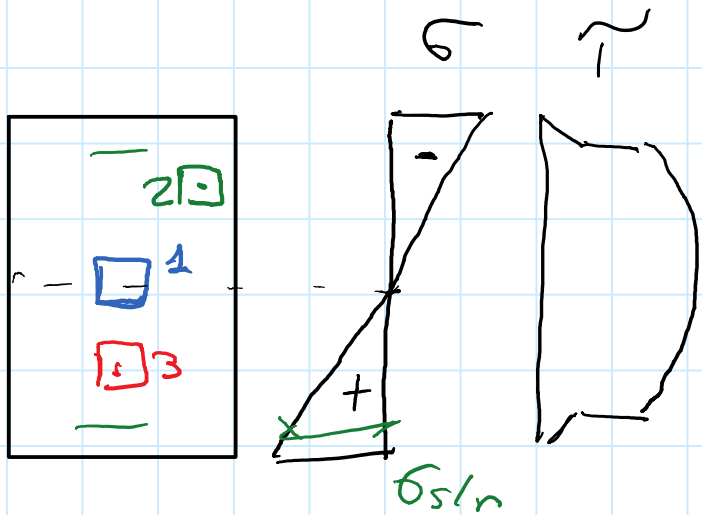
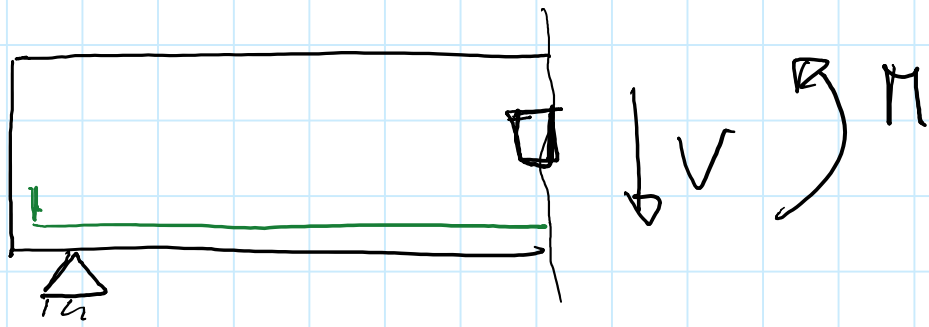
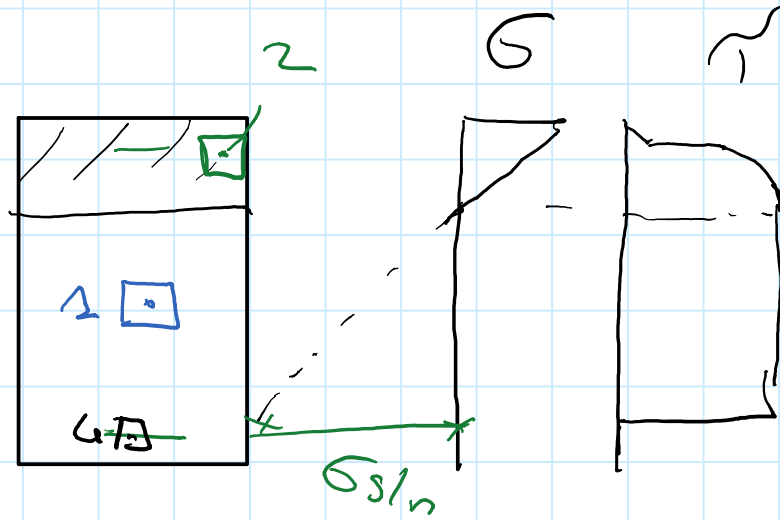


STATO TENSIONALE

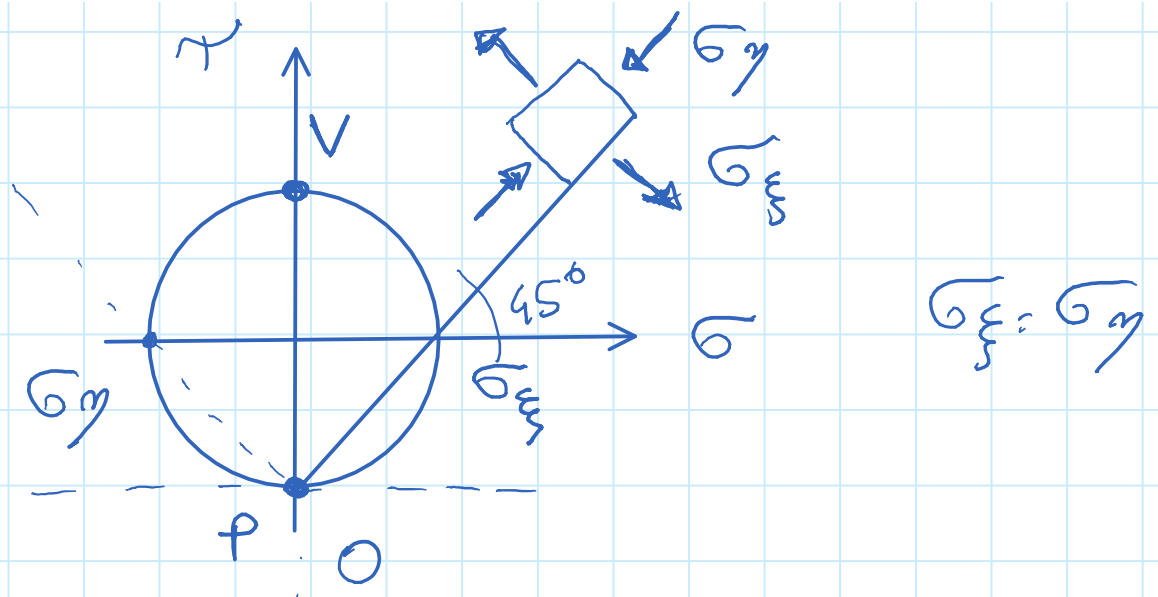
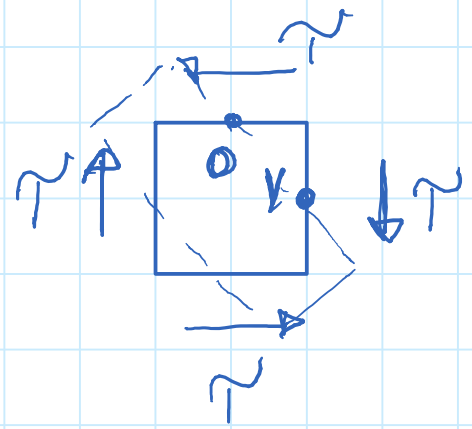


