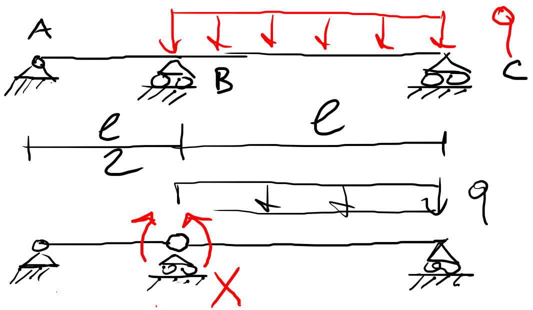
ES (TRAVE CONTINUA) 1 v. iperst. SDC, 1/12/23

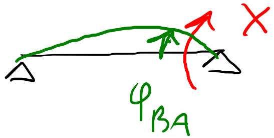
EI cost

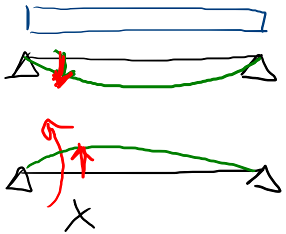


$$\boxed{\varphi_{BA} = \varphi_{BC} \quad \circlearrowleft +}$$

EQ. DI CONGR.

$$-\frac{X\, l/2}{3EI} = -\frac{q l^3}{24EI} + \frac{X l}{3EI}$$



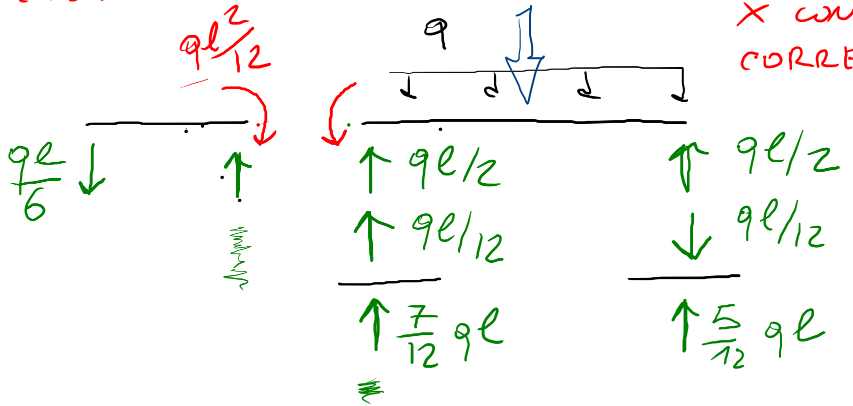


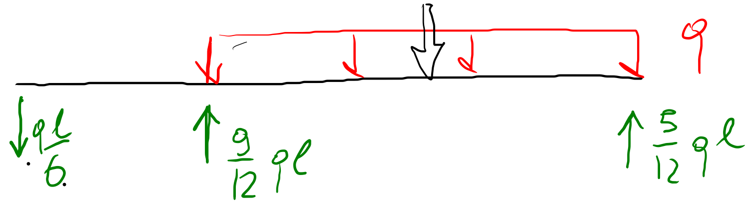
$$+\frac{X l}{6EI} + \frac{X l}{3EI} = \frac{q l^3}{24EI} \quad ; \quad \frac{X}{2} = \frac{q l^2}{24} \quad ; \quad \boxed{X = +\frac{q l^2}{12}}$$

MOMENTO

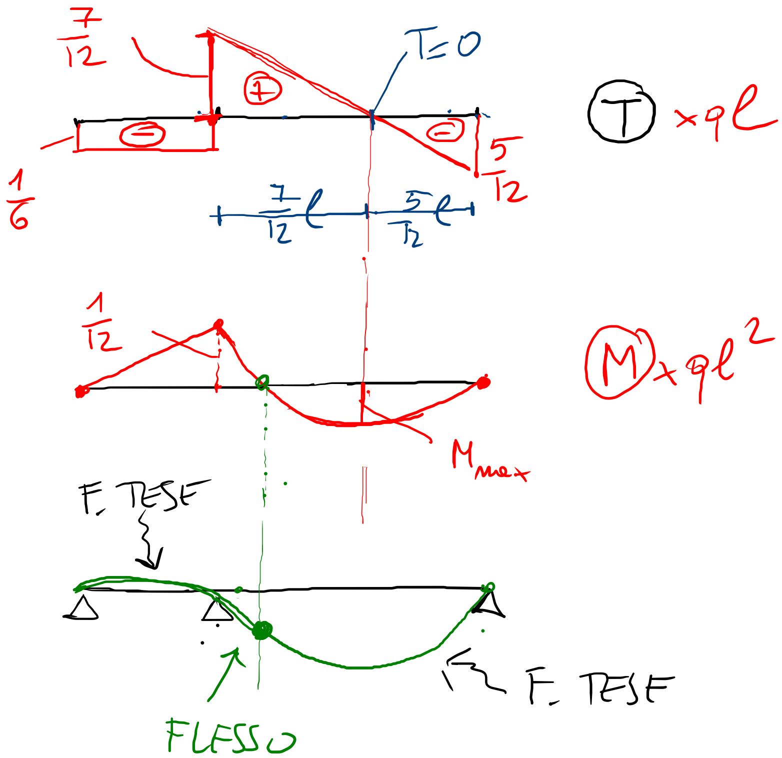
STESSO SEGNO NEI PROBLEMI 1 VOLTA IPERST.

