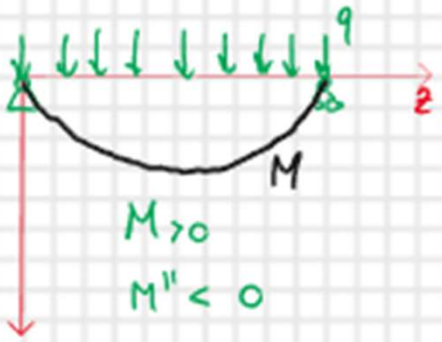
Titolo:

Nota $\frac{dQ(z)}{dz} = -q(z)$

$\frac{dM(z)}{dz} = Q(z)$ $\longrightarrow$ $\frac{d^2M(z)}{dz^2} = -q(z)$ Concavità

quando $q(z) > 0$ } Concavità verso il basso

$\frac{d^2M(z)}{dz^2} < 0$ }



$M > 0$

$M'' < 0$

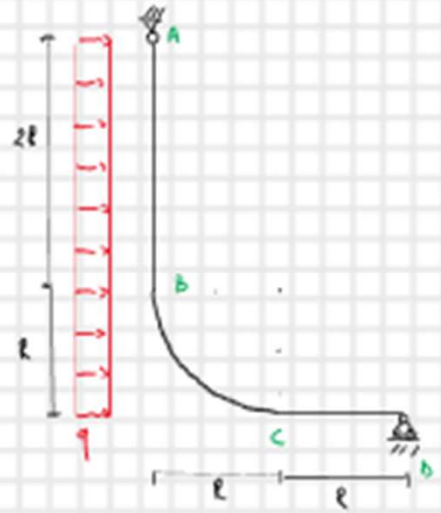
$y = x^2$ $y'' = 2$

