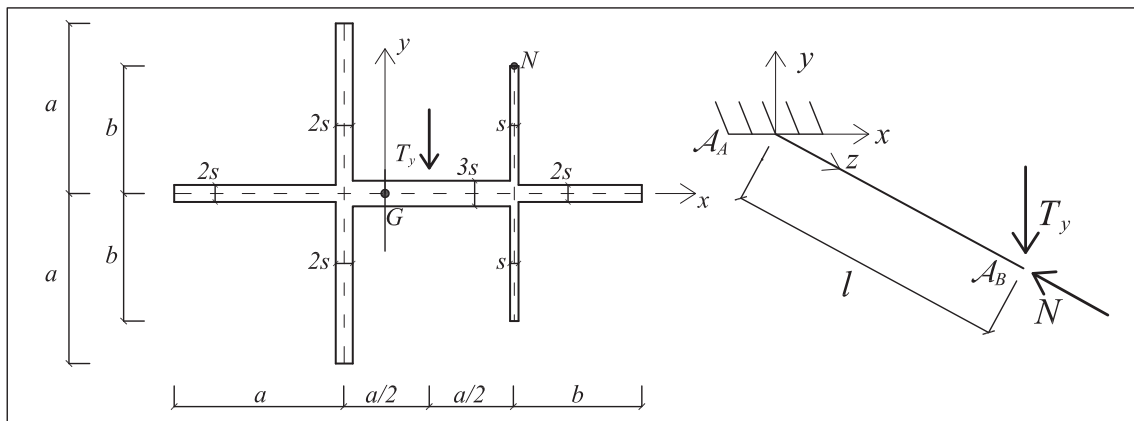
**Esercizio 1:** Scrivere e diagrammare le leggi di variazione delle caratteristiche di sollecitazione per la struttura in figura, nel caso in cui siano  $\ell = 4$  m,  $p = 20 \frac{\text{KN}}{\text{m}}$ ,  $F = 40$  KN,  $M = 20$  KNm. {Calcolare la rotazione della sezione in C, essendo  $EI = 64000$  KNm<sup>2</sup>}<sup>1</sup>.



**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,  $EI = 6.4 \times 10^4$  KNm<sup>2</sup>,  $EAD_C = EACE = 1.26 \times 10^6$  KN, altrove  $EA \rightarrow +\infty$ ,  $\delta = 5$  cm.



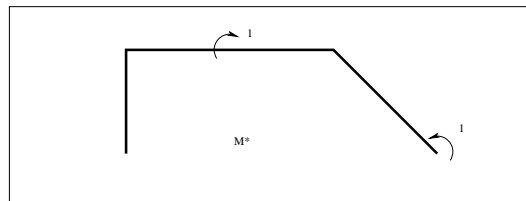
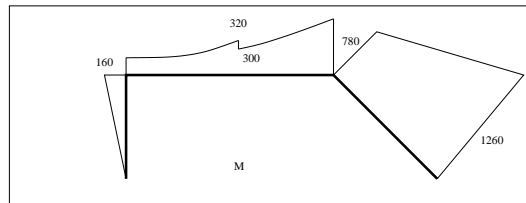
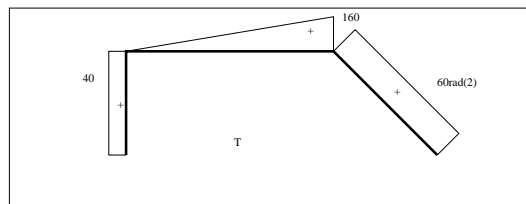
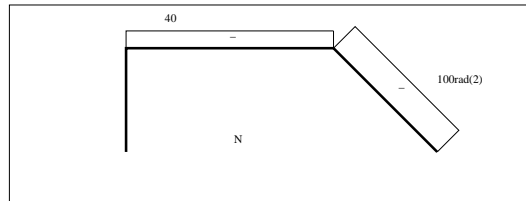
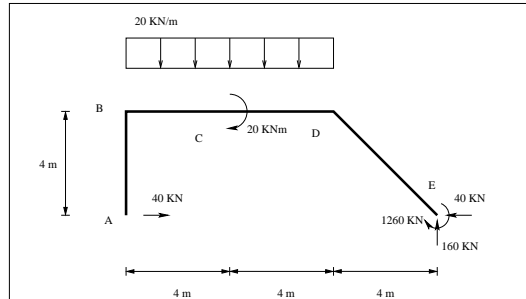
**Esercizio 3:** Si verifichi, nella sezione di incastro, un solido di DSV avente la sezione rappresentata in figura, soggetto in  $A_B$  ad una forza di taglio  $T_y = 200$  KN e ad una forza normale  $N = 120$  KN. Si diagrammi l'andamento delle tensioni normali e delle tensioni tangenziali per la 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  $\sigma_{id}$ , 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}<sup>2</sup>.



