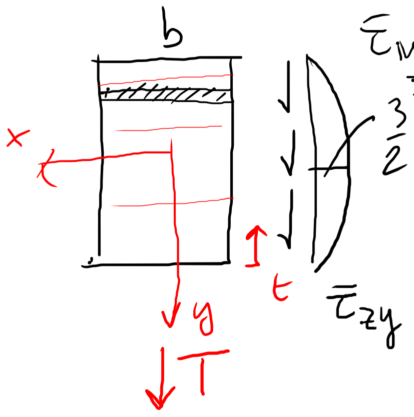
..... TRATT. APPROSS. TAGLIO

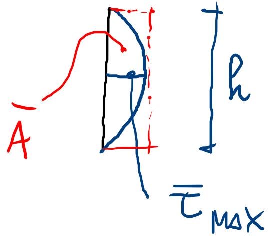


$\tau_{max} = \frac{3}{2}\frac{T}{bh}$

$$\int_A \tau_{zy}\, dS = T$$

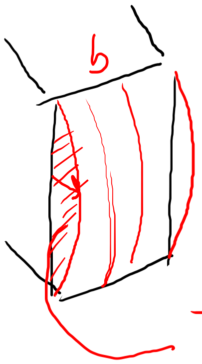
1) $\int_0^h \tau_{zy}(t)\, b\, dt = \dots T$

2)



$\bar{A} = \frac{2}{3}\tau_{max}\, h$

$T \overset{?}{=} \frac{2}{3}\tau_{max}\, h b = \frac{\cancel{2}}{\cancel{3}}\,\frac{\cancel{3}}{\cancel{2}}\,\frac{T}{b\cancel{h}}\,\cancel{hb} = T$ OK

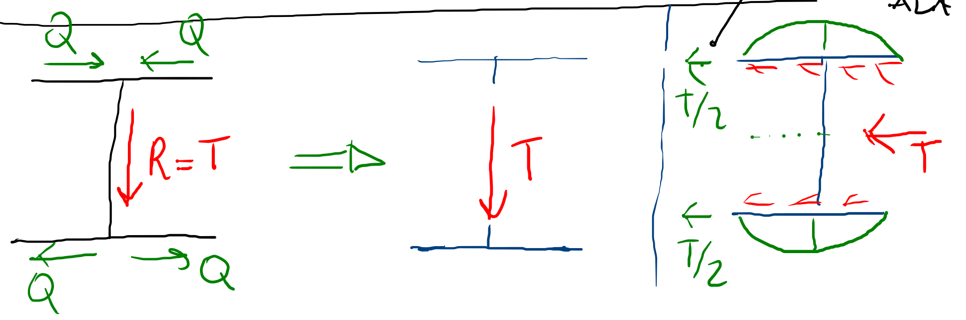


$\bar{\tau}_{zy}$

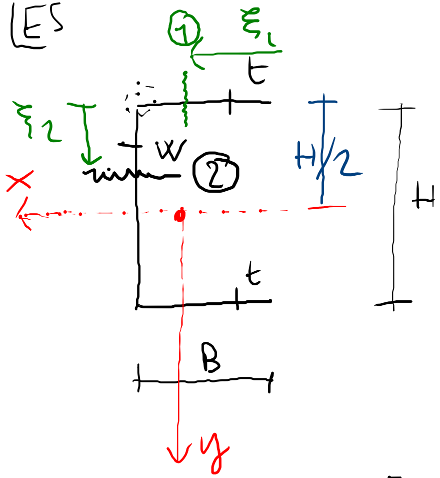
T: volume del solido

$T = \bar{A}\cdot b$

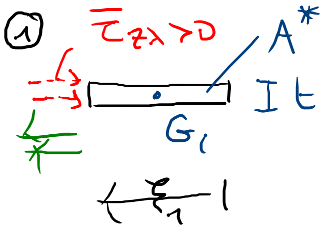
OSS.:



ES

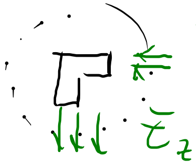


$T_y \Rightarrow J_x ,\ S_x^*$ | $\bar{\tau} = \dfrac{T_y}{J_x}\,\dfrac{S_x^*}{b}$ (b: t, w)



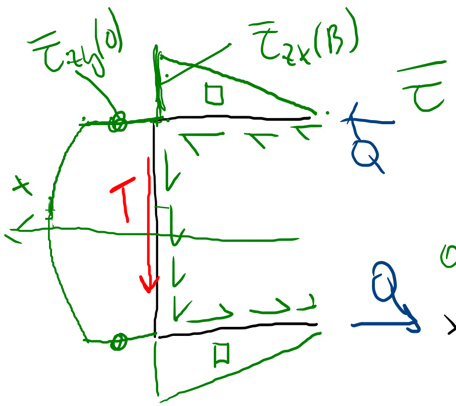
$$\bar{\tau}_{zx}(\xi_1) = \frac{T}{J_x\, t}\Big(\overbrace{-\tfrac{H}{2}}^{y_{G_1}} \cdot \xi_1 t\Big) = f(\xi_1) \rightarrow \text{lineare}$$

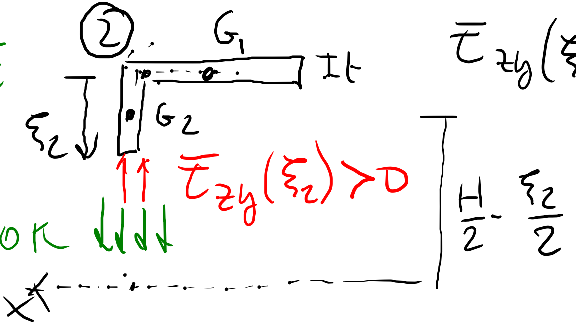
VERIFICARE



$\bar{\tau}_{zx}(B)\,t$ // $\bar{\tau}_{zy}(0)\,w$ — UGUAGL. DEI FLUSSI

DOPO FACCIAMO DELLE CONSID.

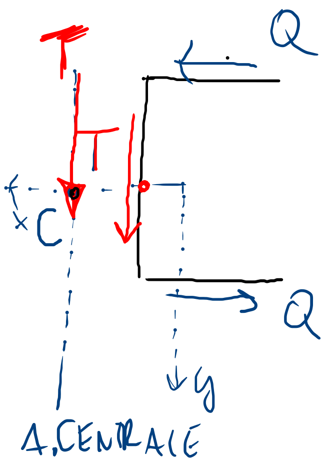




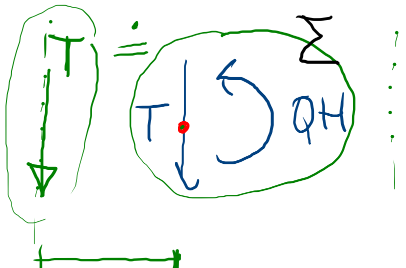
$$\bar{\tau}_{zy}(\xi_2) = \frac{T}{J_x\, w}\Big[\overbrace{Bt\left(-\tfrac{H}{2}\right)}^{S_x^*} + \overbrace{\xi_2 w\Big(-\underbrace{\left(\tfrac{H}{2} - \tfrac{\xi_2}{2}\right)}_{y_{G_2}}\Big)}^{S_x}\Big] < 0$$

$$\int_{0}^{H} \bar{\tau}_{zy}(\xi_2)\, w\, d\xi_2 = T$$

0 . TRATTO VERTICALE



$$Q = \int_0^B \tau_{zx}(\xi_1)\, t \, d\xi_1$$



$$\frac{QH}{T} = d$$

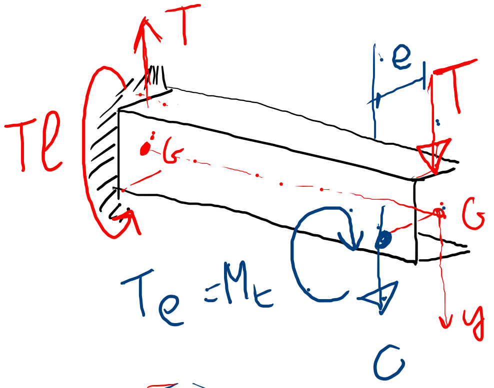
QUALI SONO LE EQUAZ. DI EQUIVALENZA STATICA A CUI LE τ_{zx}, τ_{zy} DEVONO SOTTOSTARE?

