alcotra 2007 - 2013

RiskNat

PROJET STRATEGIQUE RISQUES NATURELS (ATTIVITA' B6)

EDIFICI IN MURATURA
Analisi statica lineare

Région Autonome Vallée d'Aoste
Regione Autonoma Valle d'Aosta

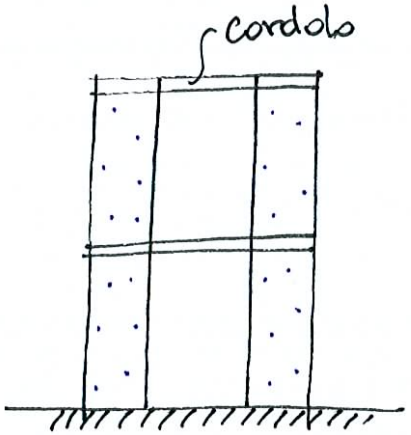
DANIELE FERRETTI

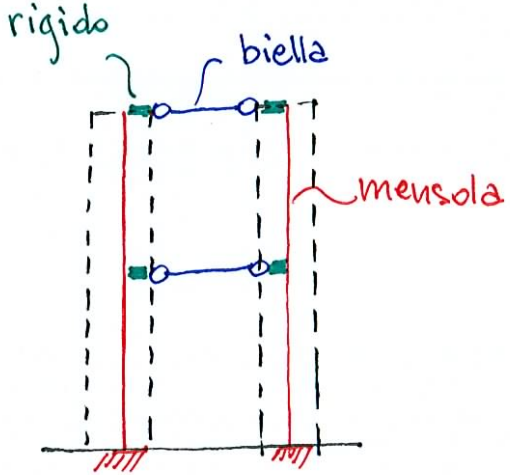
Dipartimento di Ingegneria Civile, dell' Ambiente, del Territorio ed Architettura

