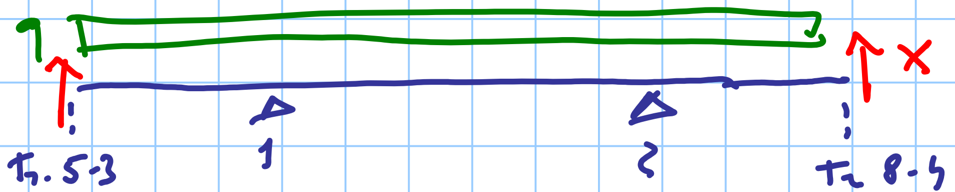
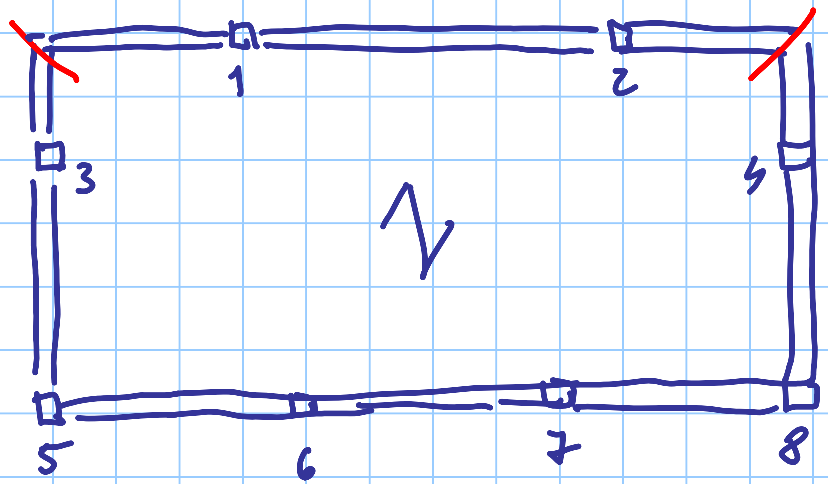
Titolo nota 31/03/2015

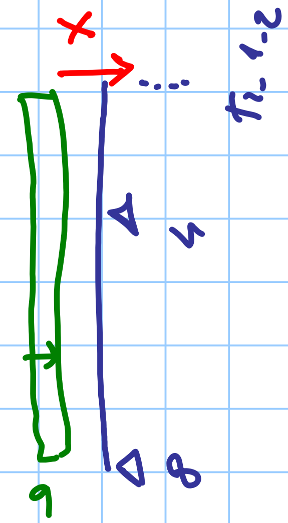
METODO DELLE FORZE	DEGLI SPOSTAMENTI
inserire sconnessioni – struttura isostatica – o iperstatica "nota"	bloccare movimenti
azioni trasmesse dalle sconnessioni sono le incognite	componenti di movimento incognite
determino incognite con condizioni di CONGRUENZA	condizioni di EQUILIBRIO