I STADIO

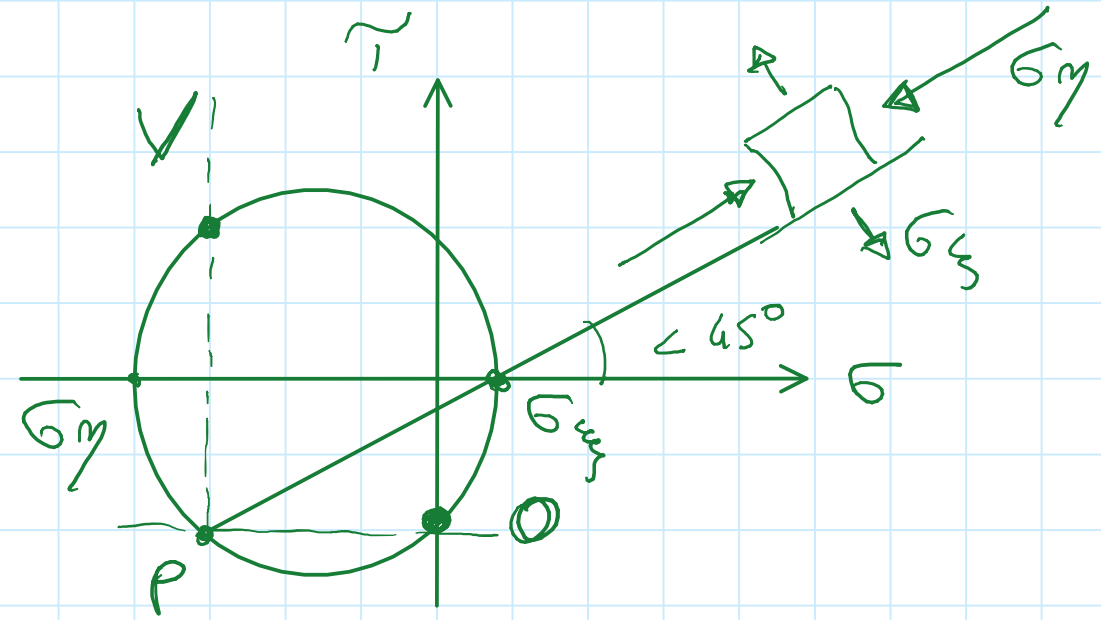
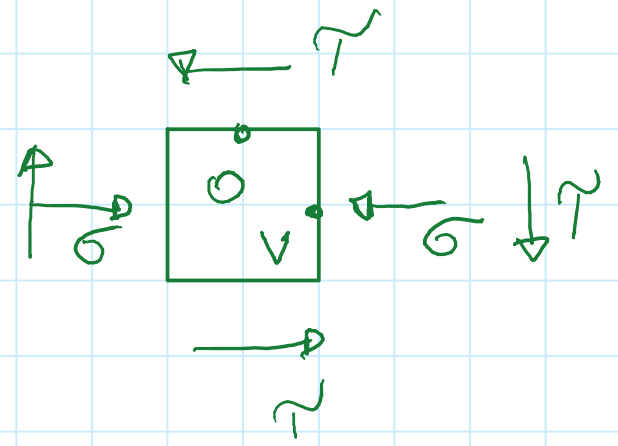


II STADIO

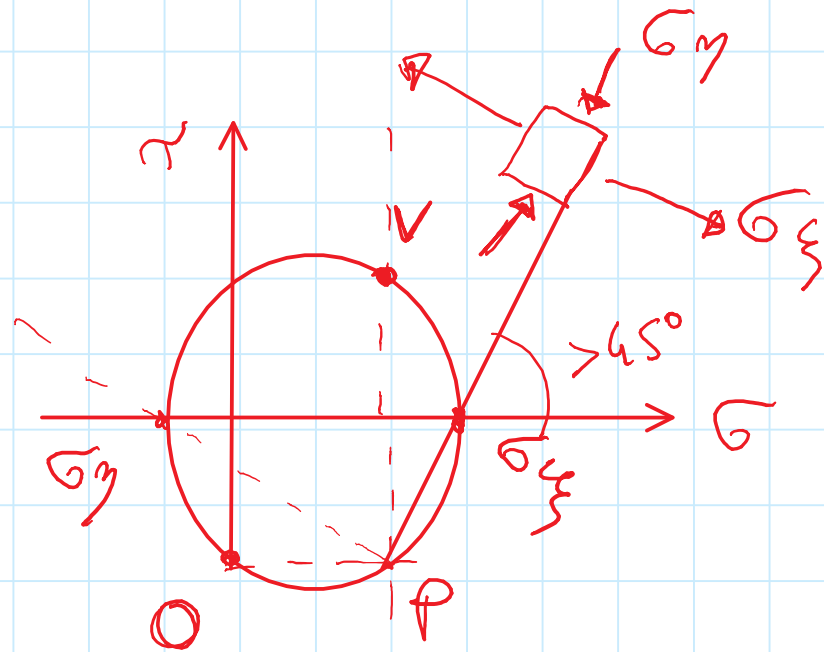
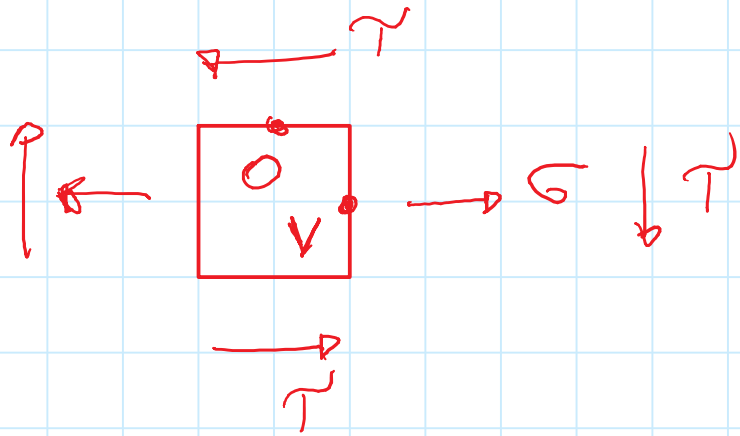
ELEMENTO 1



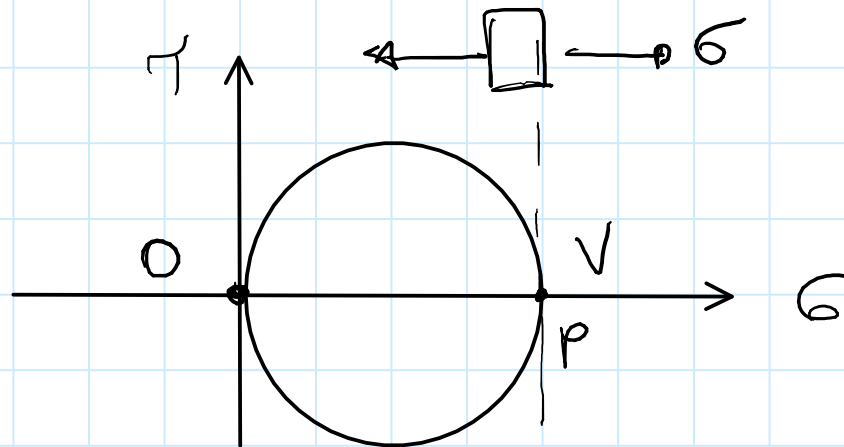
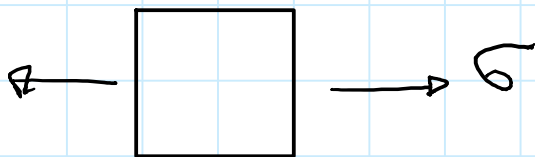
ELEMENTO 2