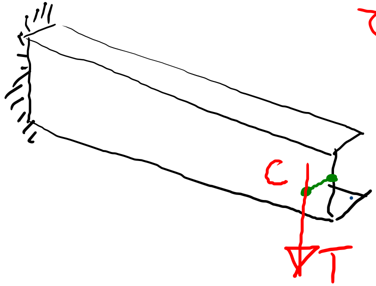
$$\Rightarrow \int \tau_{zx} \, dS = T_x , \quad \int \tau_{zy} \, dS = T_y$$

?? $\int \tau_{zy} x - \tau_{zx} y \, dS = M_z$

IL SIST. $\overbrace{\{T, Q, Q\}}^{\Sigma}$ È EQUIVALENTE A UN TAGLIO T e UN MOMENTO TORCENTE QH.

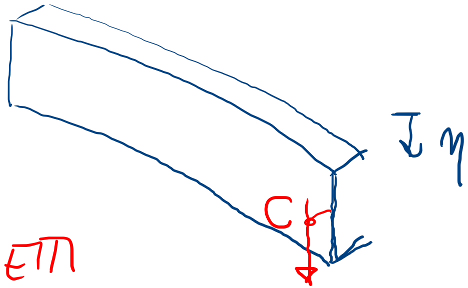
DOVE DEVO APILICARE IL TAGLIO T PERCHÉ LA SEZ. NON SUBISCA UNA TORSIONE (NO MOMENTO TORCENTE!!): SULL'ASSE CENTRALE CHE UNA RETTA ESTERNA PASSANTE PER C (C: CENTRO DI TAGLIO)



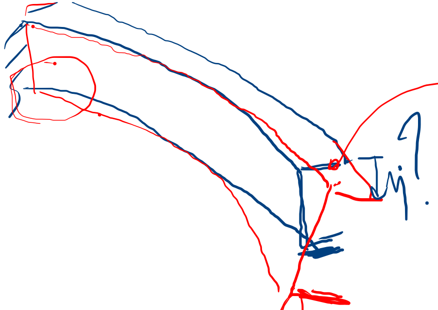


τ : JOURAWSKI

NO EFFETTI TORCENTI



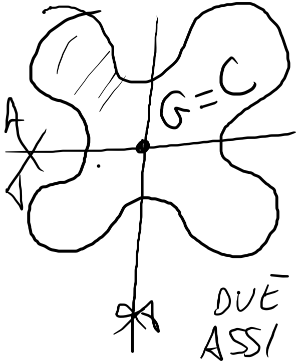
NO φ



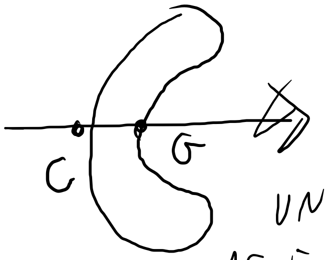
τ JOURAWSKY
+
τ MOMENTO TORCENTE

e ROTAZ.
φ "TORCENTE"