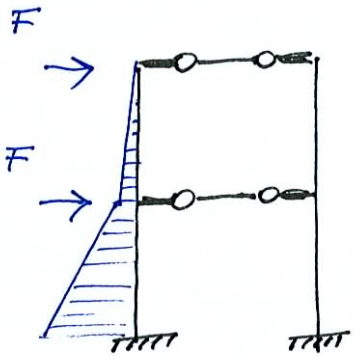
Università degli Studi di Parma

Verrès, 2 dicembre 2011

TELAIO EQUIVALENTE



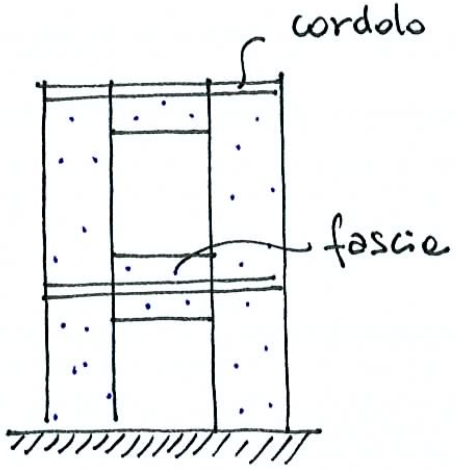


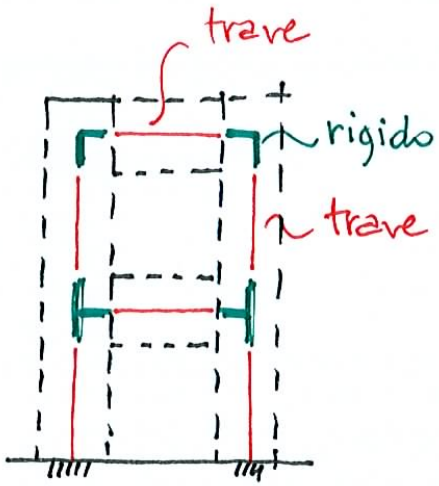


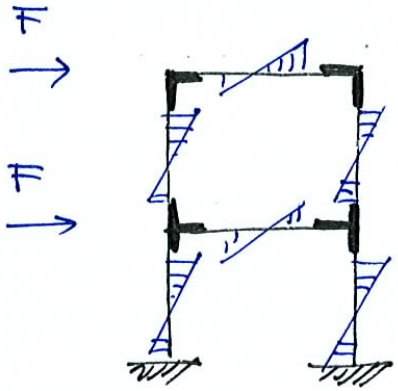
MENSOLE

I maschi si comportano come mensolone

TELAIO EQUIVALENTE



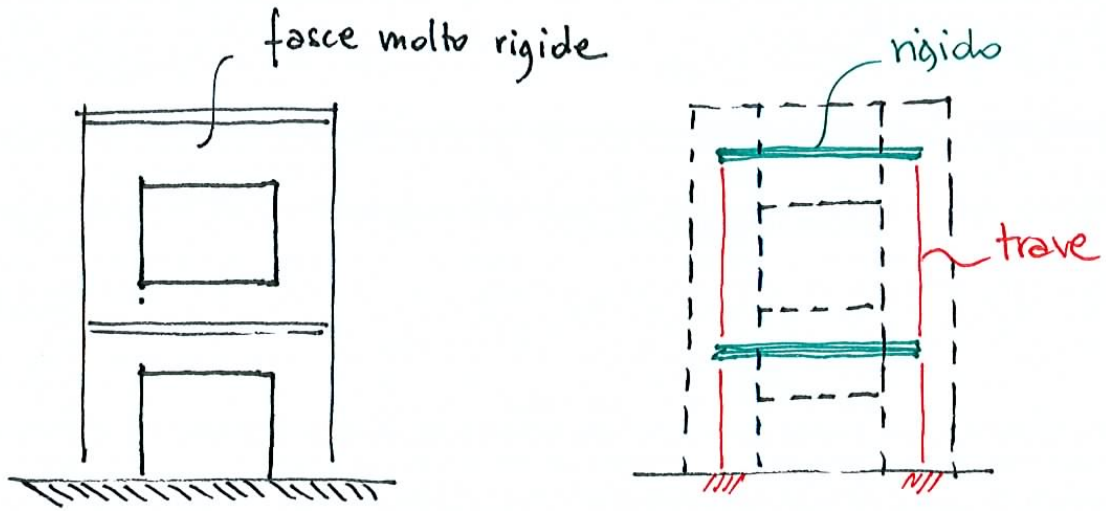


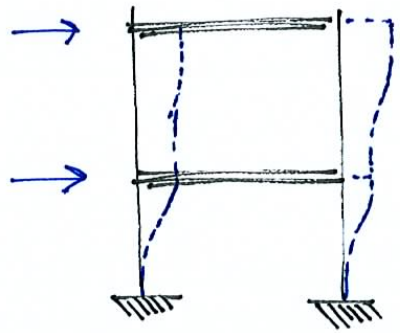


TELAIO

Le fasce sono sollecitate e DEVONO essere verificate