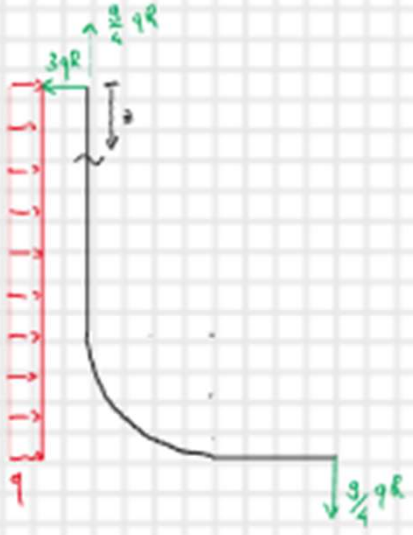
concavità verso l'alto - convessa -

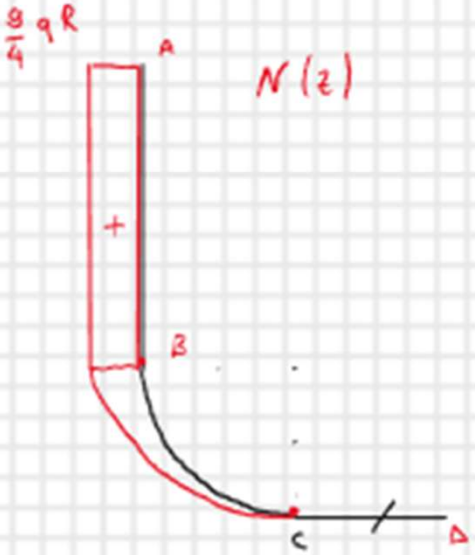
$y = -x^2$ $y'' = -2$

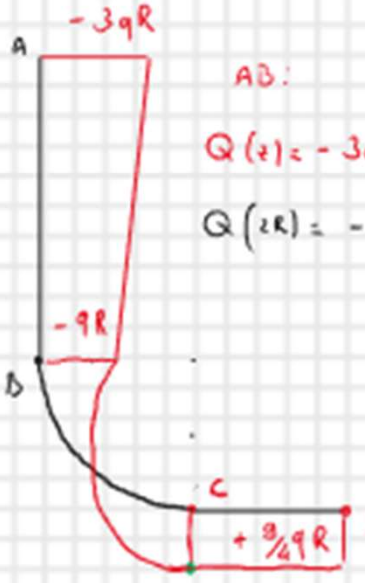
Concavità verso il basso

Esercizio





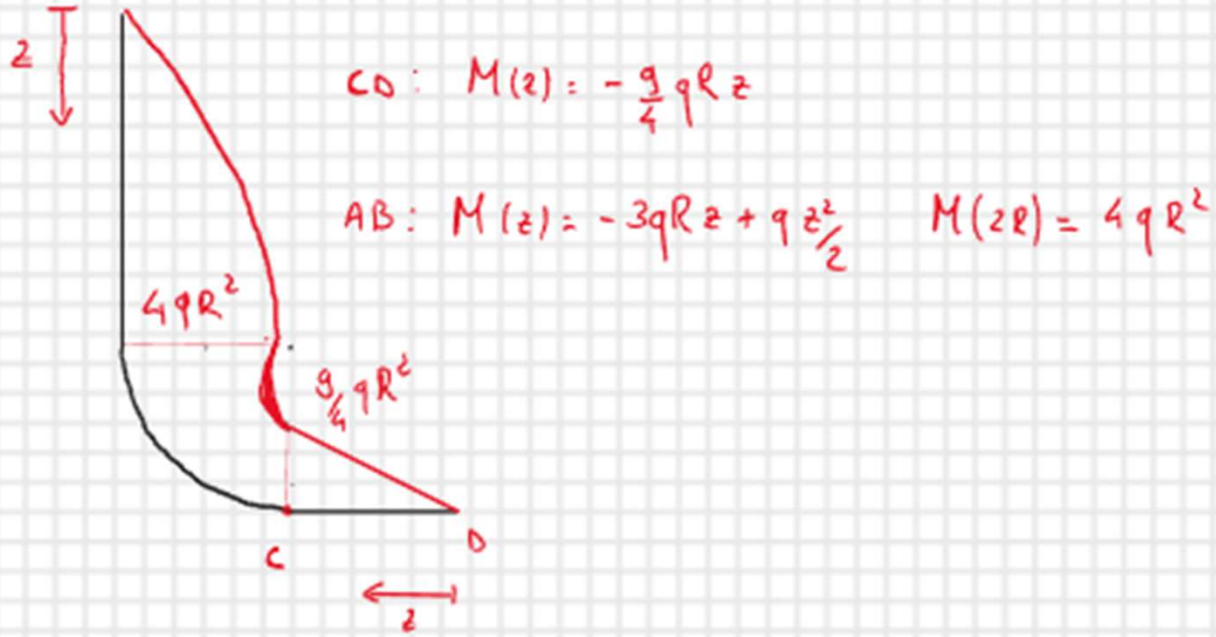




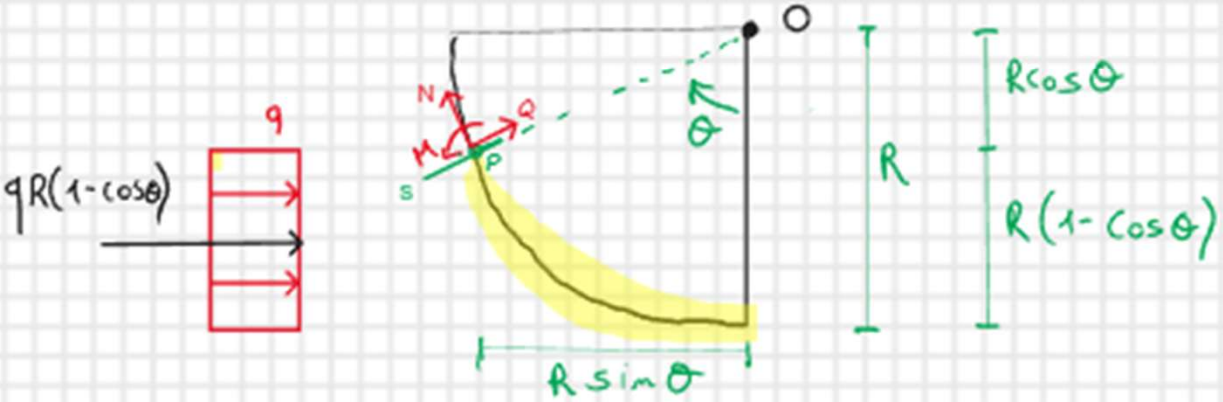
AB:

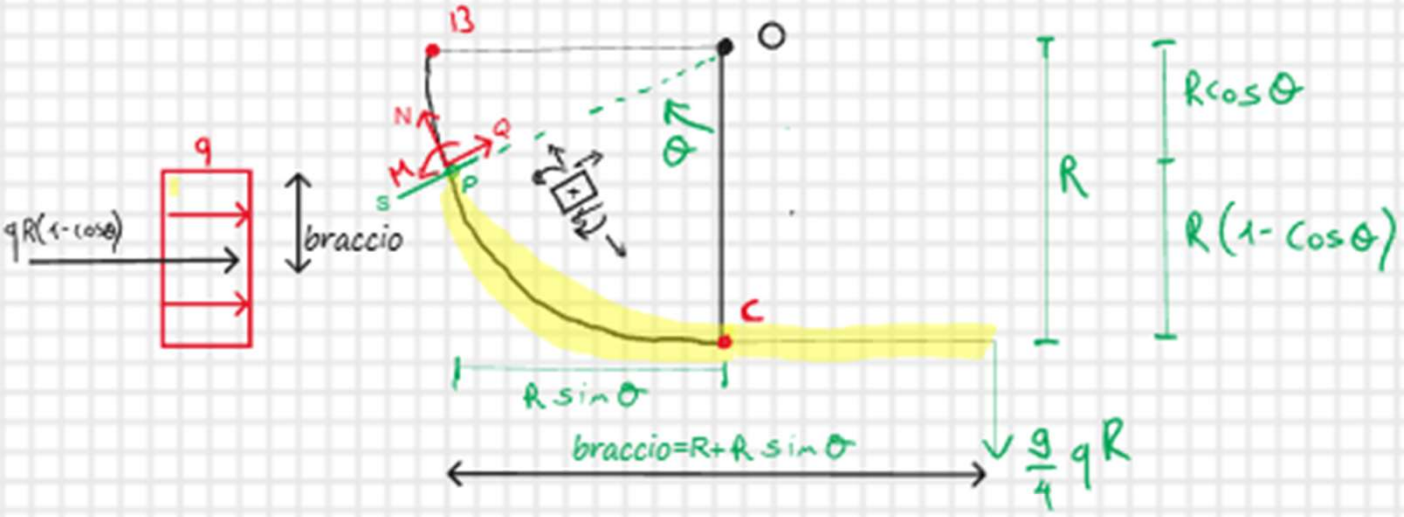
$Q(z) = -3qR + qz$

$Q(2R) = -qR$

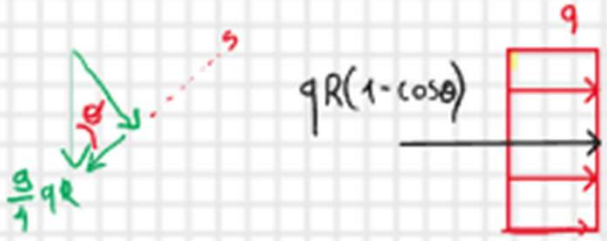


Studio del tratto curvo CD





Equilibrio della parte di struttura evidenziata in giallo



Proietto i carichi lungo la sezione e perpendicolarmente

Azione assiale

$$N(\theta) - \frac{9}{4} qR \operatorname{sen}\theta - qR(1-\cos\theta)\cos\theta = 0$$

$$N(\theta) = \frac{9}{4} qR \operatorname{sen}\theta + qR(1-\cos\theta)\cos\theta$$

$$N(0) = 0 \qquad N(\pi/2) = \frac{9}{4} qR$$

Equilibrio lungo l'asse della trave

Taglio

$$Q(\theta) - \frac{9}{4} qR\cos\theta + qR(1-\cos\theta)\operatorname{sen}\theta = 0$$

$$Q(\theta) = \frac{9}{4} qR\cos\theta - qR(1-\cos\theta)\operatorname{sen}\theta$$

$$Q(0) = \frac{9}{4} qR \qquad Q(\pi/2) = -qR$$

Equilibrio lungo la direzione perpendicolare all'asse della trave

Momento flettente

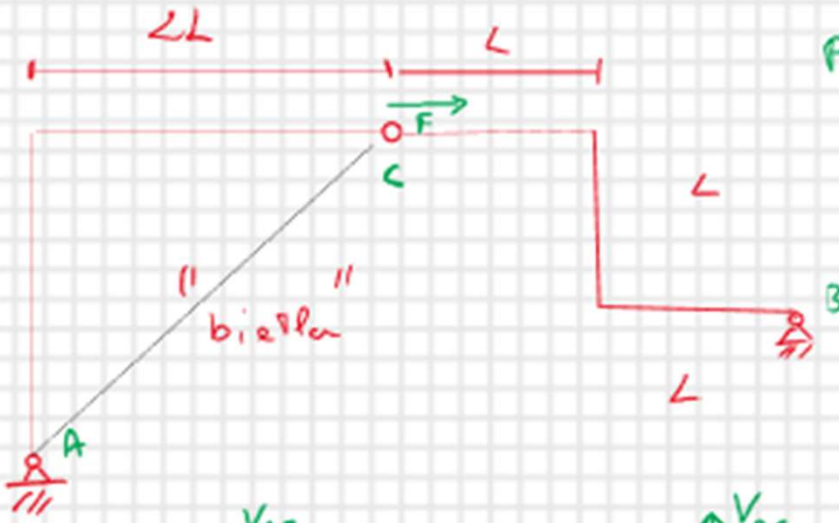
$$M(\theta) - \frac{9}{4} qR\, R(1+\operatorname{sen}\theta) + qR(1-\cos\theta)\frac{R(1-\cos\theta)}{2} = 0$$