ELEMENTO 3

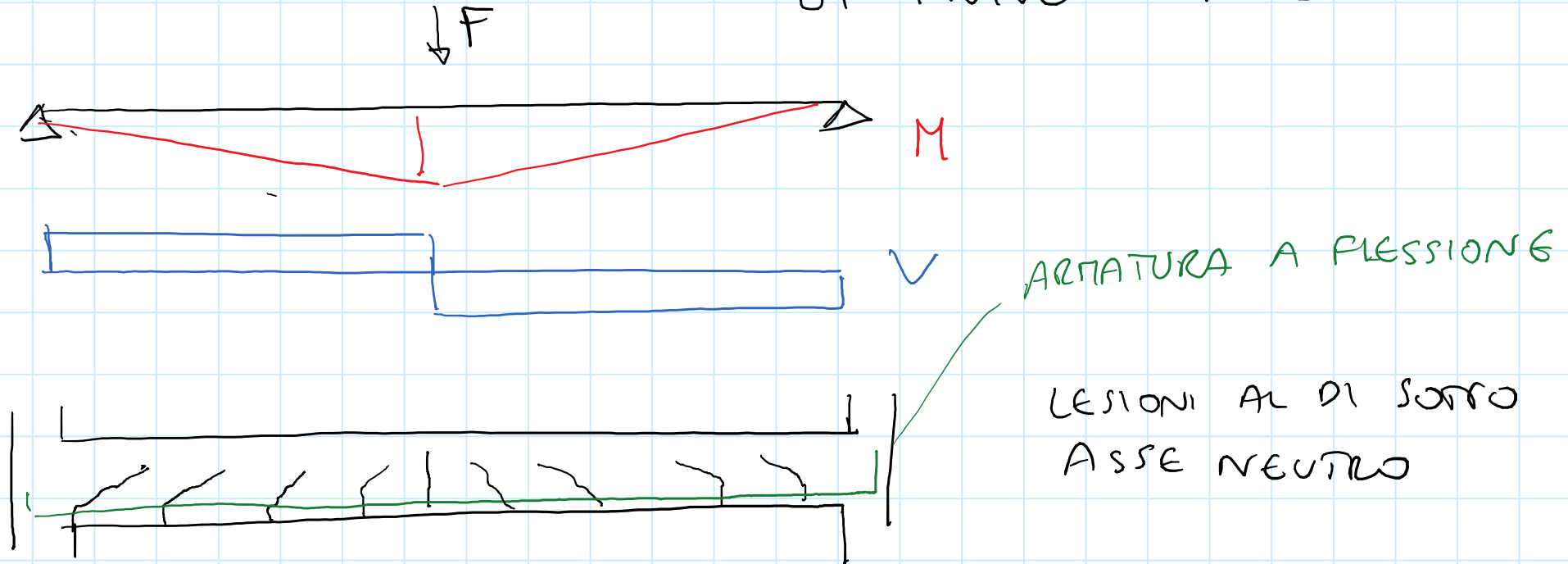


ELEMENTO 4



QUADRO FESSURATIVO

Se V CRESCE $\sigma_f >$ RESISTENZA A TRAZIONE \Rightarrow
LA TRAVE SI FESSURA

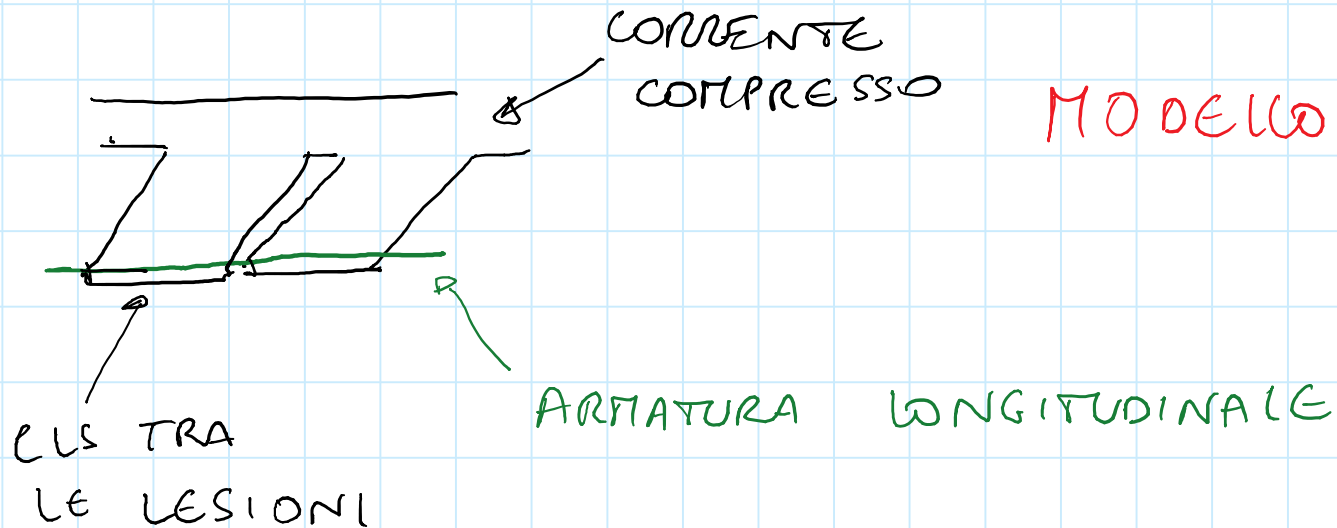


- POSSO VERIFICARE LA TRAVE FESSURATA ALLO SLU (SENZA ARMATURE A TAGLIO)
- DISPORRE ARMATURA A TAGLIO PER ASSORBIRE LA TRAZIONE

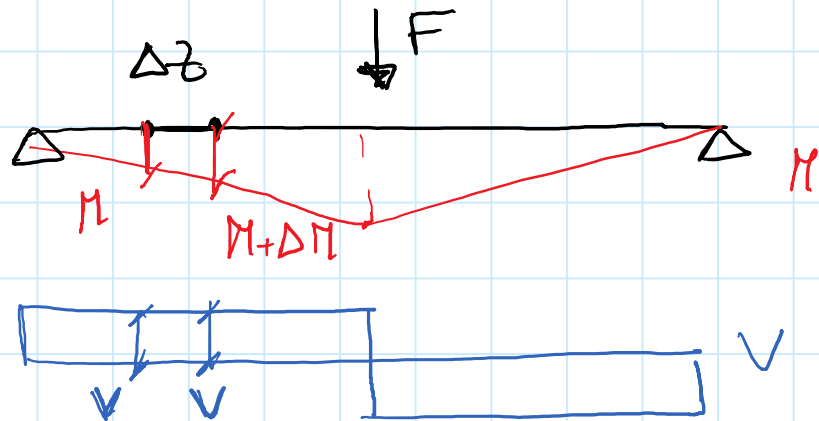
VERIFICA ALLO SLU - ASSENZA DI ARMATURE A TAGLIO