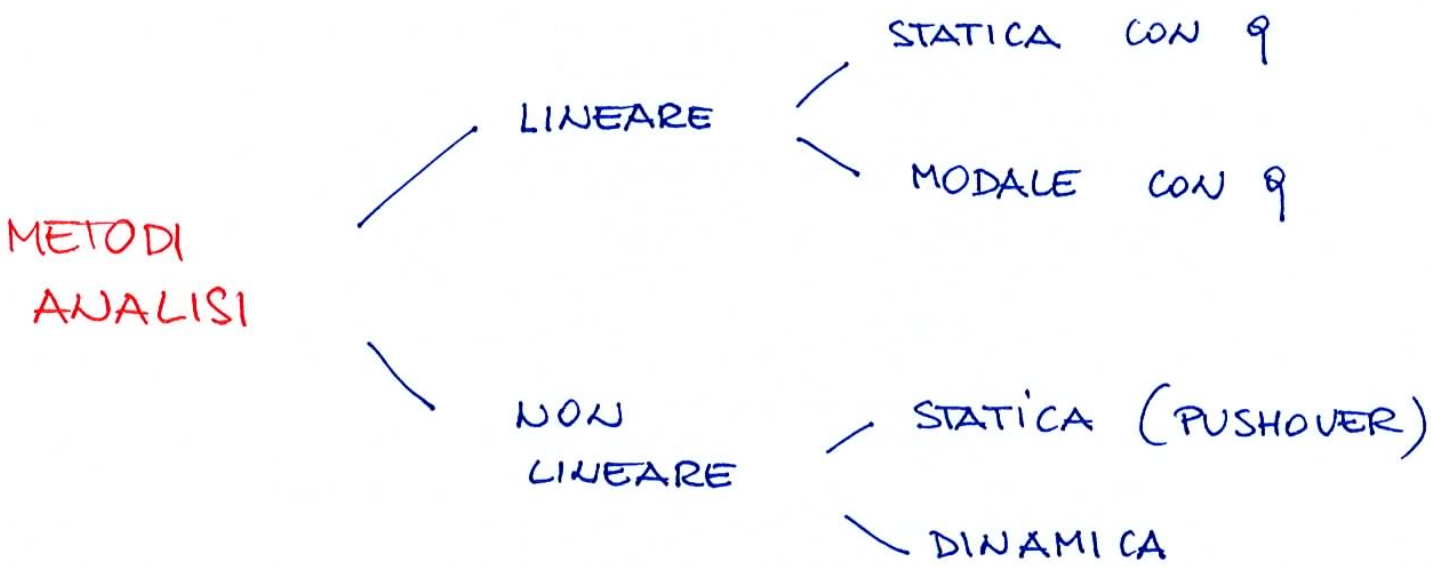
TELAIO EQUIVALENTE



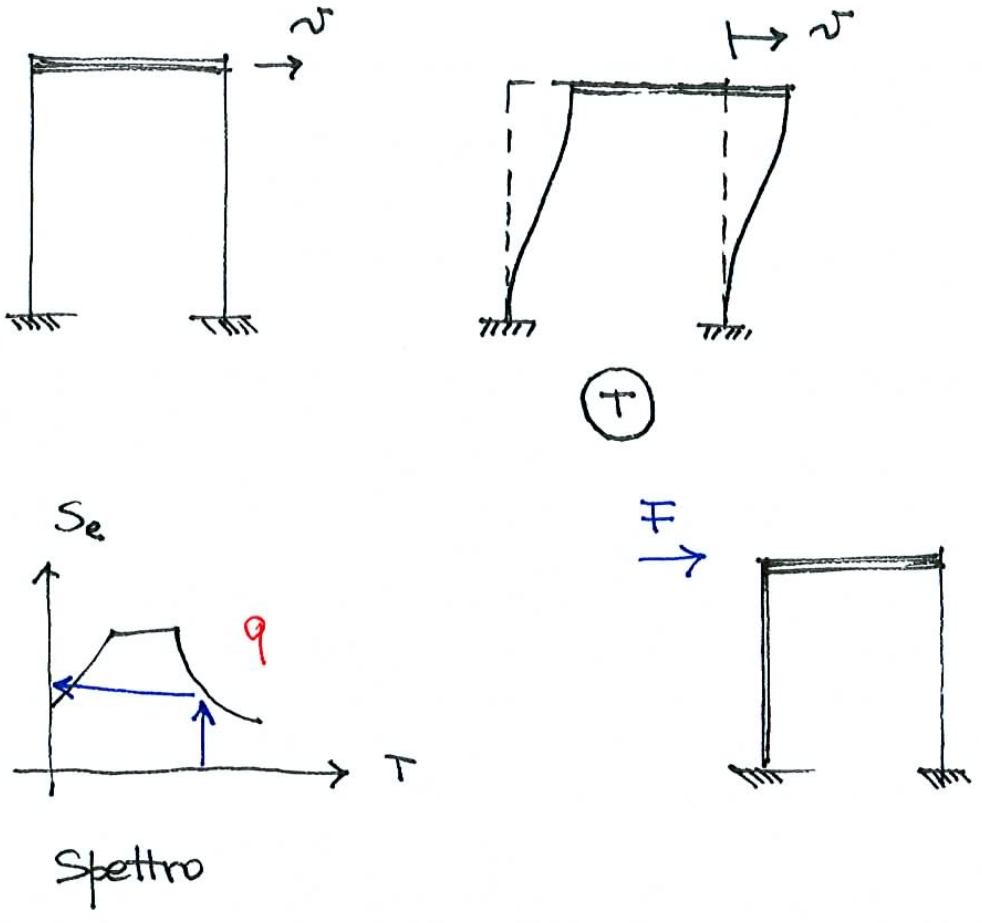


TELAIO SHEAR TYPE

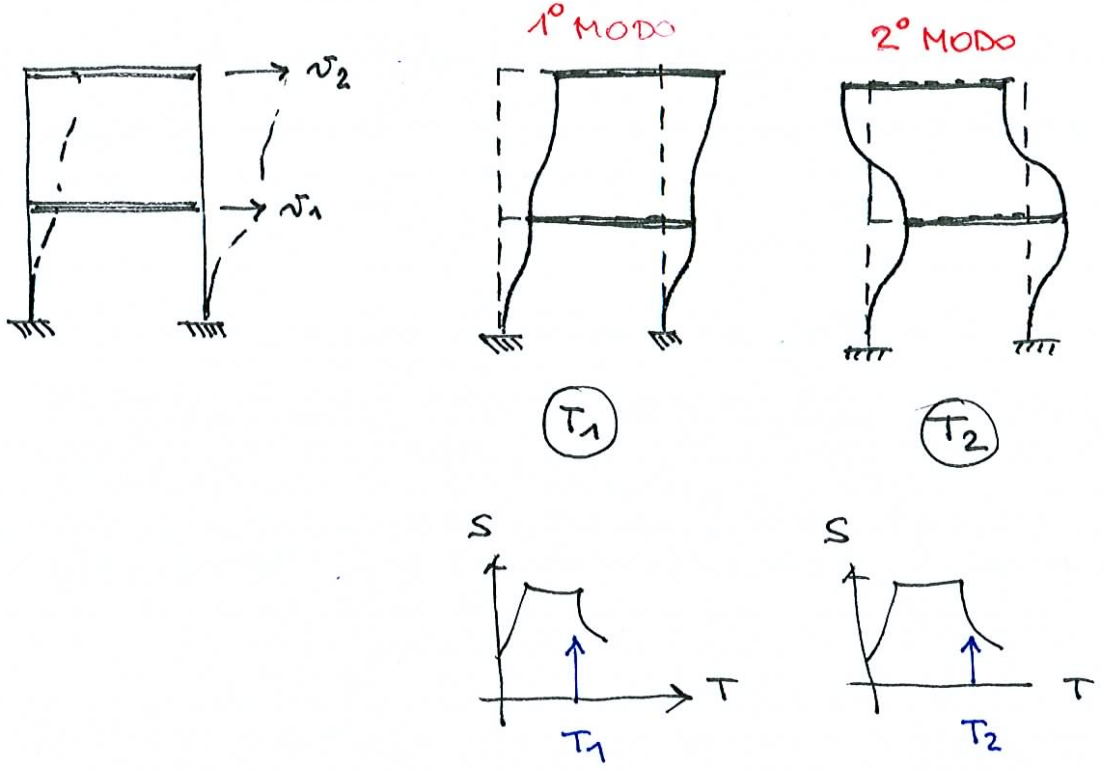
METODI DI ANALISI



ANALISI DINAMICA MODALE



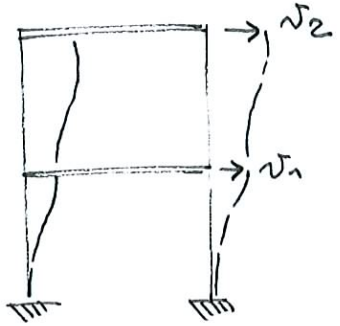
ANALISI DINAMICA MODALE

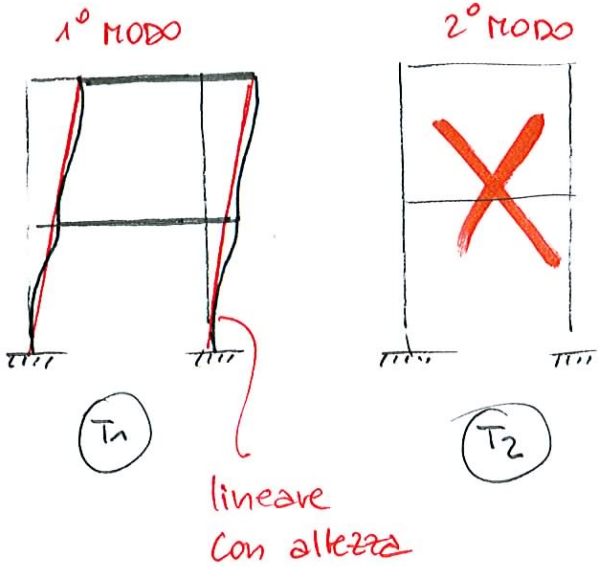


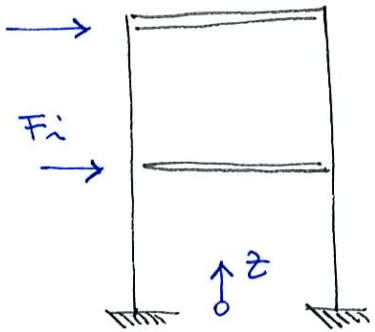
COMBINAZIONE MODALE

$$E = \left(\sum_j \sum_i \rho_{ij} E_i E_j \right)^{1/2}$$

