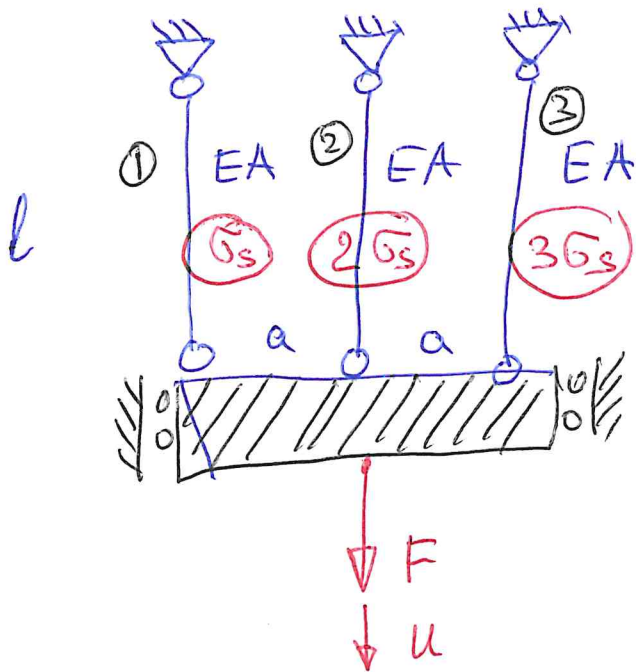
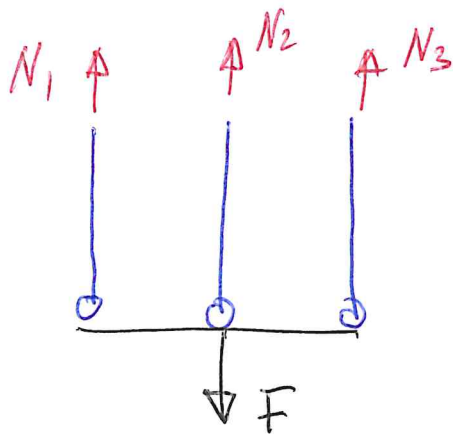
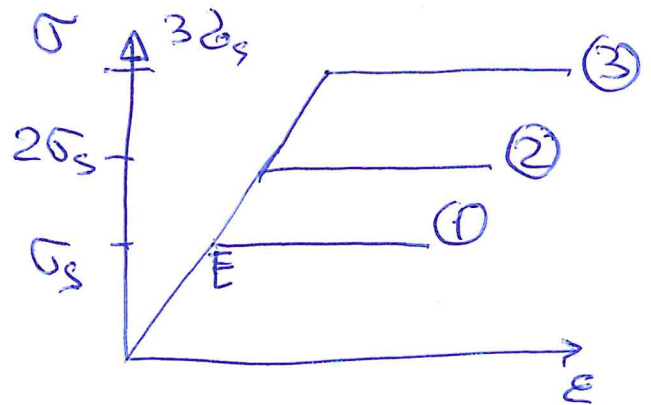


Esempio, il collasso plastico



F-u ?



equilibrio:

$$N_1 + N_2 + N_3 = F$$

Dominio elastico: $\sigma = E\varepsilon, \varepsilon = \frac{\Delta l}{l}$

$$N = \sigma A$$

$$N_1 = \sigma_1 A, N_2 = \sigma_2 A, N_3 = \sigma_3 A$$

$$\Delta l_1 = \Delta l_2 = \Delta l_3$$

1. Stato 1 : risposta elastica.

Limite elastico.

$$\sigma_1 < \sigma_s, \quad \sigma_2 < 2\sigma_s, \quad \sigma_3 < 3\sigma_s$$

$$\Delta_c = \Delta l_{1c} = \frac{\sigma_s l}{E}, \quad \varepsilon_c = \frac{\sigma_s}{E}$$