MODELLO A PETTINE

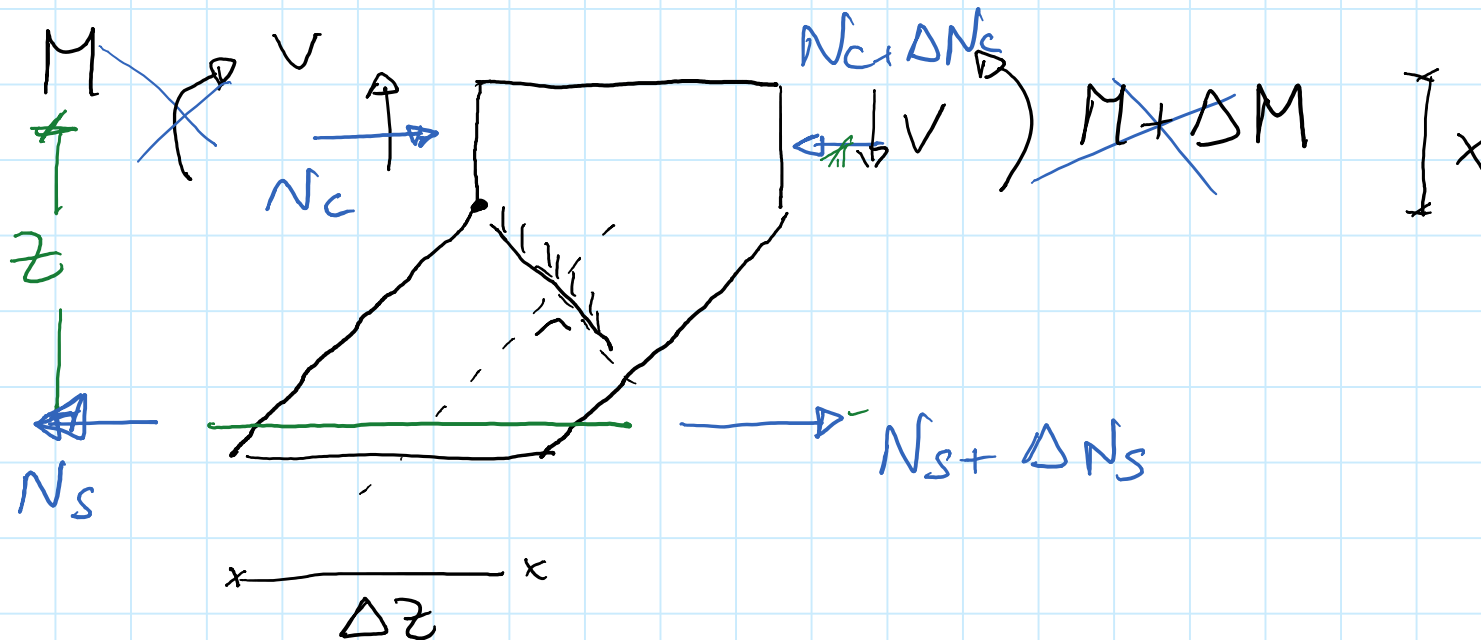


MODELLO A PETTINE



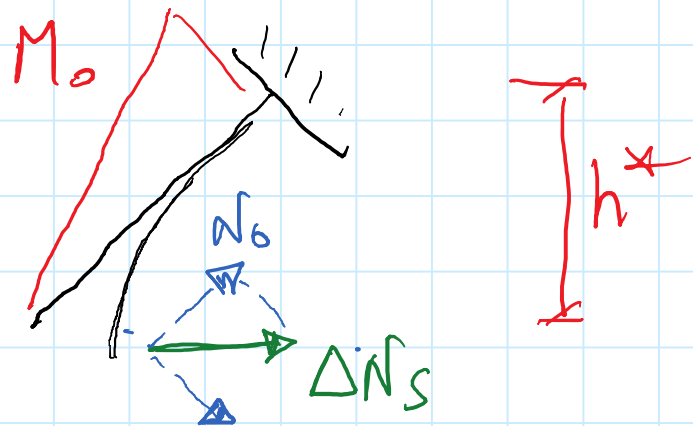
$$M + V \Delta z = M + \Delta M$$

$$\Rightarrow \Delta M = V \cdot \Delta z$$



$$\Delta N_s = \frac{\Delta M}{z}$$

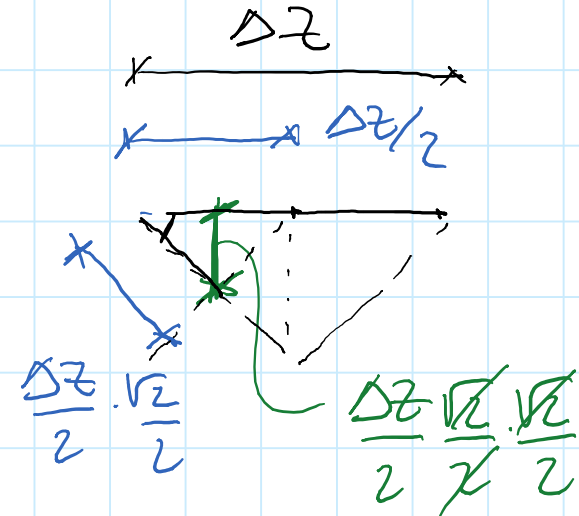
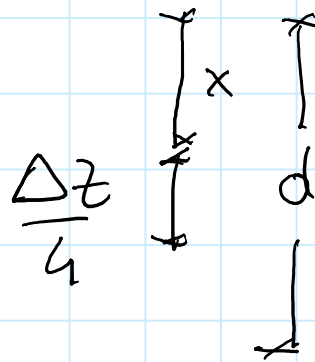
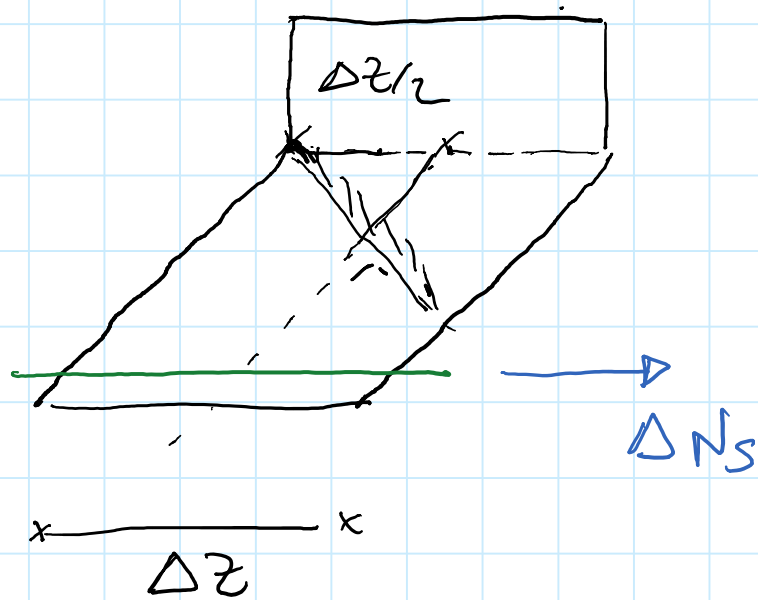
MODELLO A PETTINE