ANALISI STATICA LINEARE



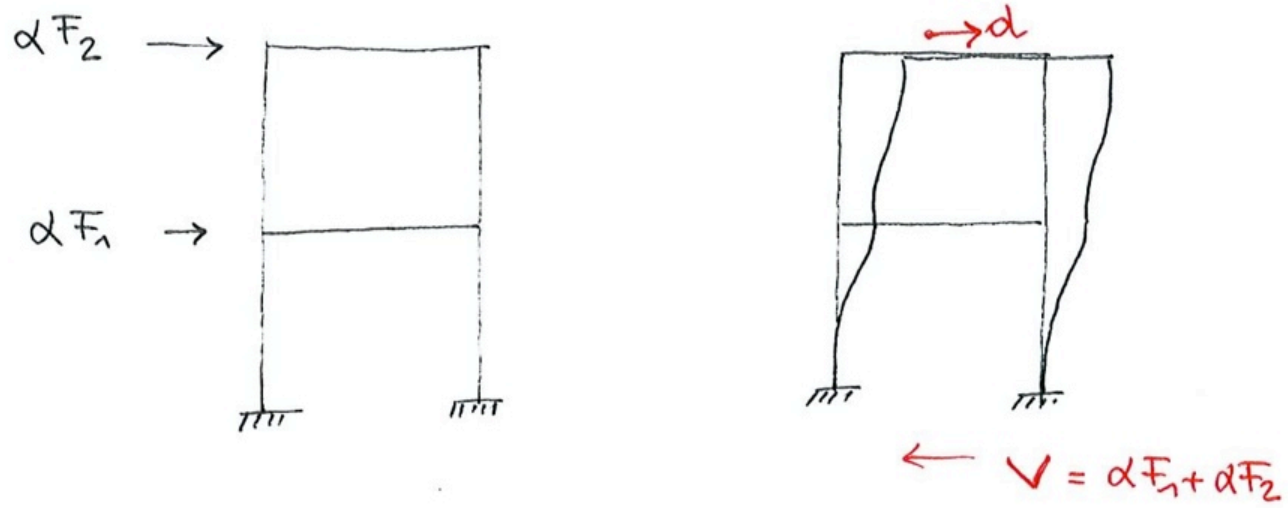


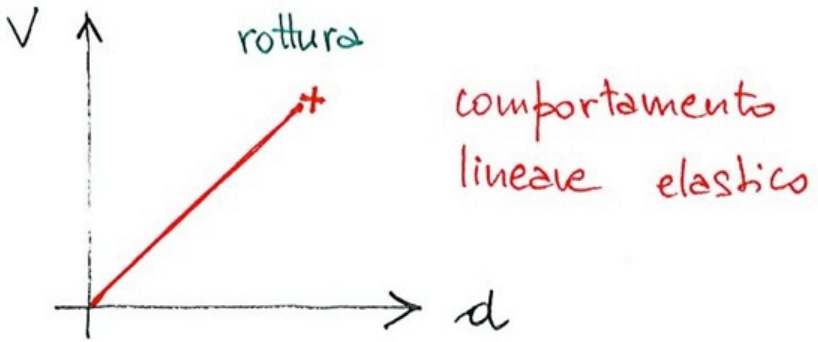


$$T_1 \approx C_1 H^{3/4}$$

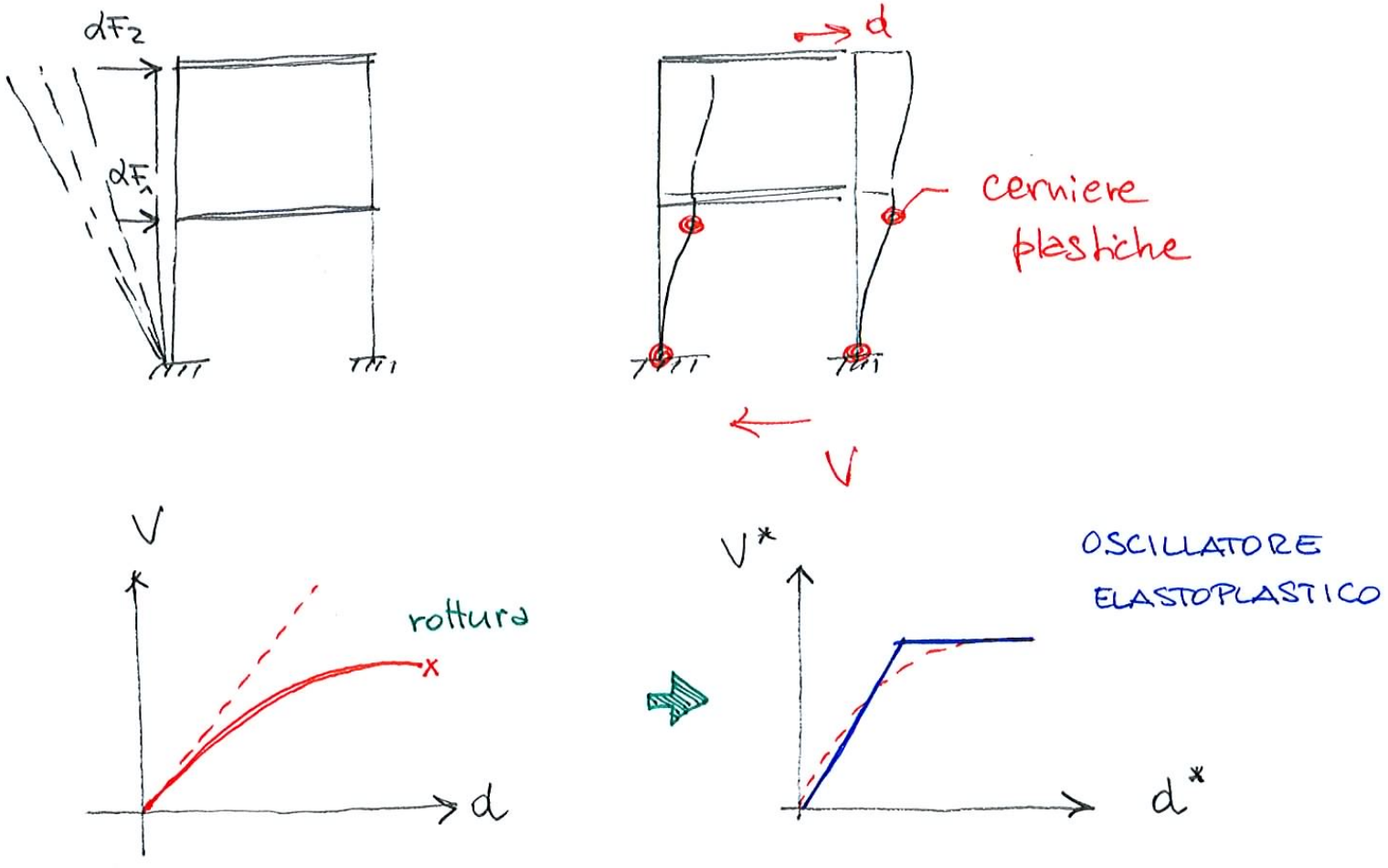
$$F_i = F_t \, z_i \, W_i \Big/ \sum_j z_j W_j$$

ANALISI STATICA LINEARE

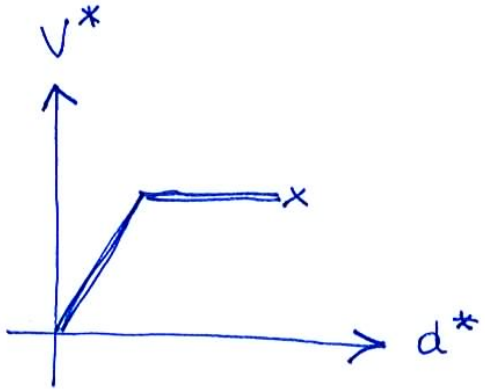


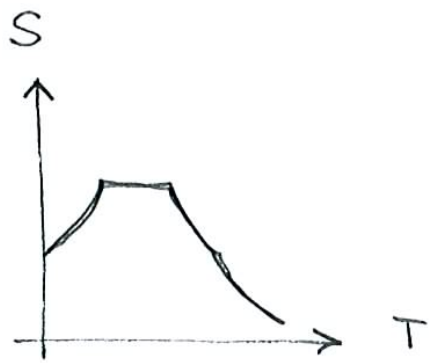


ANALISI STATICA NON LINEARE (PUSHOVER)



ANALISI STATICA NON LINEARE (PUSHOVER)





