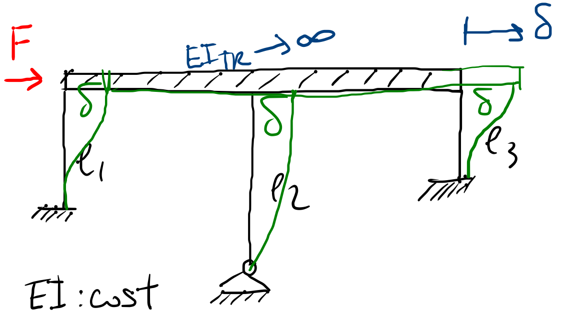
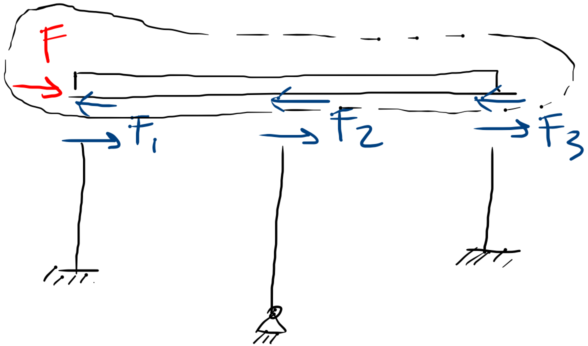
2° ESEMPIO: RIPARTIZ. DI UNA FORZA ORIZZ. APPLICATA AD UNA TRAVE RIGIDA (SHEAR-TYPE)

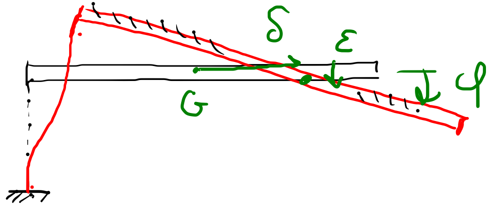
28/3/23



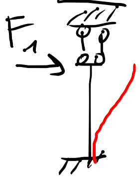
EI: cost



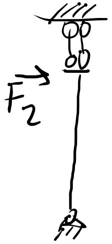
IN GENERALE QUESTO SIST. HA 3 GDL, $\delta, \varepsilon, \varphi$.



PERÒ PER CALCOLARE LA DISTRIBUZ. DI F NEI 3 PILASTRI È SUFFICIENTE, TENUTO CONTO CHE I PILASTRI SONO QUASI INESTENSIBILI, CONSID. SOLO LA TRASLAZ. δ.



$$\delta = \frac{F_1 l_1^3}{12EI} \quad ; \quad F_1 = \frac{12EI}{l_1^3}\delta$$



$$F_2 = \frac{3EI}{l_2^3}\delta$$

EQUIL. TRASL. ORIZZ. DELLA TRAVE

$$F - F_1 - F_2 - F_3 = 0 \quad ; \quad F = \overbrace{\left[\frac{12EI}{l_1^3} + \frac{3EI}{l_2^3} + \frac{12EI}{l_3^3}\right]}^{\text{RIGIDEZZA ALLA TRASLAZ.}}\delta \quad ; \quad F = K_T\,\delta \Rightarrow \boxed{\delta = \frac{F}{K_T}}$$

QUANDO VALGONO $F_1, F_2, \dots$?

$$\rho_1 + \rho_2 + \rho_3 = 1$$

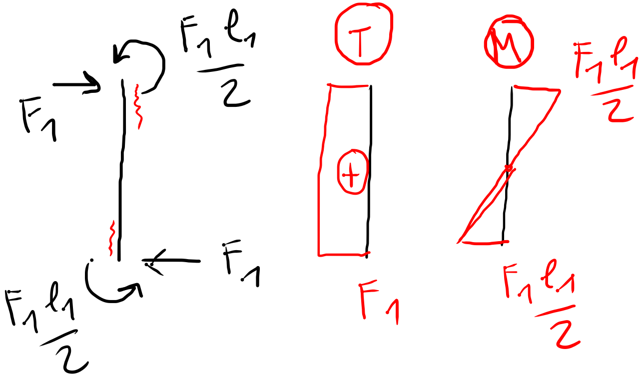
$$F_1 = \frac{12EI}{l_1^3}\frac{F}{K_T} = \underbrace{\frac{12EI}{l_1^3}\frac{1}{K_T}}_{\rho_1} F$$