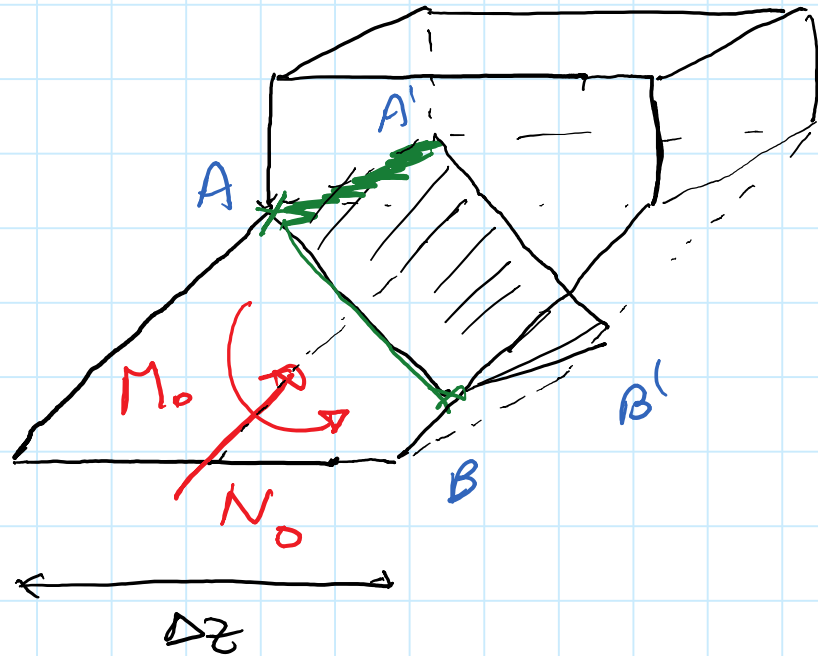
$$N_0 = - \frac{\Delta N_s \sqrt{z}}{2}$$

$$M_0 = \Delta N_s \cdot h^*$$

$$h^* = d - x - \frac{\Delta z}{6}$$



SEZIONE DI INCASTRO PRESSO - INFLESSA

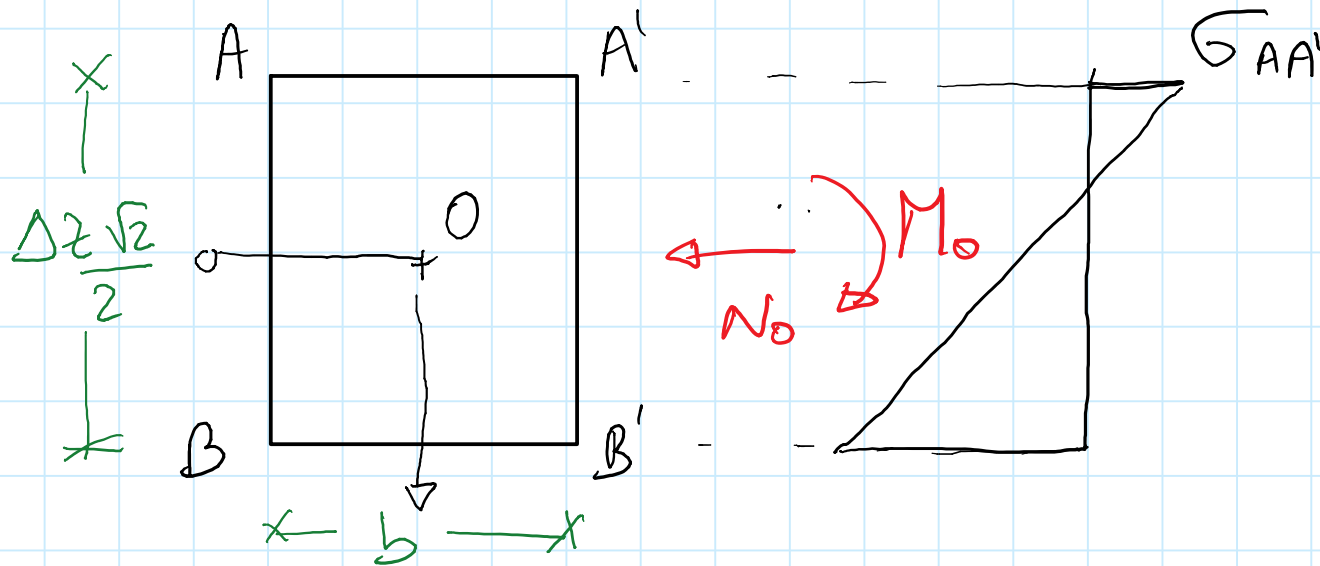


CRISI SE

$$\sigma_{AA'} = f_{cfol}$$

$$\sigma = \frac{N}{A} + \frac{M}{I} y$$

$$y = -\frac{1}{2} \frac{\Delta z \cdot \sqrt{2}}{2}$$



$$A = b \cdot \frac{\Delta z \sqrt{2}}{2}$$

$$I = \frac{b}{12} \left(\frac{\Delta z \sqrt{2}}{2} \right)^3$$

$$\bar{y} = \frac{1}{2} \frac{\Delta z \sqrt{2}}{2}$$

$$\rightarrow W = \frac{I}{\bar{y}} = \frac{b}{12} \left(\frac{\Delta z \sqrt{2}}{2} \right)^2 \cdot \frac{1}{\frac{\Delta z \sqrt{2}}{2}}$$

$$\Rightarrow W = \frac{1}{6} b \Delta z^2 \cdot \frac{1}{2} = \frac{1}{12} b \Delta z^2$$

(segno $\bar{y} < 0$)
MA $M_0 < 0$)

$$\sigma = \frac{N_0}{A} + \frac{M_0}{I} \bar{y} = - \frac{\Delta N_s \frac{\sqrt{2}}{2}}{b \Delta z \frac{\sqrt{2}}{2}} + \frac{\Delta N_s h^* \cdot 12}{b \Delta z^2}$$