$$N_1 = \sigma_1 A$$

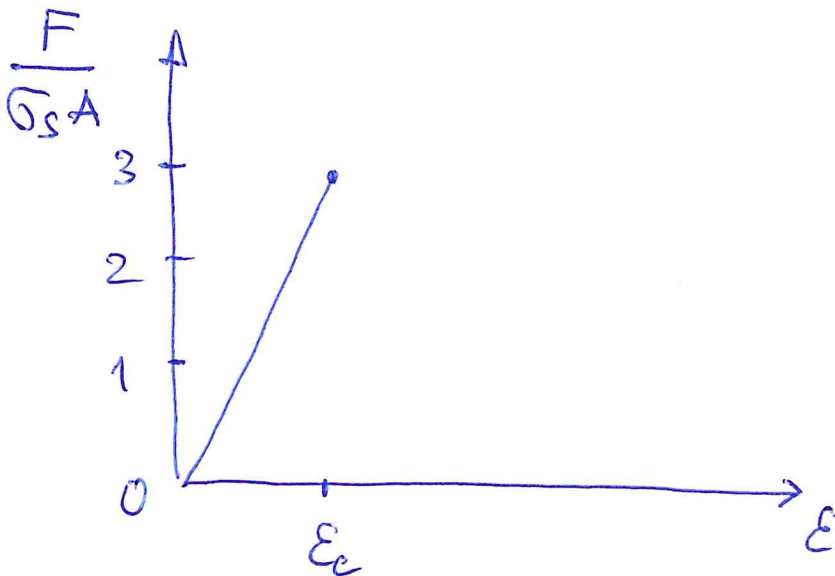
$$N_{1c} = \sigma_s A$$

$$\Delta l_1 = \Delta l_2 = \Delta l_3 = \Delta_c \equiv \Delta l_{1c}$$

$$\Rightarrow N_2 = N_3 = N_1 = N_{1c}$$

$$F = N_1 + N_2 + N_3$$

$$F_{1c} = \sigma_s A + \sigma_s A + \sigma_s A = 3\sigma_s A$$



Stato 2: risposta elasto-plastica fino
allo snervamento del pendolo 2.

$$F > F_{1c} = 3\sigma_s A$$

$$N_1 = \sigma_1 A = N_{1c} = \sigma_s A$$

$$F = N_1 + N_2 + N_3 =$$

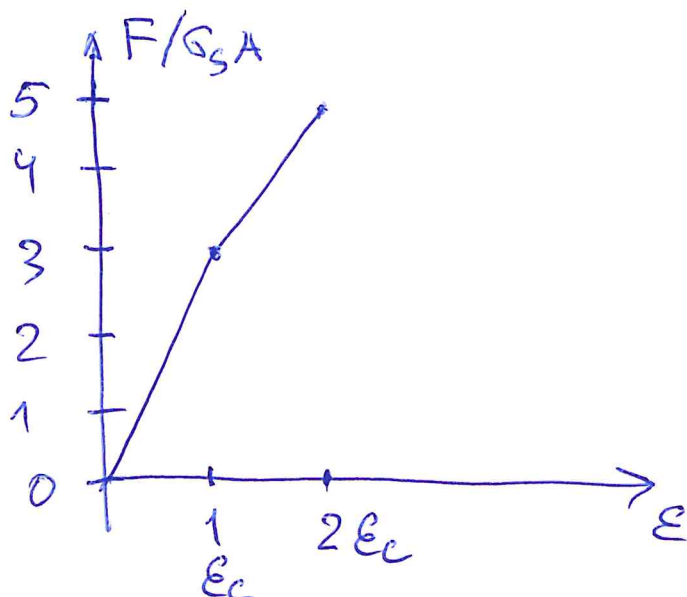
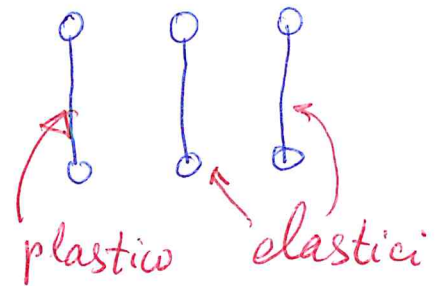
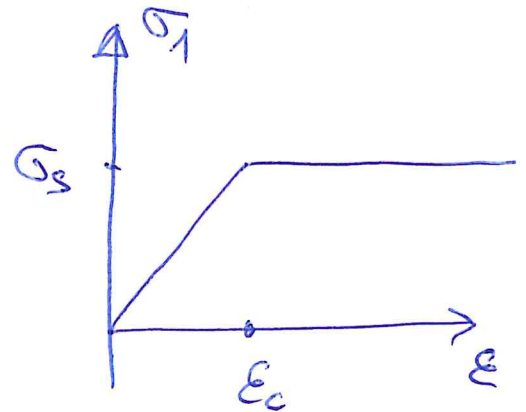
$$= \underline{\sigma_s A} + \sigma_2 A + \sigma_3 A$$

$$\underline{\sigma_2 < 2\sigma_s}, \quad \sigma_3 < 3\sigma_s$$

$$\Delta l_{2c} = \frac{\sigma_{2c}}{E} l = \frac{2\sigma_s}{E} l$$

$$\Delta l_3 = \Delta l_{2c}$$

$$F_{2c} = \underbrace{\sigma_s A}_{N_{1c}} + \underbrace{2\sigma_s A}_{N_{2c}} + \underbrace{2\sigma_s A}_{N_3} = 5\sigma_s A$$



$$\epsilon_{2c} = \frac{\Delta l_{2c}}{l} =$$

$$= \frac{2\sigma_s}{E} =$$

$$= 2\epsilon_c$$

Stato 3: risposta elasto-plastica fino
allo snervamento del pendolo 3.