forze verticali

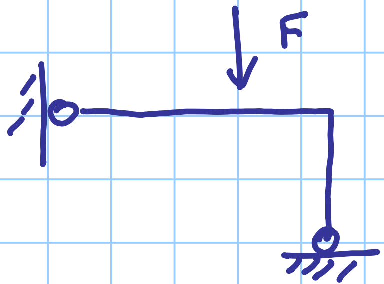
abbassamento

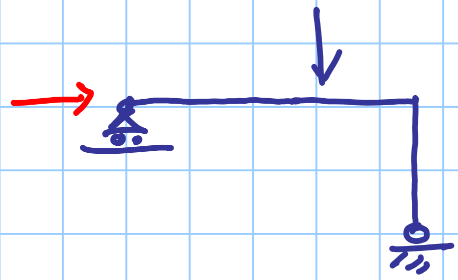




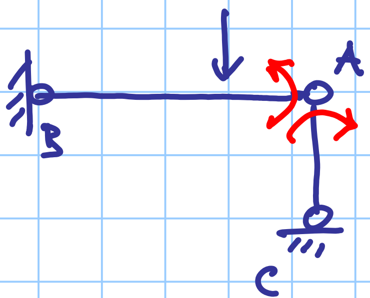
pilastri visti come appoggi

Trascuriamo congruenza flesso-torsionale

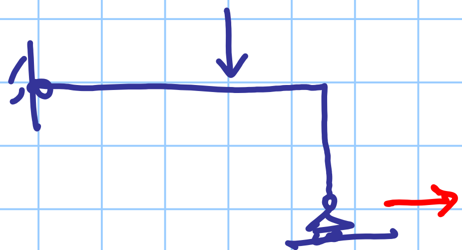




$v_B^{m} = 0$

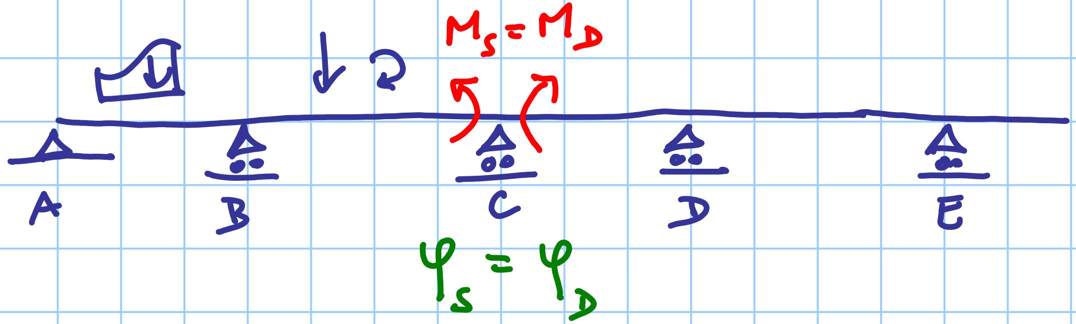


$\varphi_{AB} = \varphi_{AC}$



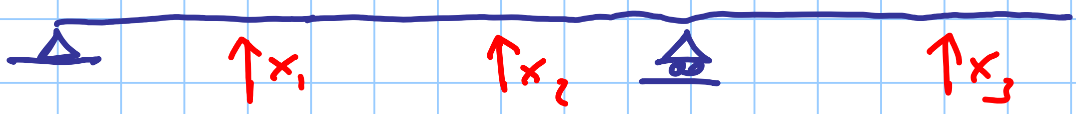
$v_C^{m} = 0$

TRAVE CONTINUA



3 volte iperstatica

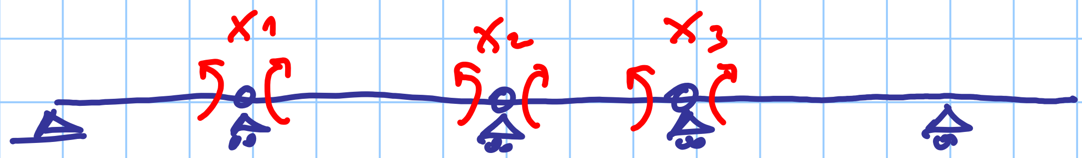
4 campate, 1 a sbalzo



$v_B^{vert} = 0$

$v_C = 0$

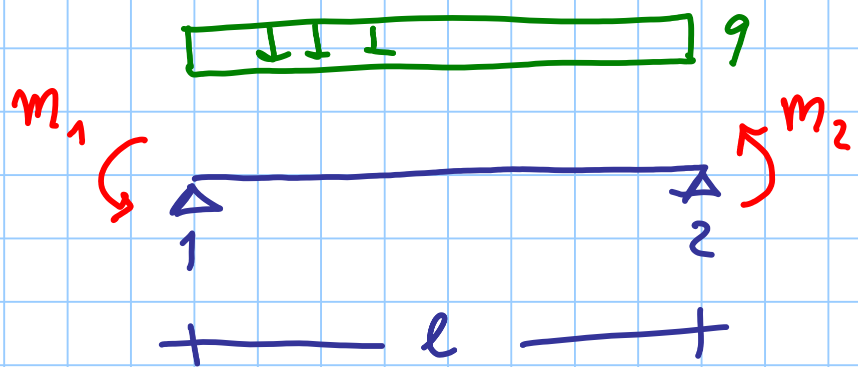
$v_E = 0$

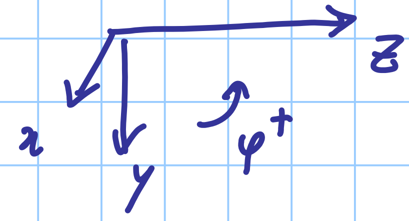


$\varphi_{BA} = \varphi_{BC}$

$\varphi_{CB} = \varphi_{CD}$

$\varphi_{DC} = \varphi_{DE}$





Trave sez. cost.