<sup>1</sup>Domanda riservata agli studenti SdC I 6cfu

<sup>2</sup>Domanda riservata agli studenti SdC II 6cfu

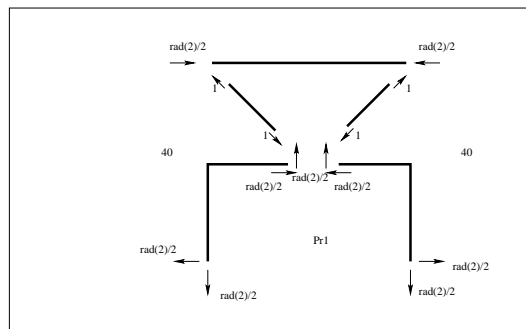
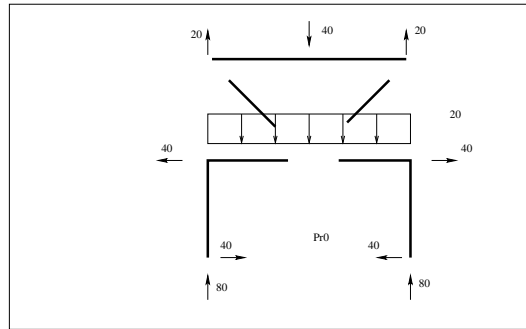
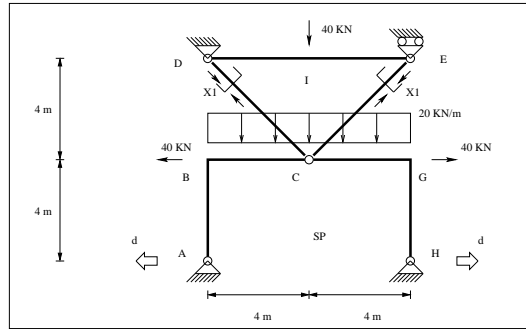
Esercizio 1:



	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

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

Esercizio 2:



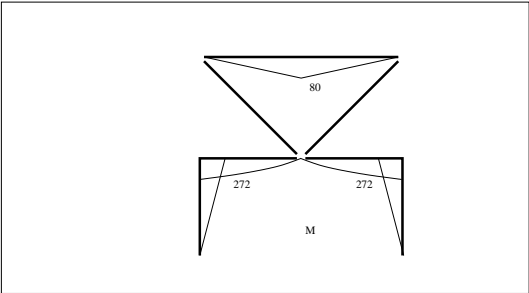
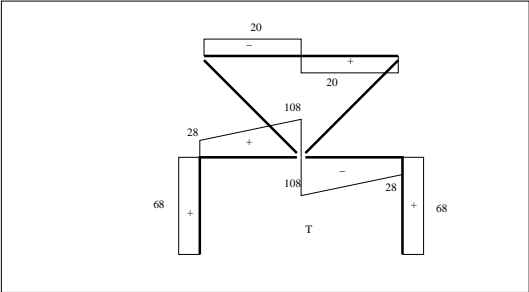
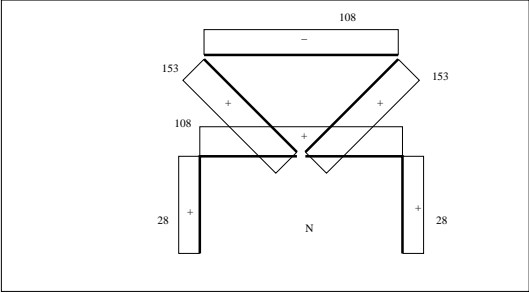
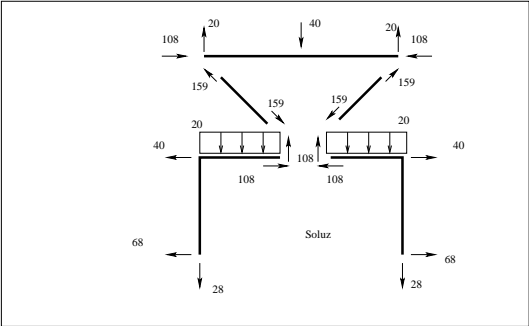
	$M_0$	$M'_1$	$N'_1$
AB	$-40x$	$\sqrt{2}/2x$	tr
BC	$-160 + 80x - 10x^2$	$\sqrt{2}/2(4 - x)$	tr
DI	$20x$	0	tr
DC	0	0	1