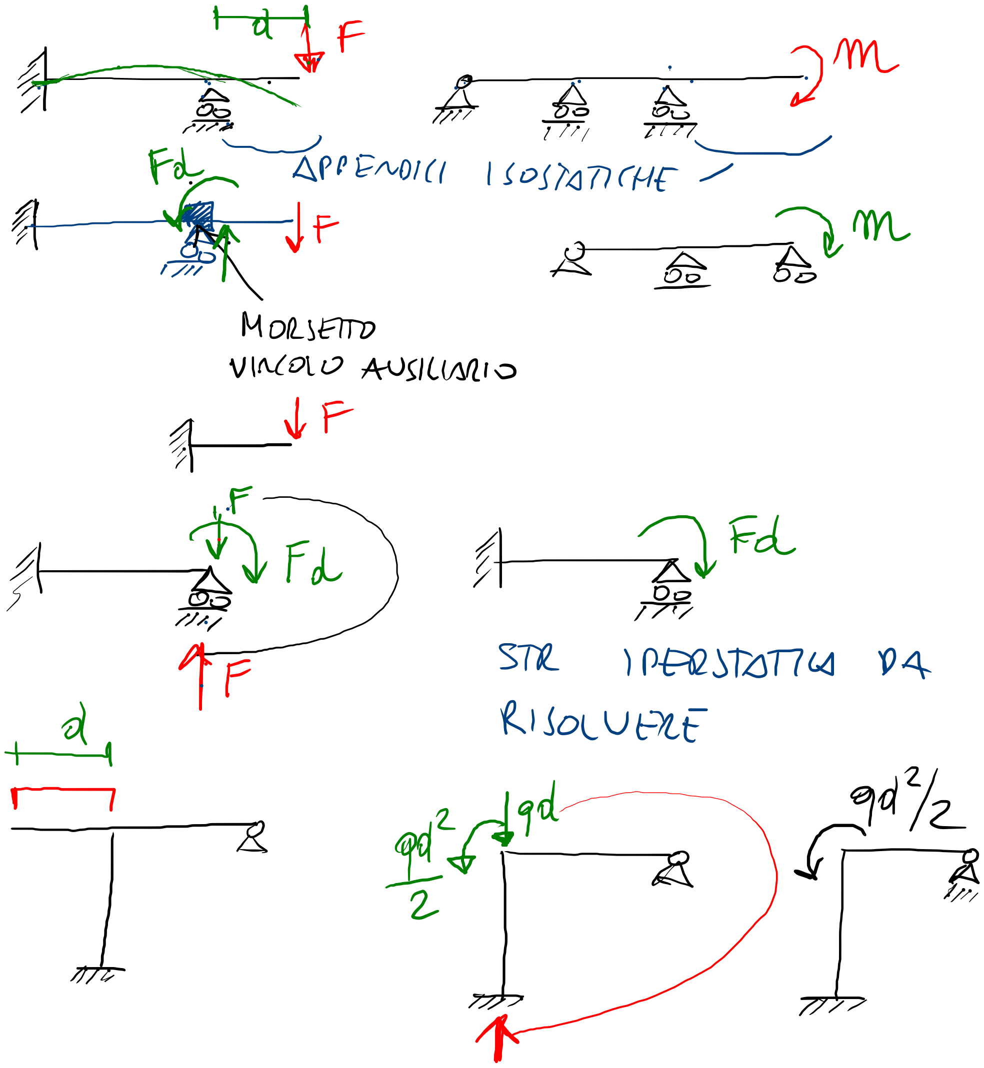
X CON VERSO CORRETTO.