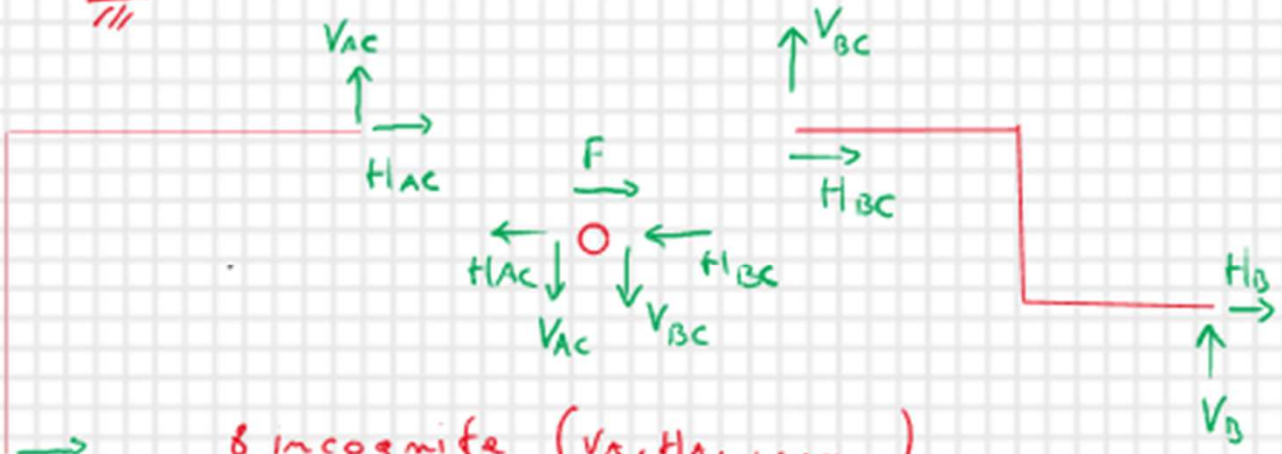
$$M(\theta) = \frac{9}{4} qR^2(1+\operatorname{sen}\theta) - qR^2\frac{(1-\cos\theta)^2}{2}$$

$$M(0) = \frac{9}{4} qR^2 \qquad M(\pi/2) = 4qR^2$$

Equilibrio intorno al centro della sezione l'asse della trave

Struttura con carico concentrato sul vincolo interno (cerniera)