CALCOLO SPOSTAMENTO

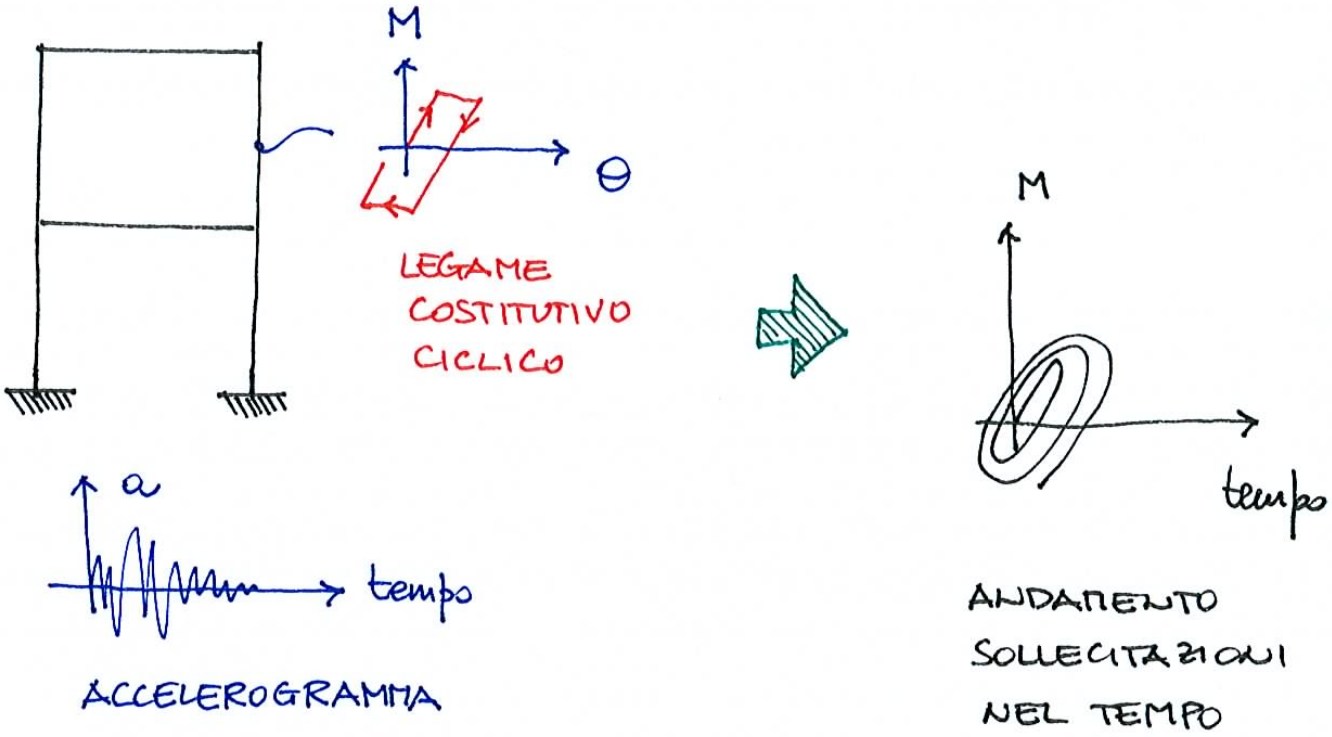
OSCILLATORE ELASTO PLASTICO

VERIFICA DEGLI SPOSTAMENTI

ANALISI STATICA NON LINEARE (PUSHOVER)

- VANTAGGI
  - considera non linearità materiali
  - evidenzia modalità rottura
  - permette calcolo q
- SVANTAGGI
  - scelta distribuzione di forze
  - metodo di verifica
  - non sempre può essere applicato

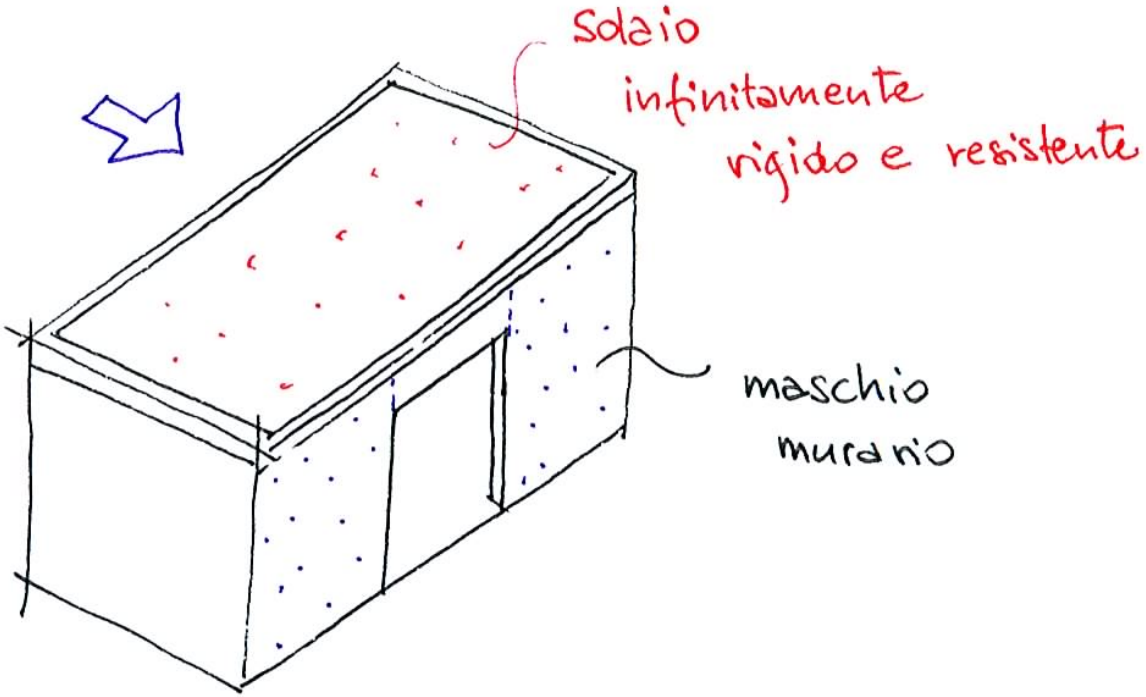
ANALISI DINAMICA



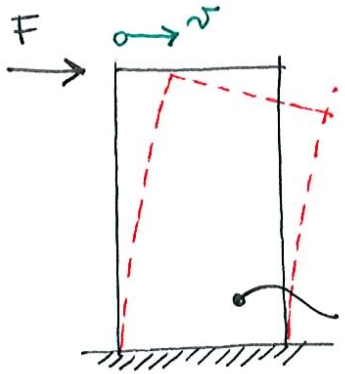
ANALISI DINAMICA

- VANTAGGI
  - generale (no ipotesi semplificative)
  - "Sperimentazione" numerica
- SVANTAGGI
  - è un metodo di verifica
  - richiede leggi costitutive cicliche (QUALI ??)
  - tempi di calcolo lunghi