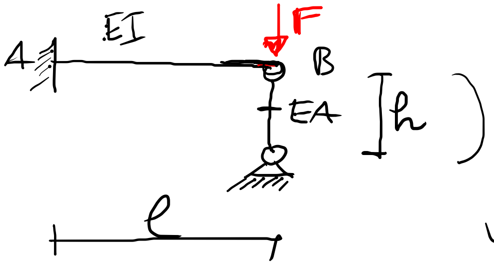


S.C.L. TRAVE IPERSTATICA

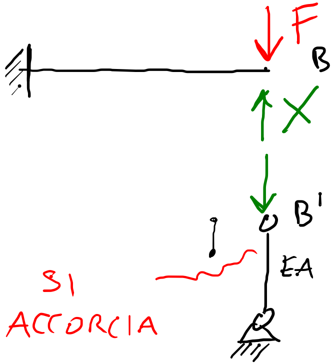

7/12
T=0
T ×ql
1/6
5/12
7/12 l
5/12 l
1/12
M ×ql²
Mmax
F. TESE
FLESSO
F. TESE


d
F
m
APPENDICI ISOSTATICHE
Fd
F
m
MORSETTO
VINCOLO AUSILIARIO
F
F
Fd
F
Fd
STR IPERSTATICA DA RISOLVERE
d
qd
qd²/2
qd²/2

STR. IPERSTATICHE CON VINCOLI CEDEVOLI



BIELLA ELASTICA COSTITUISCE PER LA MENSOLA AB UN VINCOLO CEDEVOLE (B SI MUOVE VERTICALMENTE)



EQ CONGRUENZA

$$\boxed{v_B = v_{B'}}$$

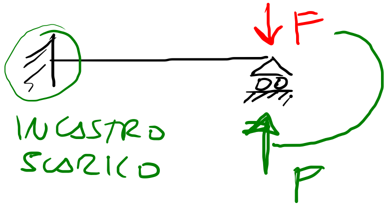
$$\frac{Fl^3}{3EI} - \frac{Xl^3}{3EI} = + \frac{Xh}{EA}$$

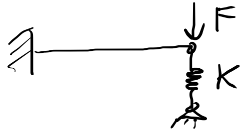
$$X\left(\frac{l^3}{3\cancel{E}I} + \frac{h}{\cancel{E}A}\right) = \frac{Fl^3}{3\cancel{E}I}$$

$A \to \infty$

$$X = \frac{Fl^3/3I}{\frac{l^3}{3I} + \frac{h}{A}} > 0 \quad ; \quad \cancel{X} = \frac{A}{c}$$

BIELLA INFINITAM RIGIDA



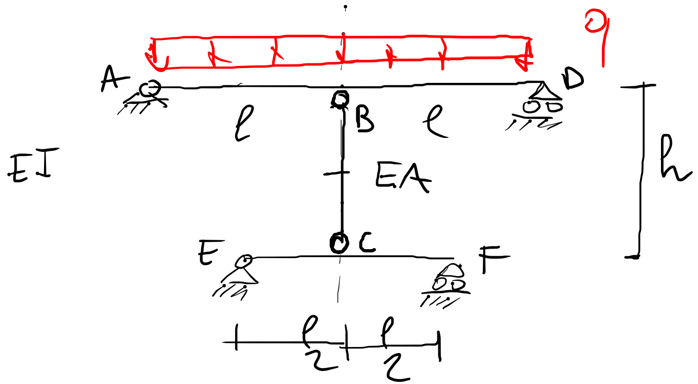


$K = \frac{EA}{h}$

CASI LIMITE

$A \to 0 \qquad X \to 0$ (BIELLA MOLTO CEDEVOLE)

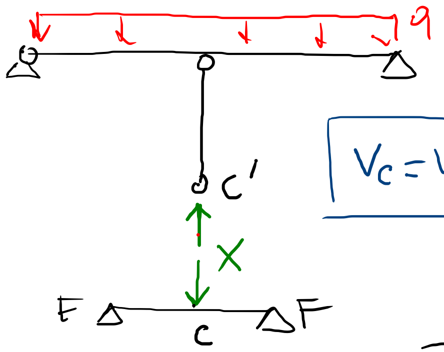
$A \to \infty \qquad X \to F$



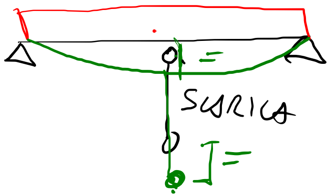
LA BIELLA BC INTRODUCE UN GRADO DI VINCOLO AGGIUNTIVO AI SIST. DELLE 2 TRAVI APPOGGIATE: 1 V. IPERSTATICA