$$\varphi_1 = \frac{m_1 \ell}{3EI} - \frac{m_2 \ell}{6EI} - \frac{q \ell^3}{24EI}$$

$$\varphi_2 = -\frac{m_1 \ell}{6EI} + \frac{m_2 \ell}{3EI} + \frac{q \ell^3}{24EI}$$

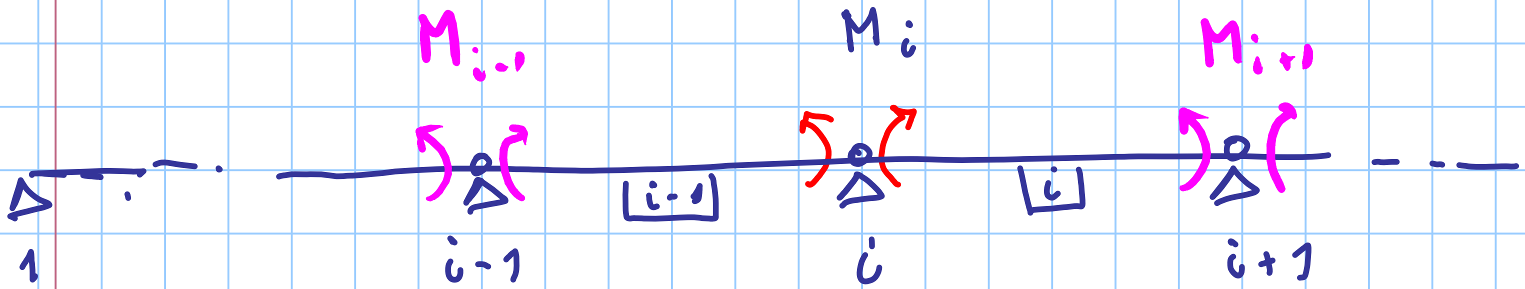
$$\alpha_1 = \frac{\ell}{3EI} = \alpha_2$$

$$\beta = \frac{\ell}{6EI}$$

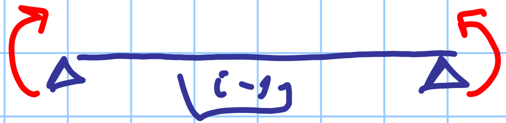
in generale

$$\varphi_1 = \alpha_1 m_1 - \beta m_2 + \varphi_{1(q)}$$

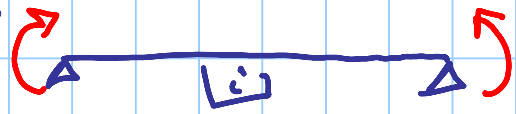
$$\varphi_2 = -\beta m_1 + \alpha_2 m_2 + \varphi_{2(q)}$$



$m_1^{i-1} = -M_{i-1}$ $\qquad$ $M_i = m_2^{i-1}$



$m_1^{i} = -M_{i}$ $\qquad$ $M_{i+1} = m_2^{i}$



$$\varphi_{i,S} = \varphi_{i,D}$$

φ_2^{i-1} $\qquad\qquad$ φ_1^{i}

$$\varphi_2^{i-1} = -\beta^{i-1} \underbrace{m_1^{i-1}}_{-M_{i-1}} + \alpha_2^{i-1} \underbrace{m_2^{i-1}}_{M_i} + \varphi_{2(q)}^{i-1}$$

$$\varphi_2^{i-1} = \varphi_1^{i}$$

$$\varphi_1^{i} = \alpha_1^{i} \underbrace{m_1^{i}}_{-M_i} - \beta^{i} \underbrace{m_2^{i}}_{M_{i+1}} + \varphi_{1(q)}^{i}$$

$$+\beta^{i-1} M_{i-1} + \alpha_2^{i-1} M_i + \varphi_{2(q)}^{i-1} = -\alpha_1^{i} M_i - \beta^{i} M_{i+1} + \varphi_{1(q)}^{i}$$

$$\beta^{i-1} M_{i-1} + \left(\alpha_1^{i} + \alpha_2^{i-1}\right) M_i + \beta^{i} M_{i+1} = \varphi_{1(q)}^{i} - \varphi_{2(q)}^{i-1}$$

$$\begin{bmatrix} x & x & 0 & 0 & 0 & 0 \\ x & x & x & 0 & 0 & 0 \\ 0 & x & x & x & 0 & 0 \\ 0 & 0 & x & x & x & 0 \\ 0 & 0 & 0 & x & x & x \\ 0 & 0 & 0 & 0 & x & x \end{bmatrix}$$