DOVE $\Delta N_s = \frac{V \cdot \Delta z}{z}$

CRISI DEL DENTE

$$\sigma = f_{ctd} \rightarrow f_{ctd} = -\frac{V \Delta z}{z b \Delta z} + \frac{V \Delta z}{z} \frac{\left(d - x - \frac{\Delta z}{4}\right) 12}{b \Delta z^2}$$

OSSERVAZIONE Sperimentale

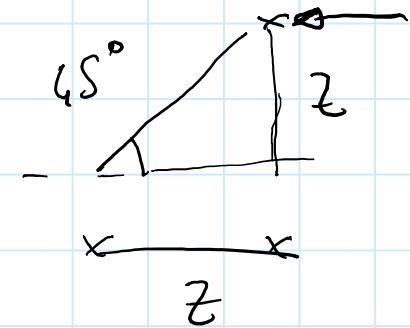
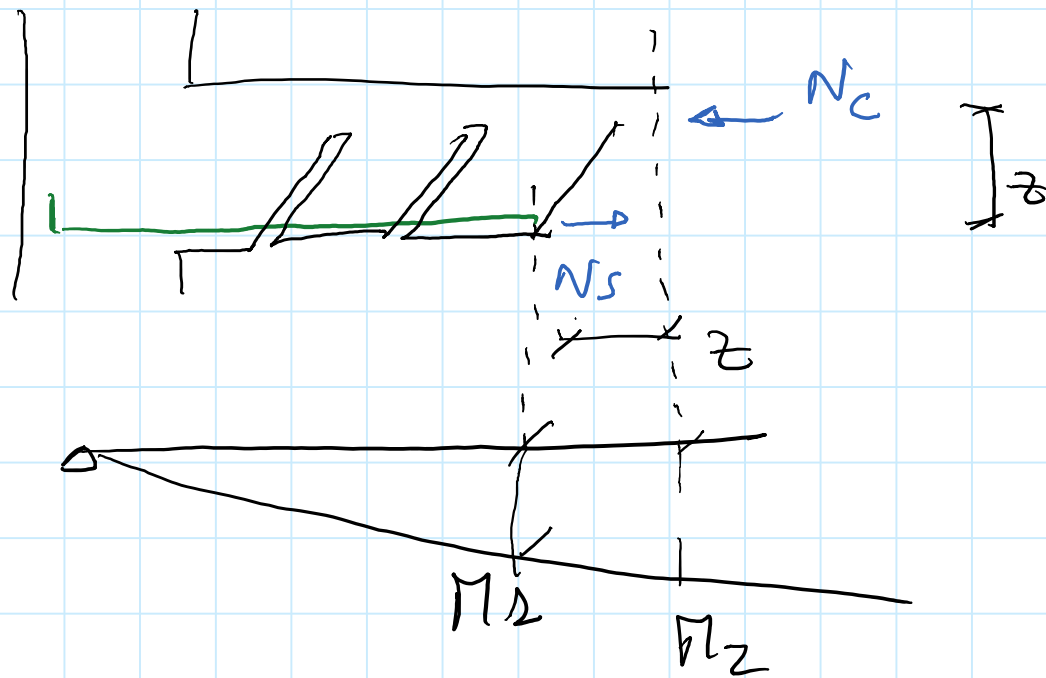
$$\begin{aligned} \Delta z &\approx d \\ x &\approx 0.25 d \end{aligned} \rightarrow f_{ctd} = -\frac{V}{z b} + \frac{V}{b z} \left(\frac{d - 0.25 d - \frac{d}{4}}{d} \right) 12$$

$$f_{ctd} = -\frac{V}{z b} + \frac{12 V}{b z} \times 0.5 = \frac{5V}{b z}$$

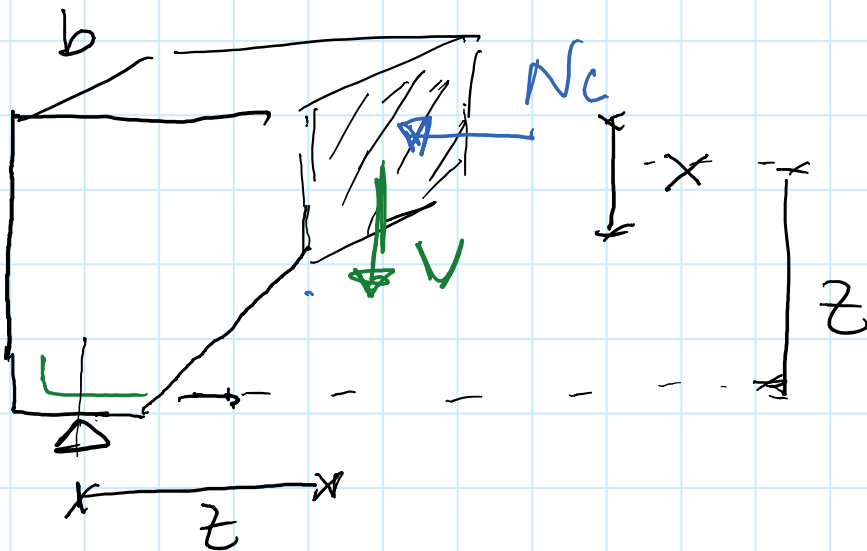
$$f_{ctd} = 1.2 f_{ctd} \Rightarrow V_{rd} = \frac{1.2 f_{ctd} b z}{5} \rightarrow 0.9 d$$

$$V_{rd} = 0.21 f_{ctd} b d$$

TRASLAZIONE DEL DIAGRAMMA DEI MOMENTI



VERIFICA DEL CORRENTE COMPRESSO



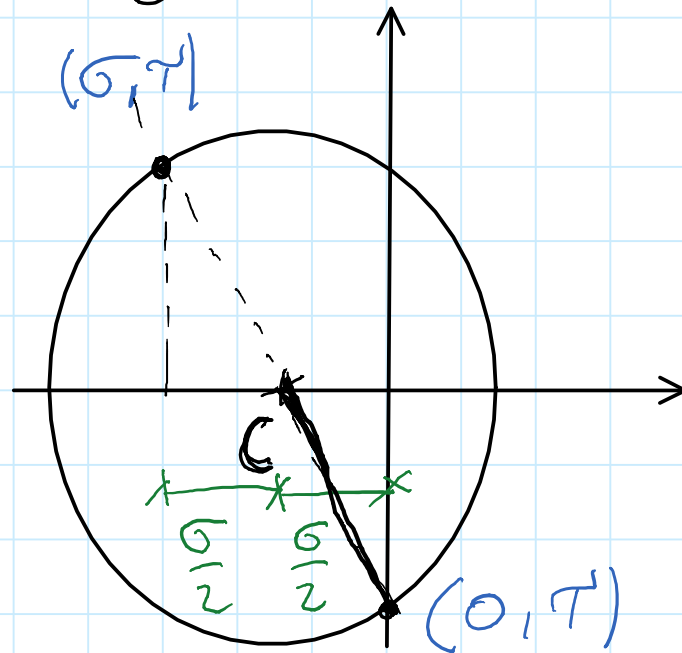
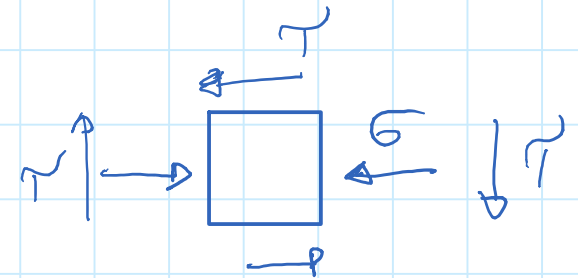
VERIFICA IN CORRESPONDENZA
DELLA PRIMA LESIONE