$F > F_{2c}$ Colasso della struttura.

$$N_1 = \sigma_s A$$

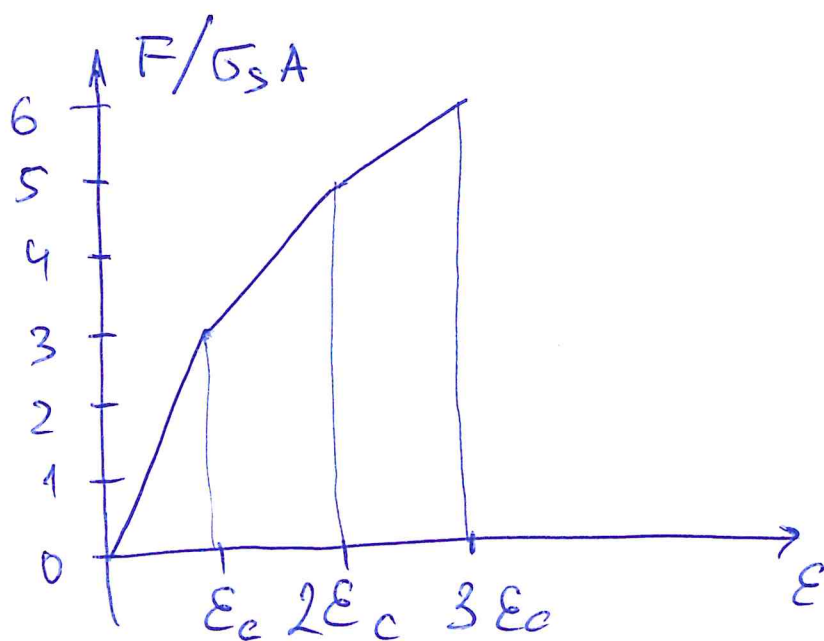
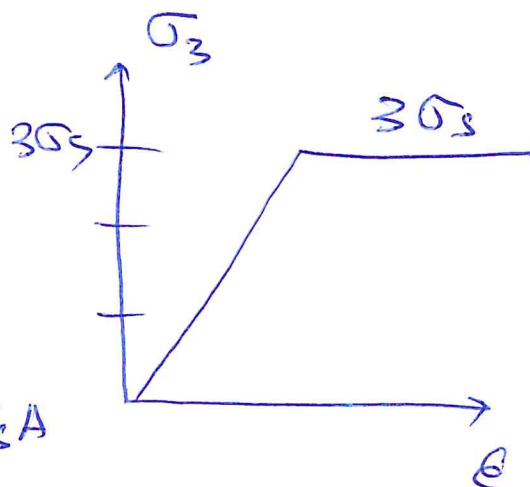
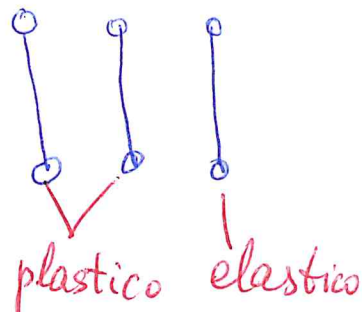
$$N_2 = 2\sigma_s A$$

$$F = N_1 + N_2 + N_3 = 3\sigma_s A + \sigma_3 A$$

$$\Delta l_{3c} = \frac{\sigma_{3c} l}{E} = \frac{3\sigma_s l}{E}$$

$$N_{3c} = \sigma_{3c} \cdot A = 3\sigma_s A$$

$$F_{c3} = 3\sigma_s A + 3\sigma_s A = 6\sigma_s A$$



Stato 4: colasso - scarico elastico

$$F > F_{e3} = 6 \sigma_s A$$

$$N_1 = \sigma_s A, \quad N_2 = 2 \sigma_s A, \quad N_3 = 3 \sigma_s A$$

$$F = N_1 + N_2 + N_3 = 6 \sigma_s A$$