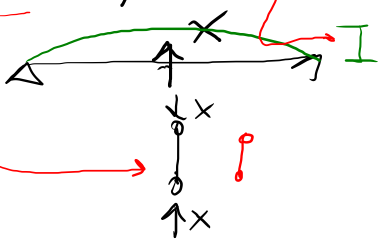
(BIELLA CEDEVOLE)

$$V_C'(q) + V_C'(X_{TRAVE}) + V_C'(X_{BIELLA}) \quad (*)$$



$$\boxed{V_C = V_C' \quad \downarrow +}$$





$$\frac{5}{384}\,\frac{q(2l)^4}{EI} - \frac{X(2l)^3}{48EI} - \underset{(*)}{\frac{Xh}{EA}} = \frac{Xl^3}{48EI}$$

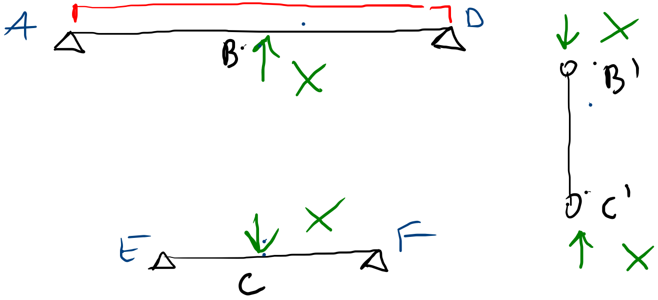
$$EA = f\left(\frac{EI}{l^2}\right)$$

$$h \rightarrow f(l)$$

$$V_C = \frac{Xl^3}{48EI}$$

SE LA BIELLA NON È CEDEVOLE $\Longrightarrow$ (*) NON C'È
(TRASCURO LA DEF. ASSIALE DELLA BIELLA)

UNA S.P. ALTERNATIVA È



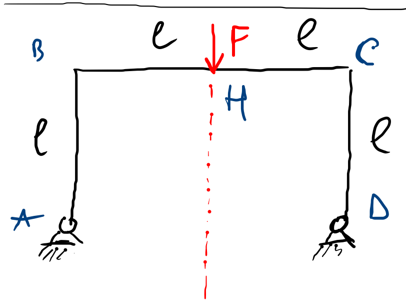
EQ. DI CONGRUENZA

$$\boxed{+\,\delta \qquad \delta_{BC} = \delta_{B'C'}}$$

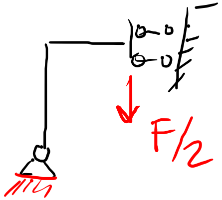
SPOST. RELATIVI TRA I PUNTI UGUALI TRA SCHEMA DELLE DUE TRAVI E BIELLA

$$\ldots\ldots = \frac{x h}{EA}$$

(x = al caso precedente)



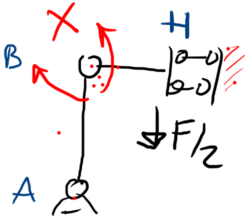
STR SYM
CARIC. SYM

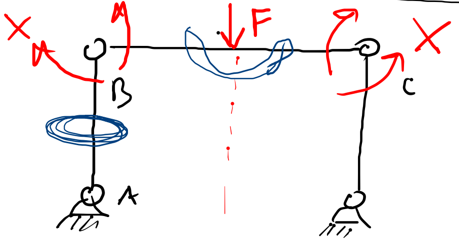


1 V. IPERSTATICA

$$\varphi_{BA} = \varphi_{BH}$$

NON IMMEDIATO



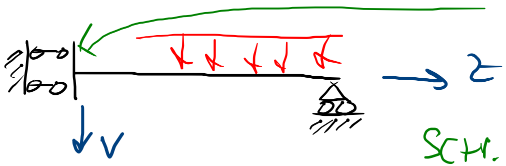


$$\varphi_{BA} = \varphi_{BC} \qquad \curvearrowright +$$

BA e BC : 2 TRAVI APPOGGIATE

$$\frac{Xl}{3EI} = -\frac{X\,2l}{3EI} + \frac{F(2l)^2}{16EI} - \frac{X\,2l}{6EI}$$

OSS. LINEA ELASTICA

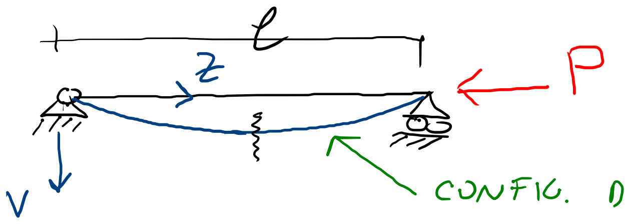


SPOST. VERTICALE INCOGNITO

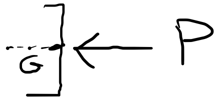
SCH. ISOST.