ANALISI STATICA LINEARE



ANALISI STATICA LINEARE

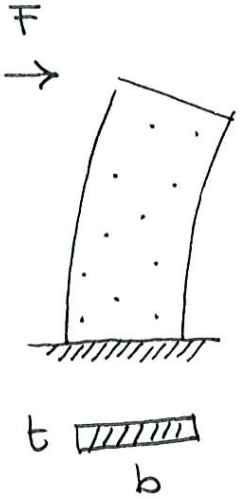


comportamento lineare elastico materiale

$$F = kv$$

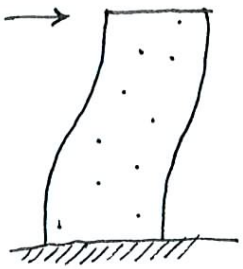
si comporta come molla di rigidezza k

ANALISI STATICA LINEARE



$$k = \frac{1}{\frac{h^3}{3EI} + \frac{2h}{GA}}$$

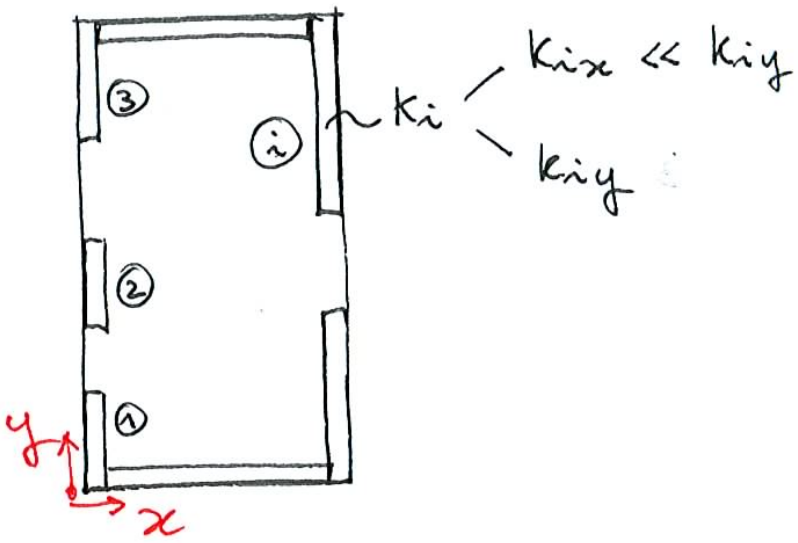
$I = \frac{b^3 t}{12}$ $\quad A = t \cdot b$

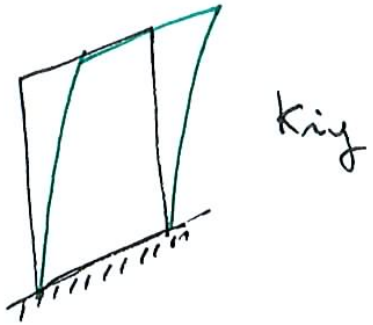


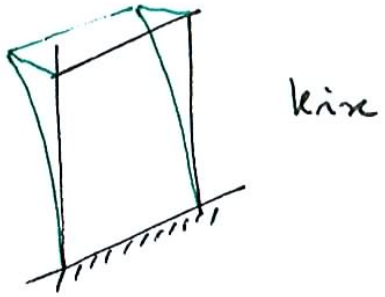
$$k = \frac{1}{\frac{h^3}{12EI} + \frac{\chi h}{GA}}$$