COEFF DI RIPARTIZIONE

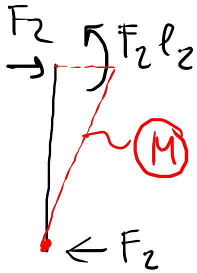
$$F_2 = \frac{3EI}{l_2^3}\frac{F}{K_T} = \underbrace{\frac{3EI}{l_2^3}\frac{1}{K_T}}_{\rho_2} F$$

$$F_3 = \frac{12EI}{l_3^3}\frac{F}{K_T}$$

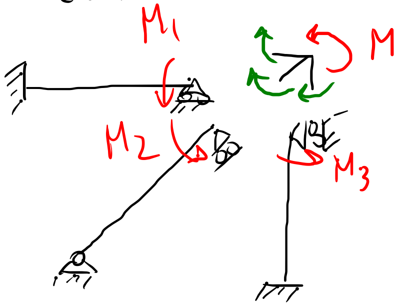
NOTO F_1 ....



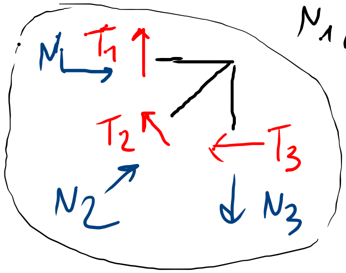
NOTO F_2



OSSERV. IMPORTANTE SUI DUE ESEMPI INTRODOTTI



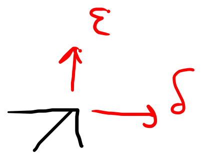
BILANCIO DEI MOMENTI OK



N_1, N_2, N_3 SONO TALI DA BILANCIARE LE FORZE NEL NODO.

(HO PERÒ A DISPOSIZ. SOLO 2 EQ. DI BILANCIO; QUINDI HO UN NUOVO PROBLEMA IPERSTATICO - 2 EQ IN 3 INCOGNITE.

INTRODUCO GLI SPOST. δ, ε DEL NODO.)

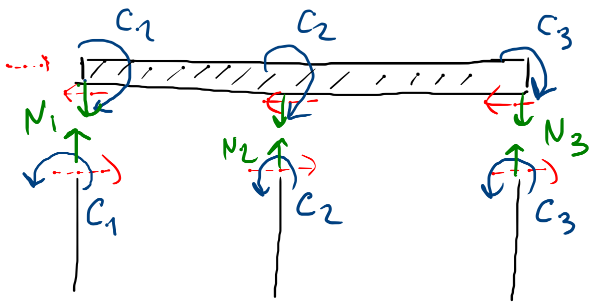


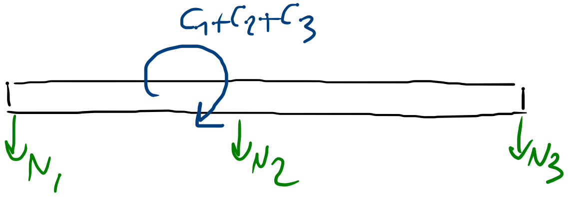
NOTI I MOMENTI M_i È SEMPLICE CALCOLARE ANCHE I TAGLI T_i

COSA POSSIAMO DIRE PER QUANTO RIGUARDA LE FORZE NORMALI N_i?

CON IL METODO INTRODOTTO NON POSSIAMO DIRE NULLA

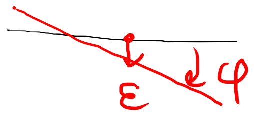
PER LA TRAVE RIGIDA (TERZO SHEAR-TYPE)





N_1, N_2, N_3 : SONO 3 INCOGNITE DEL "NUOVO" PROBLEMA:

I G.D.L. COINVOLTI SONO

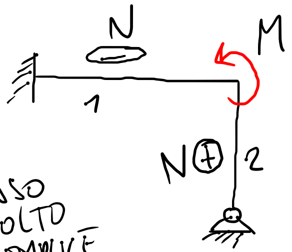


IMPONGO IL BILANCIO DELLE FORZE VERTICALE E DEI MOMENTI;