NO ROTAZ



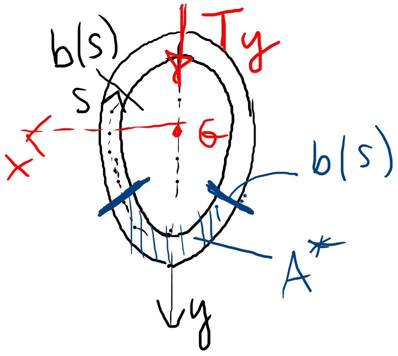
DUE ASSI DI SIMMETRIA

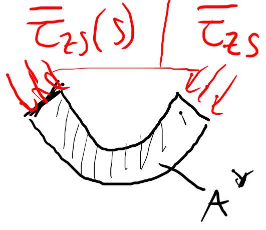


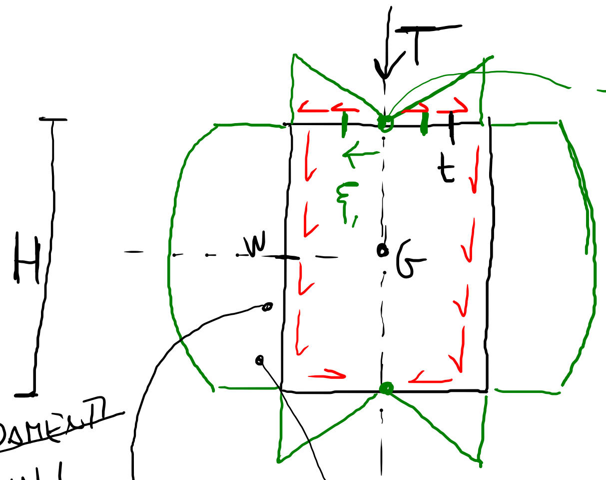
UN ASSE DI SIMM.

SEZ. SOTTILI CHIUSE CON UN ASSE DI SIMMETRIA

$$\tau_{zs}(s) = \frac{T_y}{J_x}\,\frac{S_x^*}{2b(s)}$$

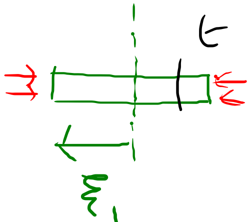




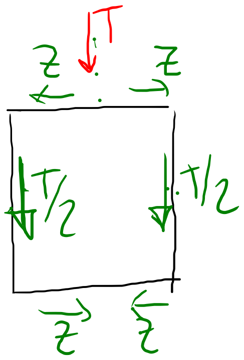


$$\tau(\xi_1 = 0) = 0$$

$$S_x^* = 0 \quad (A^* = 0)$$



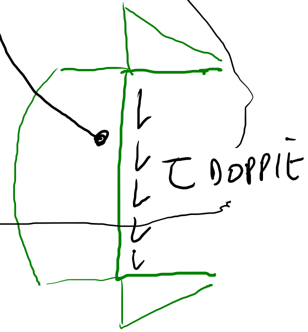
$$\tau(\xi_1) = \frac{T_y}{J_x}\,\frac{2\xi_1 t\left(-\frac{H}{2}\right)}{2t}$$



I DUE ANDAMENTI SONO UGUALI

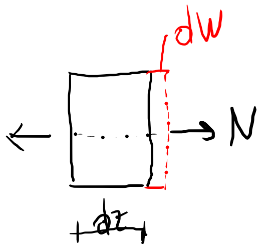
PERÒ

$$J_x^{\square} = 2 J_x^{I}$$



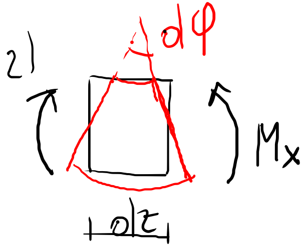
DEFORMAZIONE INDOTTA DAL TAGLIO DEL CONCIO ELEMENTARE (DEL CILINDRO DSV)

1)



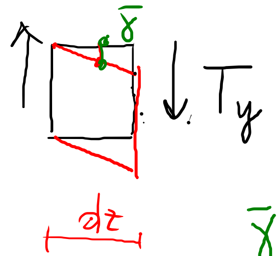
$$\varepsilon = \frac{N}{EA}$$

2)