$$\begin{cases} v'' = -\dfrac{M(z)}{EI} \\ v'(0) = 0 \\ v(\ell) = 0 \end{cases}$$

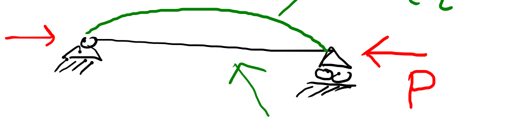
CARICO CRITICO DI EULERO (INSTABILITA' DELL'EQUILIBRIO ELASTICO)



CONFIG. DEFORMATA QUANDO $P \to P_{cr}$

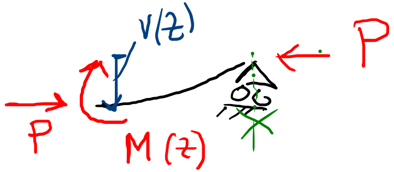


STABILE $P > P_{cr}$



per $P > P_{cr}$ CONFIG. INST.

COME DET. P_{cr}? STUDIAMO L'EQUIL. DELLA STRUTTURA IN CONFIGURAZIONE DEFORMATA



L'EQUAZ RISOLVENTE : $\boxed{M(z) - P\,v(z) = 0}$

VISTO CHE $M(z) = -EI\,v''(z)$ (ELASTICO LINEARE)

POSSO SOSTITUIRE $\boxed{+EI\,v''(z) + P\,v(z) = 0}$ v(z) E' L'INCOGNITA

$$\begin{cases} v'' + \alpha^2 v = 0 \\ v(0) = 0 \\ v(\ell) = 0 \end{cases} \qquad \alpha^2 = \frac{P}{EI} > 0$$

$$v(z) = C_1 \sin \alpha z + C_2 \cos \alpha z$$

$$C_2 = 0$$

$$\boxed{C_1 \sin \alpha \ell = 0}$$

$C_1 = 0$ CONF. BANALE

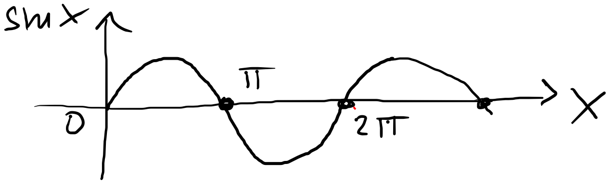
$\boxed{\sin \alpha \ell = 0}$

CONDIZIONE "CRITICA" $\Rightarrow P_{cr}$

QUANDO

$$\boxed{\alpha^2 = \frac{P}{EI}}$$

$\sin \alpha l = 0 \rightarrow \alpha l = n\pi$ $\quad (n = 1, 2, 3 \ldots)$



$C_1 \sin \alpha z$ $\quad |\alpha_{cr}$

INDEFINITA

$$\alpha^2 = \frac{n^2 \pi^2}{l^2}$$

$$\frac{P}{EI} = n^2 \frac{\pi^2}{l^2}$$

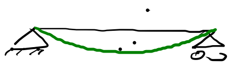
; QUESTA EQUAZ. DEFINISCE I VALORI DI P CHE SODDISFANO LA CONDIZIONE "CRITICA".

$$P = n^2 \frac{\pi^2}{l^2} EI$$

$$\boxed{P_{cr} = P(n=1) = \frac{\pi^2}{l^2} EI}$$

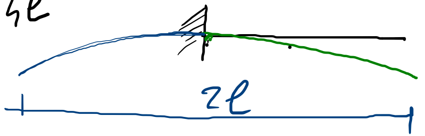
CARICO CRITICO DI EULERO.

$\lambda = 2l$



$\leftarrow P_{cr} (l_0 = l)$

$\lambda = 4l$

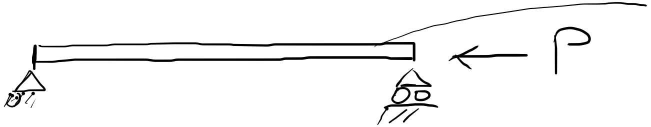


$\leftarrow P_{cr}^{MENS.}$ $(l_0 = 2l)$

CHIAMIAMO LUNGHEZZA LIBERA DI INFLESSIONE $l_0 = \lambda / 2$

$$\boxed{P_{cr} = \frac{\pi^2}{l_0^2} EI}$$

$$P_{cr}^{MENS} = \frac{\pi^2}{4 l^2} EI = \frac{P_{cr}}{4}$$



PROGETTIAMO LE STRUTTURE PERCHÉ NON SI INSTABILIZZINO

$P < P_{cr}$