DIMEZZARE E e G PER CONSIDERARE FESSURAZIONE

ANALISI STATICA LINEARE

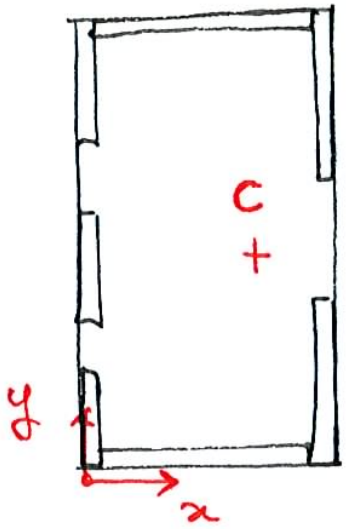






molto deformabile $k_{ix} \approx 0$

ANALISI STATICA LINEARE



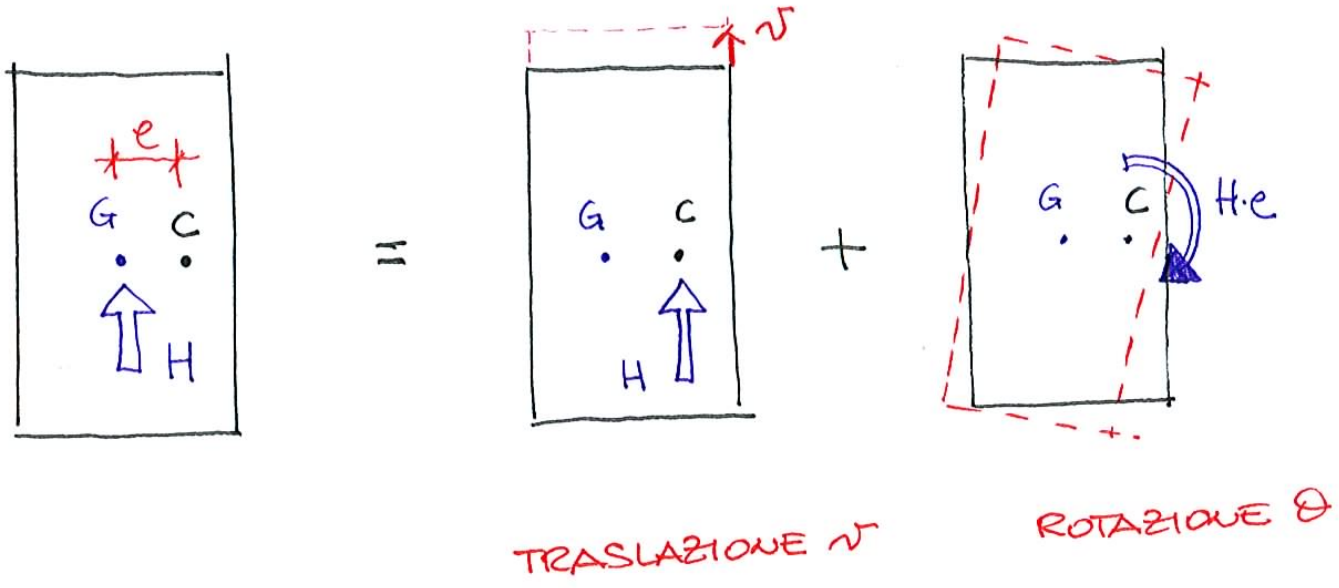
C = baricentro rigidezze k

C = centro di rotazione / taglio

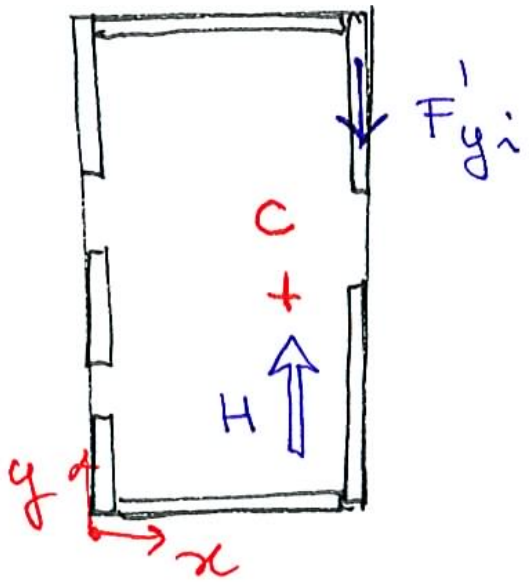
$$x_C = \frac{\sum k_y \cdot x}{\sum k_y}$$

$$y_C = \frac{\sum k_x \cdot y}{\sum k_x}$$

ANALISI STATICA LINEARE



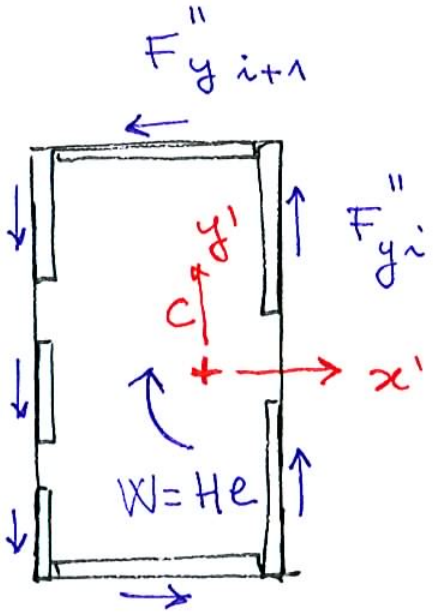
ANALISI STATICA LINEARE



$$v = \frac{H}{\sum_j k_{yj}}$$

$$F'_{yi} = k_{yi} \cdot v = \frac{k_{yi}}{\sum_j k_{yj}} H$$

ANALISI STATICA LINEARE

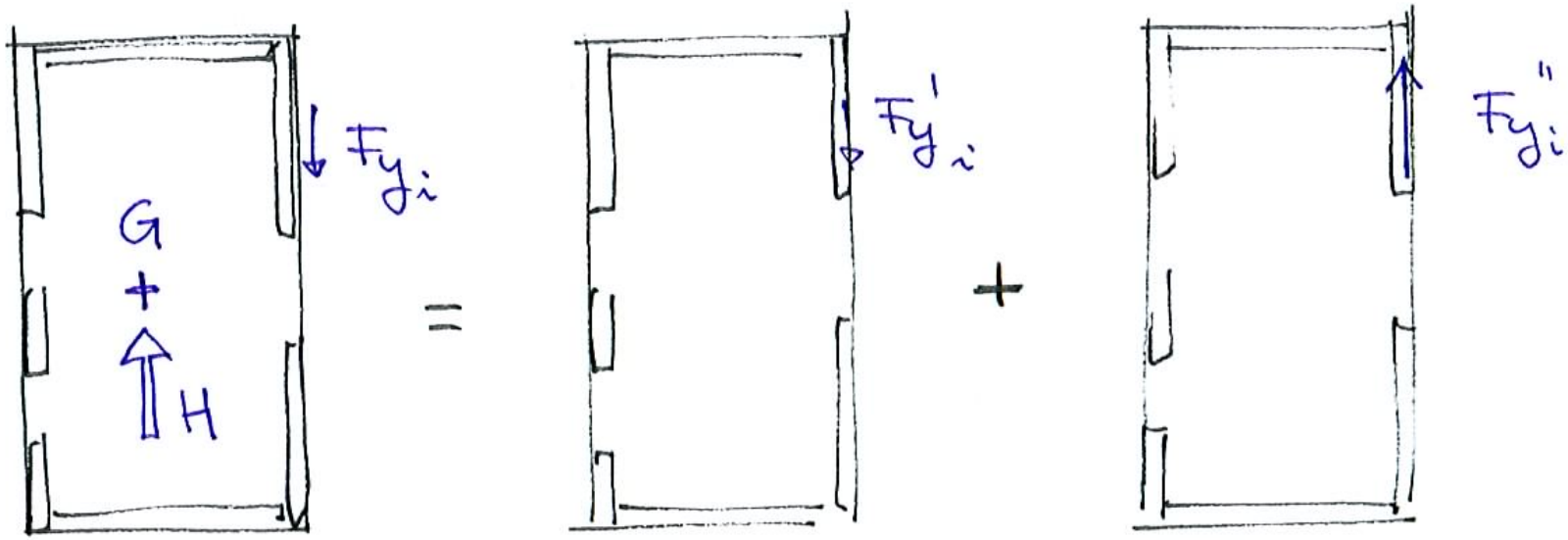


$$F''_{y\,i} = \frac{k_{y\,i}\, x'_i}{I_p}\, W$$

$$F''_{x\,i+1} = \frac{k_{x\,i+1} \cdot y'_i}{I_p} \cdot W$$

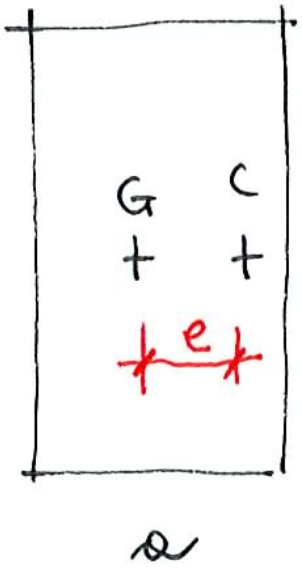
$$I_p = \sum k_y \cdot x'^2 + \sum k_x \cdot y'^2$$