$$N_c \cdot z = V \cdot z \rightarrow N_c = V$$

TENSIONI MEDIE:

$$\sigma = \frac{N_c}{b \cdot x}$$

$$\tau = \frac{V}{b \cdot x}$$



CRISI SE $\sigma_{\xi} = \rho_{ctd}$

$$\sigma_{\xi} = R - \sigma/2$$

TENSIONE
IN
VALORE
ASSOLUTO

$$R = \sqrt{\tau^2 + \left(\frac{\sigma}{2}\right)^2}$$

$$R = \sqrt{\left(\frac{V}{bx}\right)^2 + \left(\frac{V}{2bx}\right)^2} = \frac{V}{bx} \sqrt{1 + \frac{1}{4}}$$

$$\sigma_{\xi} = \frac{V}{bx} \sqrt{1 + \frac{1}{4}} - \frac{V}{2bx} = \frac{V}{bx} \left[\frac{\sqrt{5}}{2} - \frac{1}{2} \right]$$

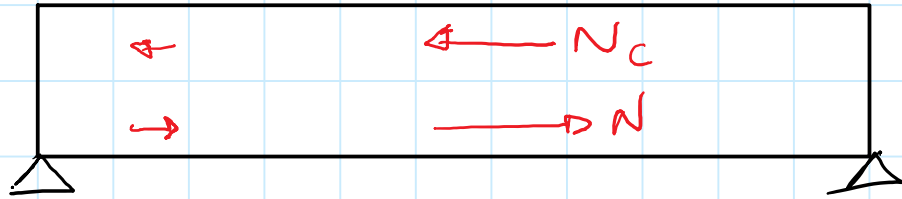
0.62

crisi se $\sigma_{\xi} = f_{ctd} \Rightarrow$

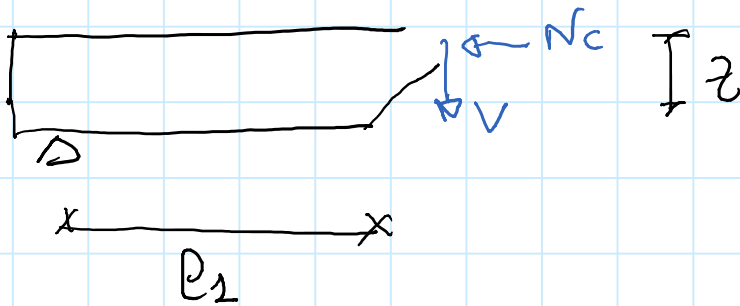
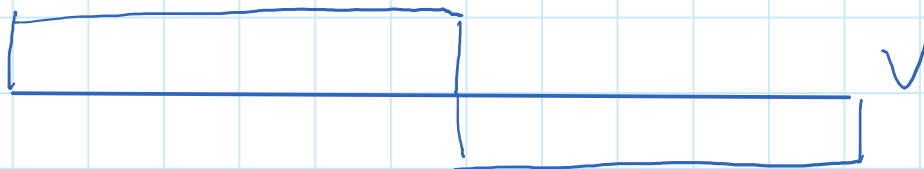
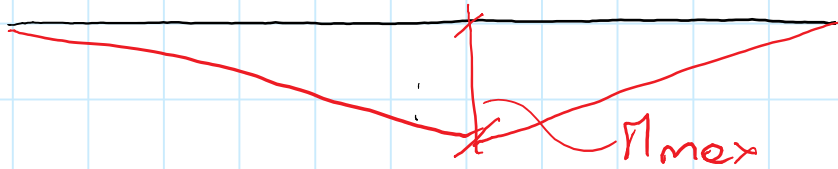
$$V = \frac{f_{ctd} bx}{0.62} = 1.61 bx f_{ctd}$$

$$V_{rd} = 1.61 bx f_{ctd}$$

VERIFICA NEUE ALTRE SEZIONI MENO GRAVOSA



$$N_c = \frac{M}{z}$$



$$N_c \neq V$$

CRISI NEL DENTE O NEL CORRENTE ?