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

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

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

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

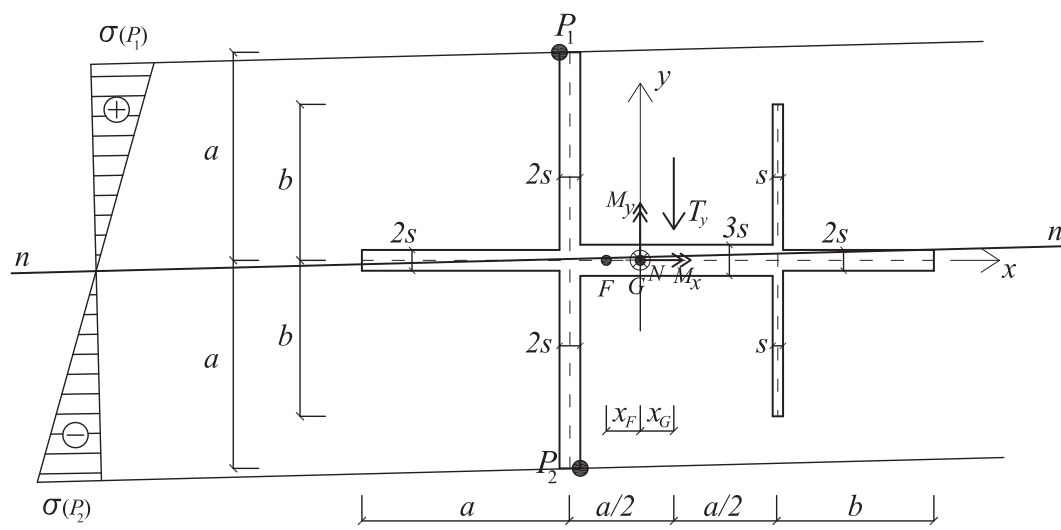


**Esercizio 3:**

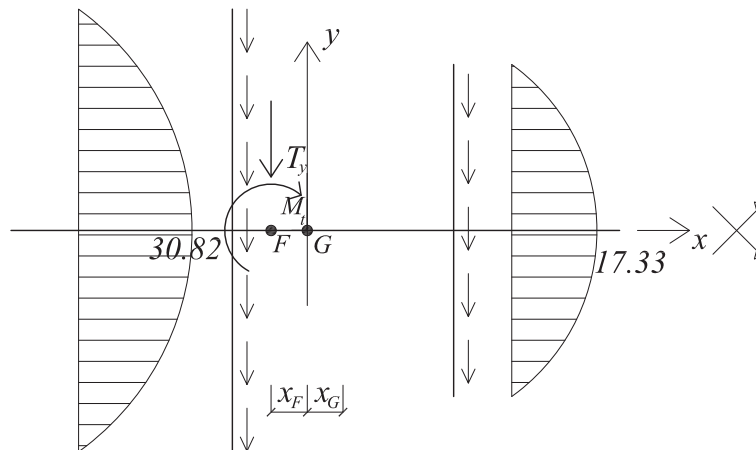
$$\begin{aligned}
 A &= 23250 \text{ mm}^2 \\
 x_G &= 32.27 \text{ mm} \\
 x_F &= 32.72 \text{ mm} \\
 I_x &= 12.98 \cdot 10^7 \text{ mm}^4 \\
 I_y &= 36.95 \cdot 10^7 \text{ mm}^4 \\
 N &= -120 \cdot 10^3 \text{ N} \\
 T_y &= -200 \cdot 10^3 \text{ N} \\
 M_x &= 58.2 \cdot 10^7 \text{ N} \cdot \text{mm}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

**PRESSO-FLESSIONE**

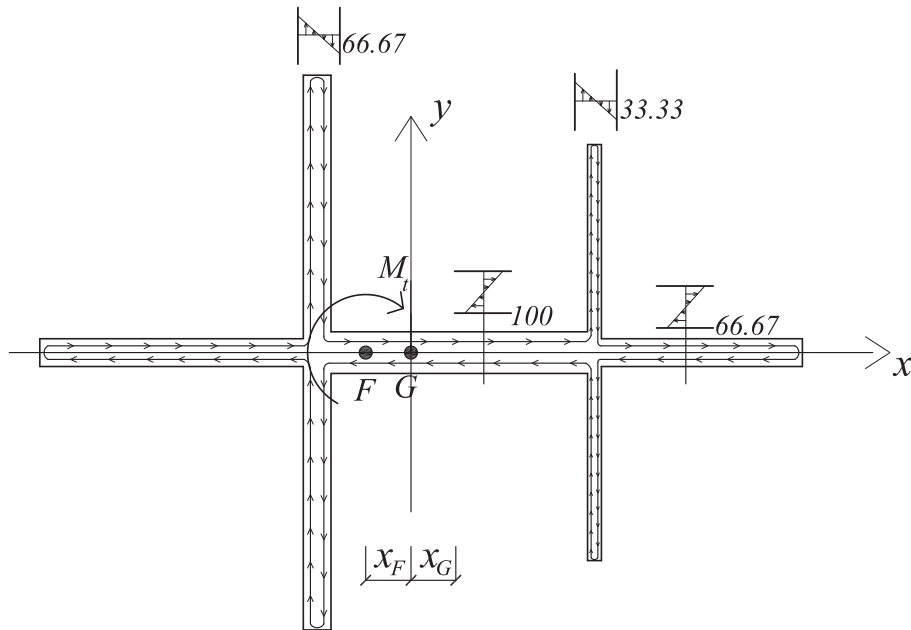
$$\begin{aligned}
 \sigma(P_1) &= 894.9 \frac{\text{N}}{\text{mm}^2} \\
 \sigma(P_2) &= -899.4 \frac{\text{N}}{\text{mm}^2}
 \end{aligned}$$



**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

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

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

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