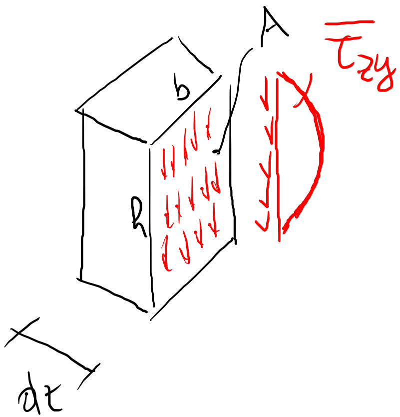


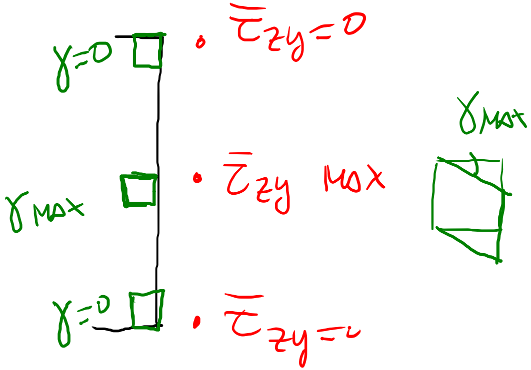
$$\chi = \frac{M_x}{EJ_x}$$

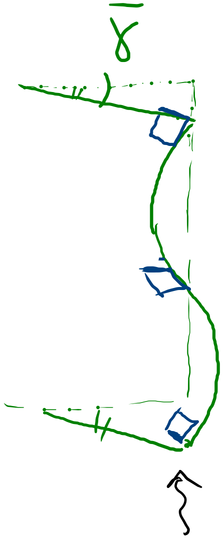
3) TAGLIO-FLESS.



$$\bar{\gamma} \Leftrightarrow T_y$$







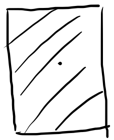
INGOBBAMENTO DELLA SEZIONE PER SCORRIMENTO DISOMOGENEO

$$\bar{\gamma} = \kappa \frac{T_y}{GA}$$

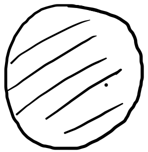
κ: FATTORE DI TAGLIO (ADIMENS).

$$\kappa > 1$$

$$\gamma = \frac{\bar{\tau}_{zy}}{G}$$: LEGGE ELASTICA LINEARE

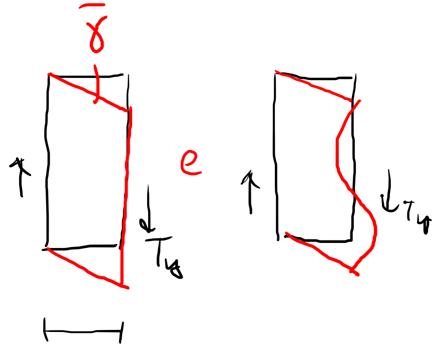


$K = \frac{6}{5}$



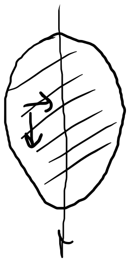
$K = \frac{32}{27}$

PER CALCOLARE K UTILIZZO UN METODO ENERGETICO: IMPONGO CHE ABBIANO LA STESSA ENERGIA ELASTICA (Φ)

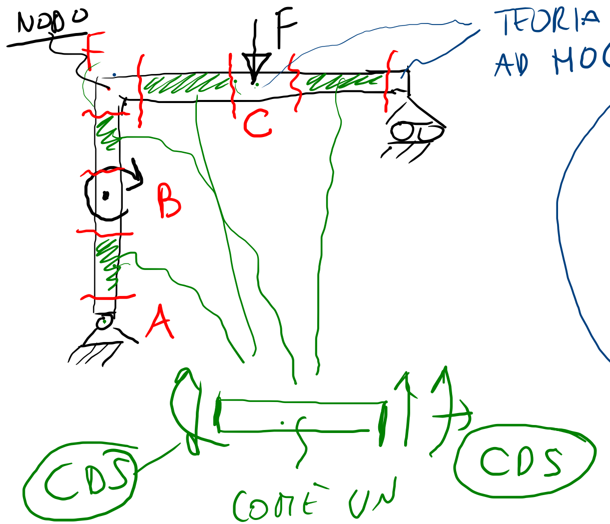


$\Rightarrow K$

$$\Phi = \int_V \left(\tau_{zx}^2 + \tau_{zy}^2\right) \frac{1}{2G} \, dV \qquad \left(\int_V \underset{\sim}{\sigma} \cdot \underset{\sim}{\varepsilon} \, dV \right) + \tau = G\gamma$$