DENTE

$$V_{rd} = 0.21 b d f_{ctd}$$

CORRENTE

$$V_{rd} = 1.6 b x f_{ctd}$$

HO CRISI NEL DENTE SE $1.6 b x f_{ctd} > 0.21 b d f_{ctd}$

$$\Rightarrow x > \frac{0.21 d}{1.6} = 0.13 d$$

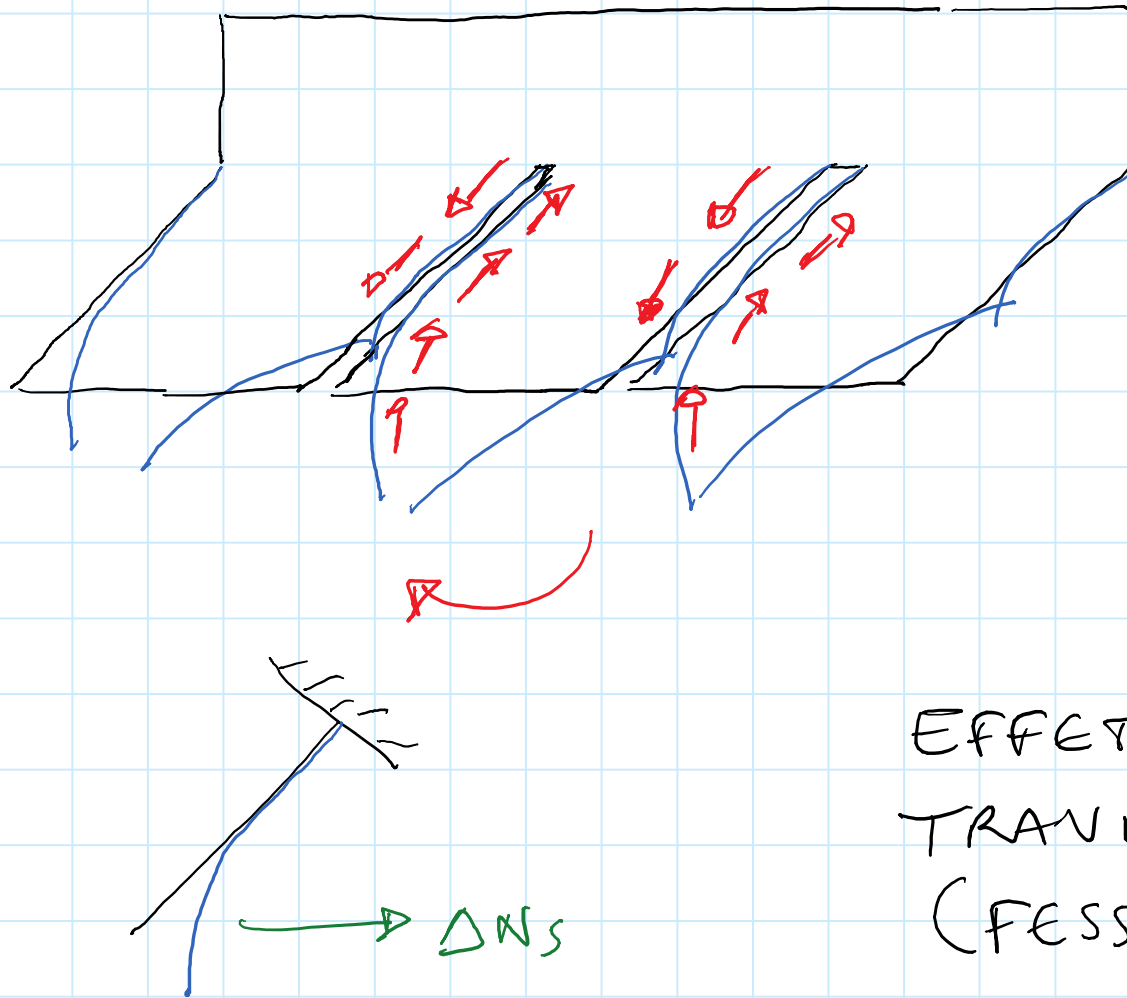
PER FLESSIONE SEMPLICE

$$x \approx 0.25 d \Rightarrow$$

CRISI NEL DENTE

NEL CASO DI TENSO-FLESSIONE POTREI AVERE
CRISI CORRENTE

EFFETTI MIGLIORATIVI PER LA RESISTENZA DEL DENTE

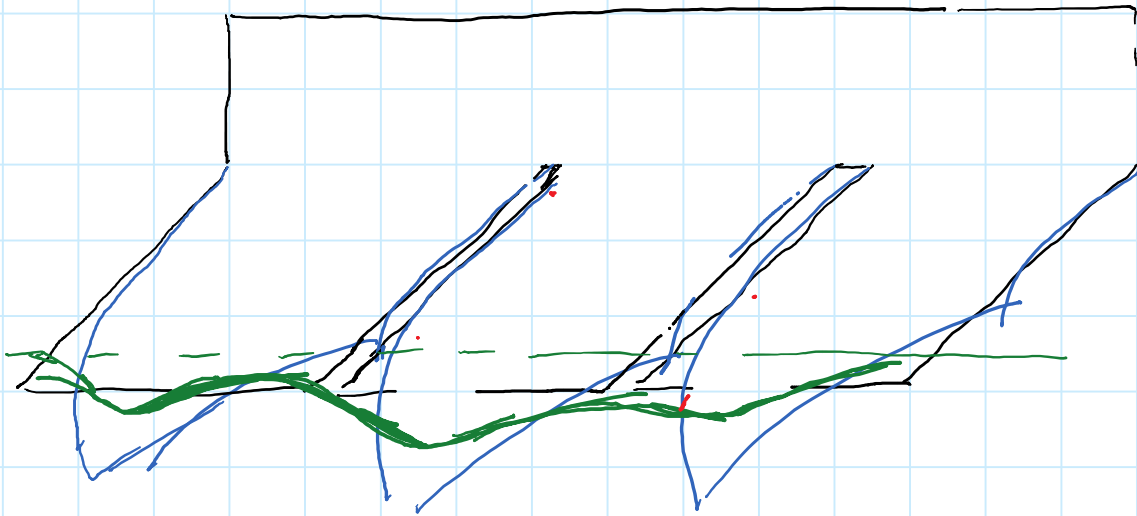


INGRANAMENTO
DEGLI INERTI

AZIONI MUTUE
CREANO M OPPOSTO
A QUELLO PRODOTTO
DA ΔN_s

EFFETTO IMPORTANTE PER
TRAVI BASSE
(FESSURE PIU' STRETTE)

EFFETTI MIGLIORATIVI PER LA RESISTENZA DEL DENTE



EFFETTO
SPINOTTO

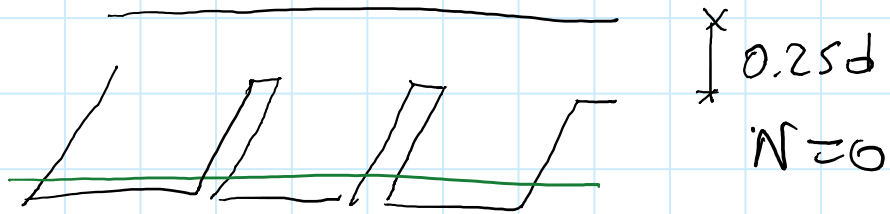
AZIONI MUTUE
CREANO M OPPOSTO
A QUELLO PRODOTTO
DA ΔN_s

LO SCORRIMENTO TRA LE FESSURE

CAUSA DEFORMAZIONE DELL'ARMATURA CHE

SPINGE SUL RICOPRIMENTO FACENDOLO SALTARE

EFFETTI MIGLIORATIVI PER LA RESISTENZA DEL DENTE



SFORZO NORMALE
DI COMPRESSIONE



SI RIDUCE M_0
PERCHÉ SI
RIDUCE h^*

INDICAZIONI DI NORMATIVA

$$V_{rdc} = \max \left\{ \begin{array}{l} \left[0.18 k \frac{\sqrt[3]{100 \rho_e f_{ck}}}{\gamma_c} + 0.15 \sigma_{cp} \right] b_w d \\ \left[0.035 \sqrt{k^3 f_{ck}} + 0.15 \sigma_{cp} \right] b_w d \end{array} \right.$$

serve se ρ_e basso

$$k = 1 + \sqrt{\frac{200}{d}} < 2$$

INCREMENTO RESISTENZA PER
INGRANAMENTO INERTI
(d in mm)

$$\rho_e = \frac{A_{se}}{b_w d} \leq 0.02 \quad A_{se} = \text{ARMATURA TESA (EFFETTO SPINOTTO)}$$

$$\sigma_{cp} = \frac{N_{ed}}{A_c} \leq 0.2 f_{cd} \quad \left(\begin{array}{l} \text{POSITIVO SE} \\ N_{ed} < 0 \end{array} \right)$$

$$b_w = \text{BASE ANIMA} ; \quad \sqrt{f_{ck}}, \sqrt[3]{f_{ck}} \quad \left(\begin{array}{l} \text{RESISTENZA A} \\ \text{TRAZIONE} \end{array} \right)$$