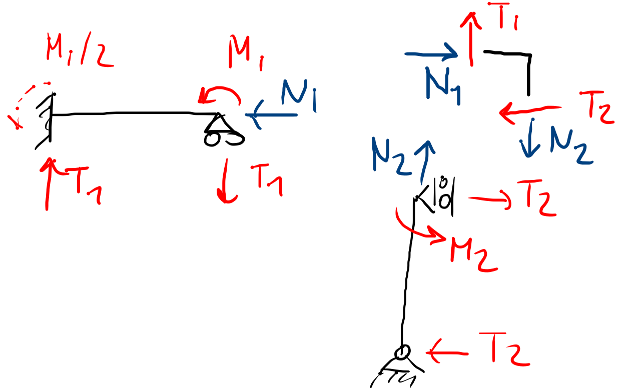
2 EQ. IN 3 INCOGNITE

FORMULO UN NUOVO PROBLEMA NEGLI SPOST. ε, φ.

ALCUNI CASI SEMPLICI DI DETERMINAZ. DI FORZE NORMALI NELLE ASTE

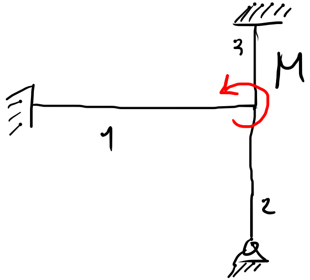


CASO MOLTO SEMPLICE

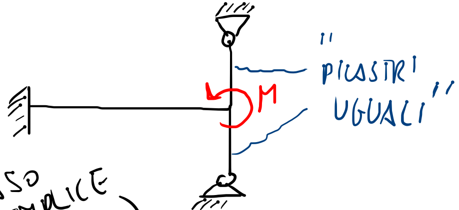


$N_1 = T_2$

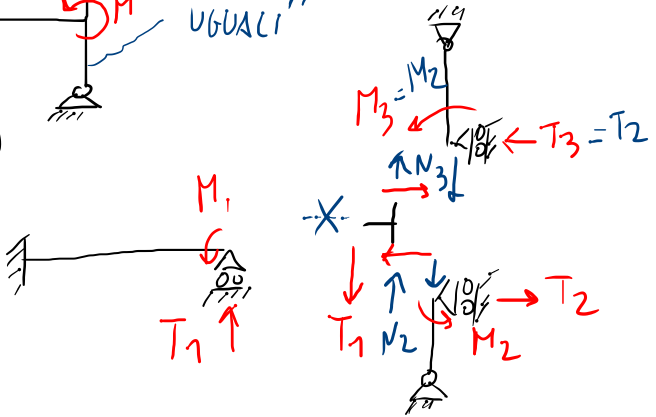
$N_2 = T_1$



CASO NON IMMEDIATO



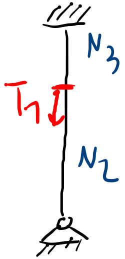
CASO SEMPLICE (SIMMETRIA)

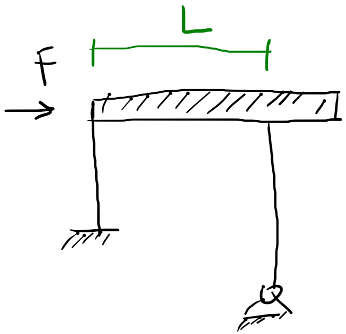


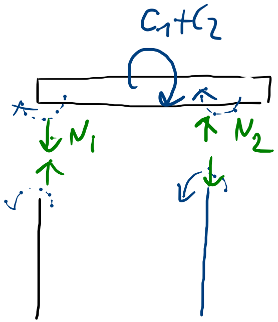
$N_2 = N_3 = \frac{T_1}{2}$

$N_1 = 0$

Per calcolare N_2 ed N_3 devo ripartire T_1 con uno schema iperstatico:



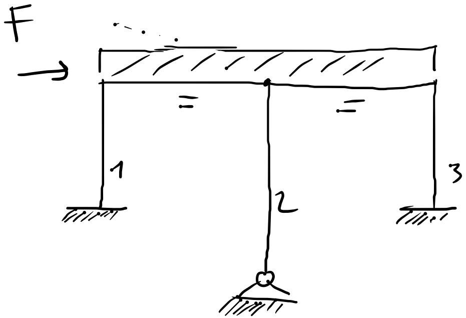


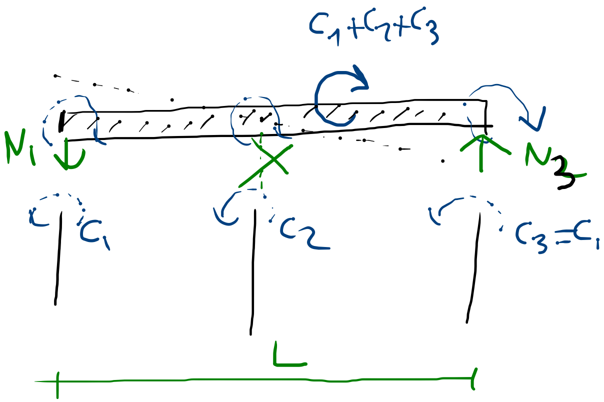


CASO MOLTO SEMPLICE

$N_1 = N_2$

$N_1 L = C_1 + C_2 \Rightarrow N_1 = \dfrac{C_1 + C_2}{L}$



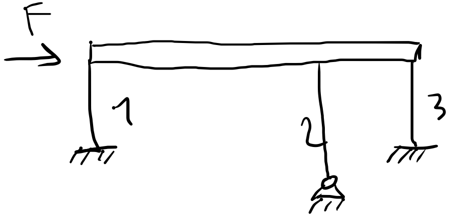


$N_1 = N_3$

$N_1 L = C_1 + C_2 + C_3 \Rightarrow N_1$

$N_2 = 0$

CASO SEMPLICE (SIMMETRIA)

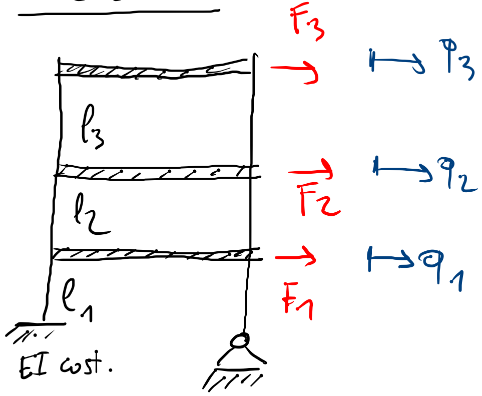


Per calcolare N_1, N_2, N_3 devo impostare un problema generale esprimendo $N_1(\xi,\varphi)$, $N_2(\xi,\varphi)$, $N_3(\xi,\varphi)$

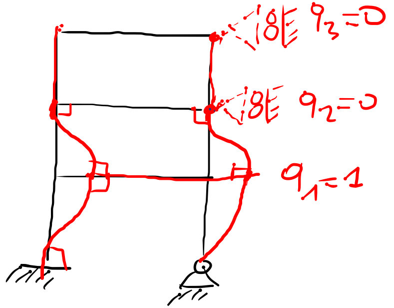
DAL PUNTO DI VISTA OPERATIVO LA COMPONENTE K_{ij} DELLA MATRICE DI RIGIDEZZA CORRISPONDE ALLA FORZA CORRELATA ALLO SPOST. i-SIMO QUANDO IL GDL j-SIMO VALE 1 E TUTTI I RESTANTI GDL SONO NULLI.

3° ESEMPIO

$$\boxed{q_1 = 1 \, ; \, q_2 = q_3 = 0} \Rightarrow K_{11}, K_{21}, K_{31}$$ I COLONNA DI K_{ij}



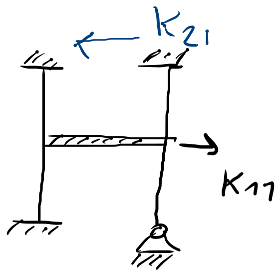
TELAIO SHEAR-TYPE



$\rightarrow K_{31}$
$\leftarrow K_{21}$
REAZ VINC. VINCOLI AUSILIARI

$\rightarrow K_{11}$
FORZA CHE INDUCE $q_1 = 1$

$K_{31} = 0$



$$\underset{\sim}{K}\, \underline{q} = \underline{F} \; ; \; \underset{\sim}{K} = \begin{bmatrix} 3\times 3 \end{bmatrix} ; \; \underline{F} = \begin{bmatrix} F_1 \\ F_2 \\ F_3 \end{bmatrix}$$

STATICO $$\underline{q} = \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix}$$

$$\Rightarrow \underline{q} = \underset{\sim}{K}^{-1} \underline{F}$$