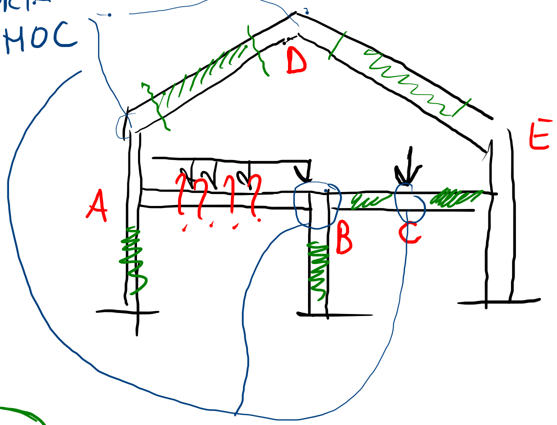


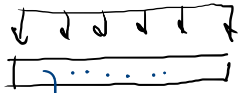
ESTENSIONE DEL PROBL. DSV E TEORIA TECNICA DELLA TRAVE



TEORIA AD HOC

COME UN CILINDRO DI SV



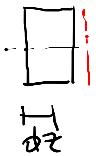


QUI POSSO DIMOSTRARE CHE LA TEORIA DSV SI ADATTA BENE (NAVIER, JOURAWSKY)

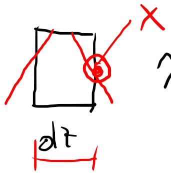
USO N, T, M DEI VARI PUNTI

TEORIA TECNICA DELLA TRAVE: ADOTTA LA TEORIA DEL CILINDRO DSV E LA APPLICA AI CASI PRATICI UTILI PER LA PROGETTAZIONE. SONO ESCLUSE LE PARTI DI TRAVE SOLLECITATE PUNTUALMENTE DA CARICHI E MOMENTI CONCENTRATI E NODI DI STRUTTURE

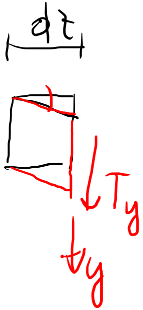
TEORIA DELLA TRAVE PIANA:



$$\varepsilon = \frac{N}{EA}$$



$$\chi = \frac{M_x}{EJ_x}$$

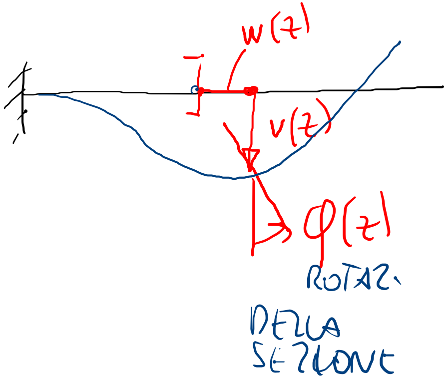


$$\bar{\gamma} = \frac{\kappa T_y}{GA}$$

LEGAME COSTITUTIVO
(TRAVE EL. LINEARE)

$$\frac{dN}{dz} = -p(z) \qquad \frac{dM}{dz} = T(z) \qquad \frac{dT}{dz} = -q(z)$$

EQUAZ. EQUILIBRIO
PUNTUALE

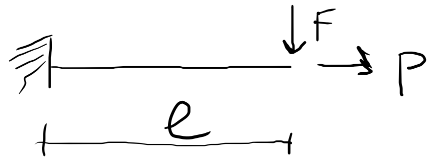


LEGAME TRA
COMPONENTI DI
SPOSTAMENTO DELLA
TRAVE E DEFORMAZIONI

w, v, φ $\qquad$ $\varepsilon, \chi, \bar{\gamma}$

CONGRUENZA

SPOSTAMENTI? $w(z),\ v(z),\ \varphi(z)$ $\quad z \in [0, \ell]$



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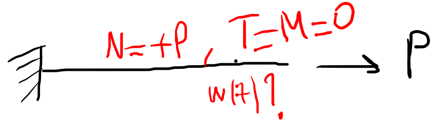