ANALISI STATICA LINEARE

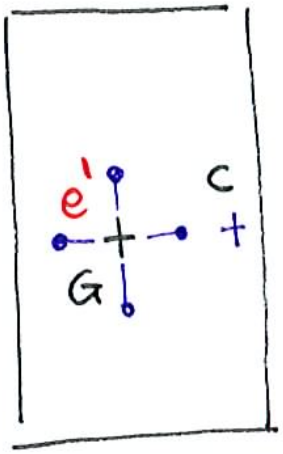


SOVRAPPOSIZIONE EFFETTI

ANALISI STATICA LINEARE

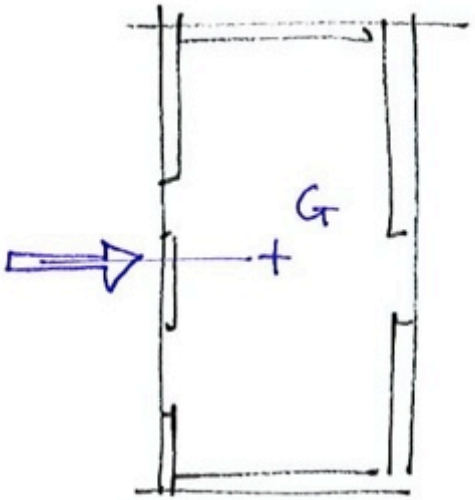


a

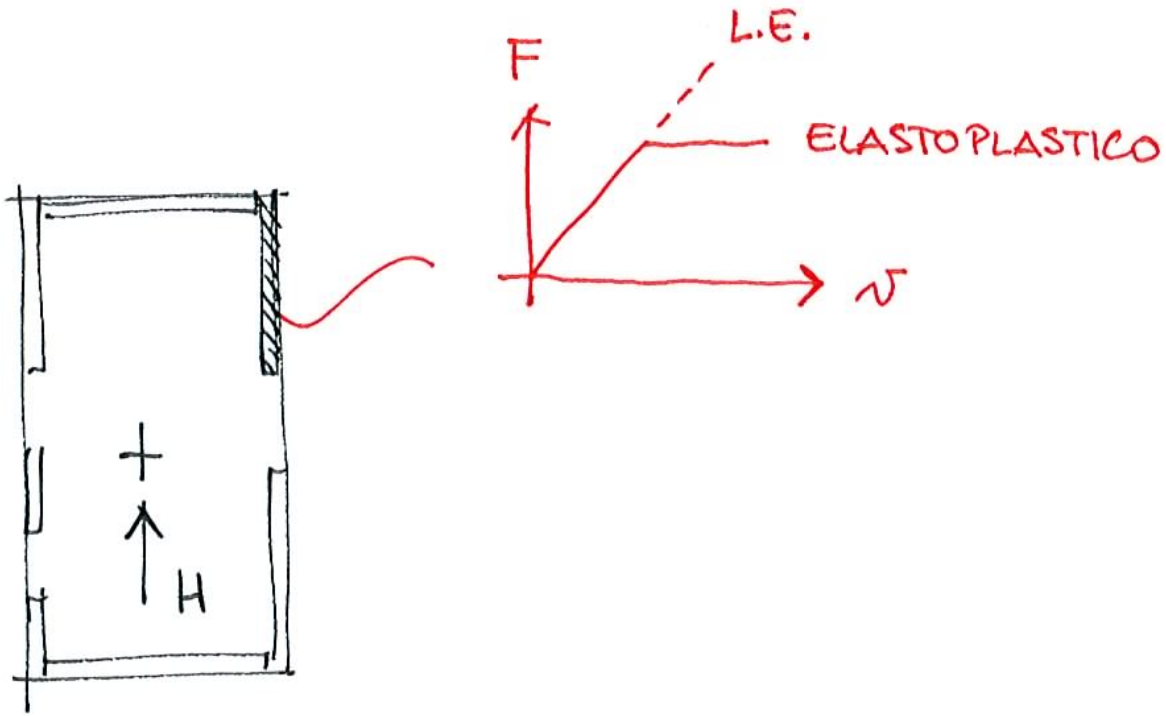


$e' = 5\% a$

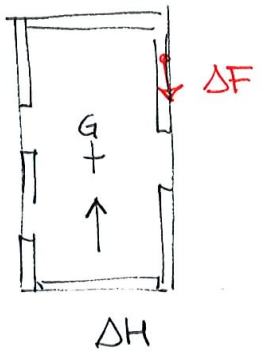
ANALISI STATICA LINEARE



ANALISI STATICA LINEARE



ANALISI STATICA LINEARE

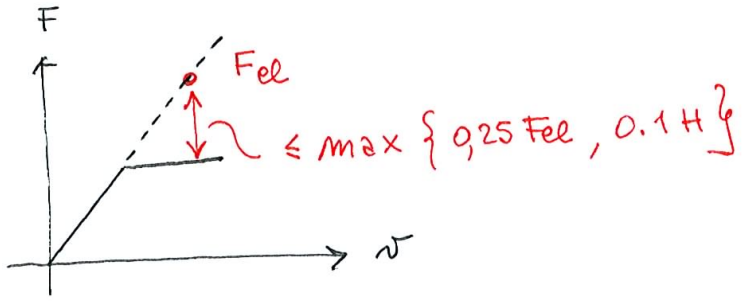


LAVORO PER PASSI DI CARICO i

$H_i = H_{i-1} + \Delta H$

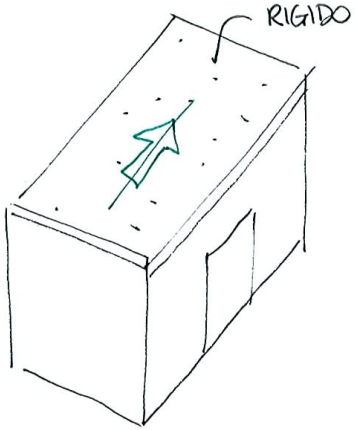
$F_i = F_{i-1} + \Delta F$

ΔF calcolato con $k_{y,i}$ lineare elast.
0 se plasticizzata
⇝ $\Delta F = 0$



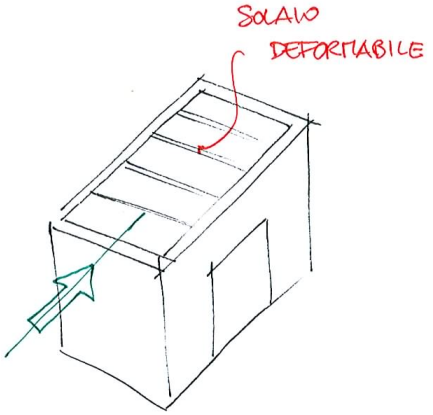
non sono ammesse ridistribuzioni eccessive → duttilità

ANALISI STATICA LINEARE



LAVORANO

TUTTE LE PARETI



ANALIZZO PARETI SINGOLARMENTE