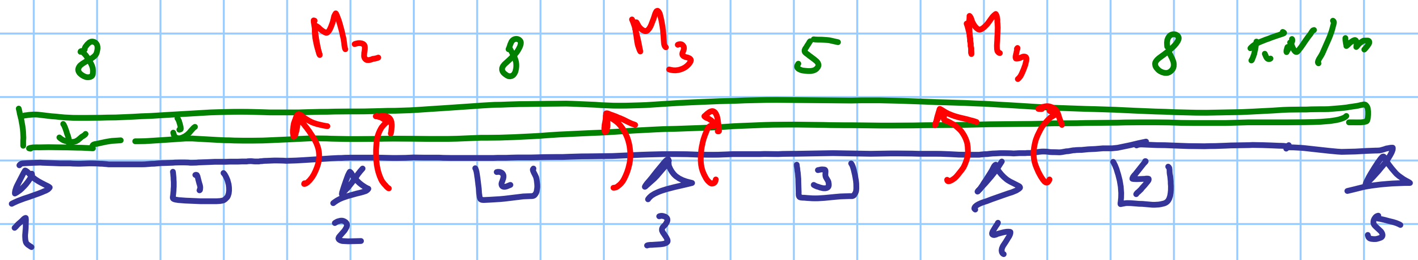
matrice dei coeff. incogniti

procedimento generale

Triangolarizzazione

e

sostituzione all'indietro



$EI =$
$= \text{cost}$

	4.50	5.40	6.00	4.20
$\alpha_1 = \alpha_2 = \frac{\ell}{3EI}$	$\boxed{\frac{1.50}{EI}}$ α_2^1	$\boxed{\frac{1.80}{EI}}$ α_1^2	$\frac{2.00}{EI}$	$\frac{1.40}{EI}$
$\beta = \frac{\ell}{6EI}$	$\frac{0.75}{EI}$	$\boxed{\frac{0.50}{EI}}$ β^2	$\frac{1.00}{EI}$	$\frac{0.70}{EI}$
$\varphi_{1(q)} = -\frac{q\ell^3}{24EI}$	$-\frac{30.38}{EI}$	$\boxed{-\frac{52.49}{EI}}$ $\varphi^2_{1(q)}$	$+\frac{45.00}{EI}$	$-\frac{24.70}{EI}$
$[= -\varphi_{2(q)}]$				

$$\beta^{i-1} M_{i-1} + \left(\alpha_1^{i} + \alpha_2^{i-1}\right) M_i + \beta^{i} M_{i+1} = \varphi_{1(q)}^{i} - \varphi_{2(q)}^{i-1}$$

$i = 2$ $$\frac{3.30}{EI} M_2 + \frac{0.90}{EI} M_3 = -\frac{52.49}{EI} - \frac{30.38}{EI}$$

$i = 3$ $$\frac{0.90}{EI} M_2 + \frac{3.80}{EI} M_3 + \frac{1.00}{EI} M_4 = -\frac{45.00}{EI} - \frac{52.49}{EI}$$

$i = 4$ $$\frac{1.00}{EI} M_3 + \frac{3.40}{EI} M_4 = \frac{-24.70}{EI} - \frac{45.00}{EI}$$

$$3.30\, M_2 + 0.90\, M_3 = -82.87$$

$$0.90\, M_2 + 3.80\, M_3 + 1.00\, M_4 = -97.49$$

$$1.00\, M_3 + 3.40\, M_4 = -69.70$$

$M_2 = -25.11 - 0.27\, M_3$

$M_3 = -21.10 - 0.28\, M_4$

$M_4 = -15.88$ KNm

$M_2 = -20.59$ KNm

$M_3 = -16.74$ KNm