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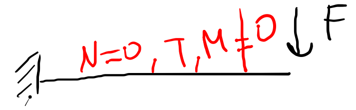
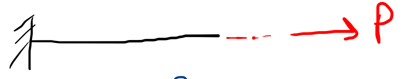


} SOVRAPPOSIZIONE DEGLI EFFETTI

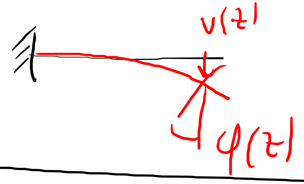


$w(z) \neq 0 \quad \begin{cases} v = 0 \\ \varphi = 0 \end{cases}$

$\boxed{N \neq 0}$

PROBLEMA ASSIALE

PROBLEMA DISACCOPPIATI

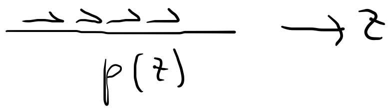


$w(z) = 0 \ ; \ \begin{cases} v \neq 0 \\ \varphi \neq 0 \end{cases}$

PROBLEMA DI FLESSIONE E SCORRIM.

$\boxed{M, T \neq 0}$

PROBLEMA ASSIALE



EQUILIBRIO: $\dfrac{dN}{dz} = -p$

CONGRUENZA $\dfrac{dw}{dz} = \varepsilon$

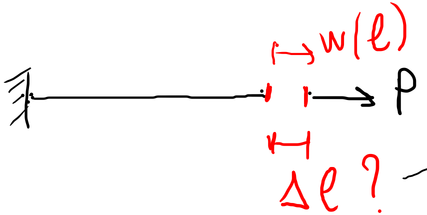
LEG. COST. $\varepsilon = \dfrac{N}{EA}$

$\left.\right\}\ \dfrac{dw}{dz} = \dfrac{N}{EA} \Rightarrow EA\, w'(z) = N \Rightarrow N' = (EA\, w'(z))'$

$-p = (EA\, w'(z))'$

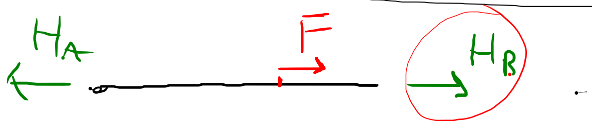
$N(z) = +P$

$$\begin{cases} w'(z) = \dfrac{P}{EA} \\ w(0) = 0 \end{cases} \Rightarrow w(z)$$



Δl ? → $w(l)$

$$\boxed{\Delta l = \frac{Pl}{EA}}$$: DAL PROBL 1 DSV



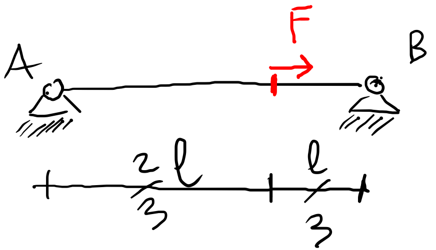
$\xrightarrow{+}$: $-H_A + F + H_B = 0$ 1 EQUAZ. CON 2 INCOGNITE

STAT. INDETERM.

∞^1 SOLUZ.

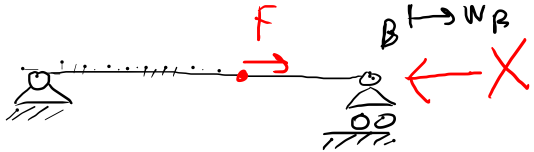
AGGIUNGO UN'EQUAZ. DI "ELASTICITA'"

UNA STRUTTURA IPERSTATICA



$g = 3$
$v = 4$
$i = 1$

∞^1 SOLUZ CON LE E.C.S.



(INCOGNITA IPERSTATICA)

STR. ISOSTATICA
(STR. PRINCIPALE - S.P.)

$$\boxed{w_B(F, X) = 0}$$

EQ. DI CONGRUENZA