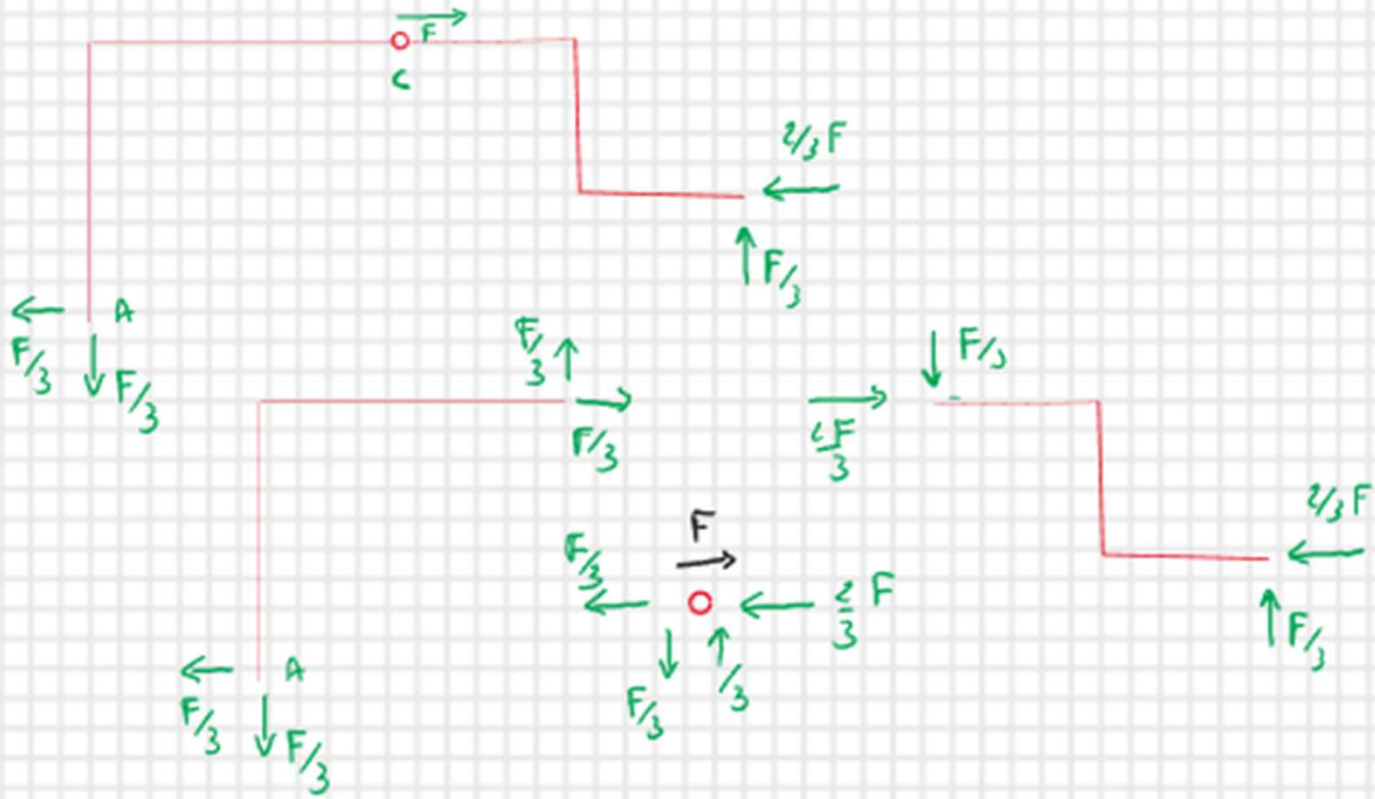


8 incognite (V_A, H_A, ...)

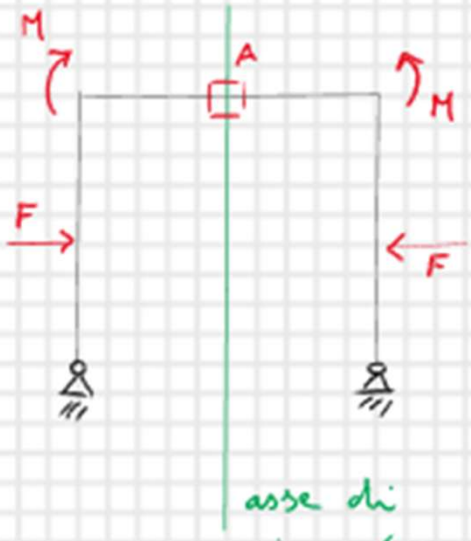
6 eq. c. statica (3 per ogni corpo

2 eq equilibrio del nodo

Soluzione



Introduzione alla simmetria strutturale

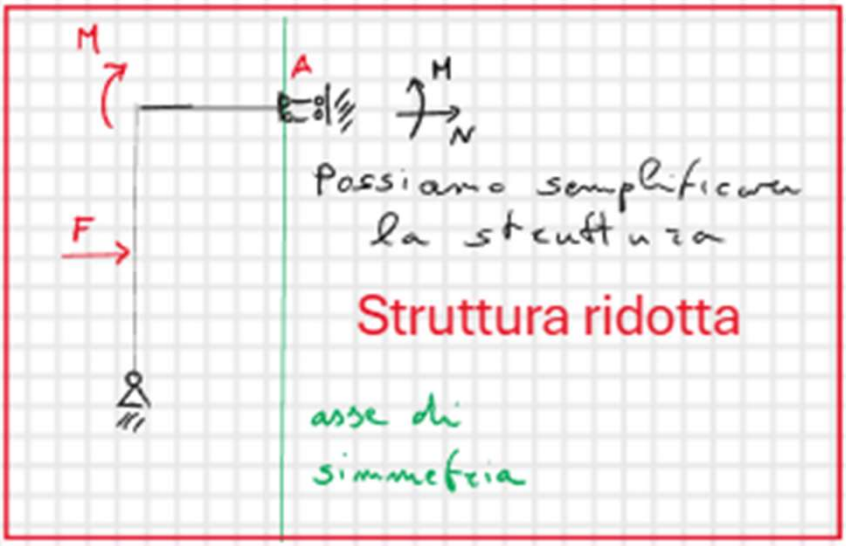


1) Struttura simmetrica
2) Carichi simmetrici

↓

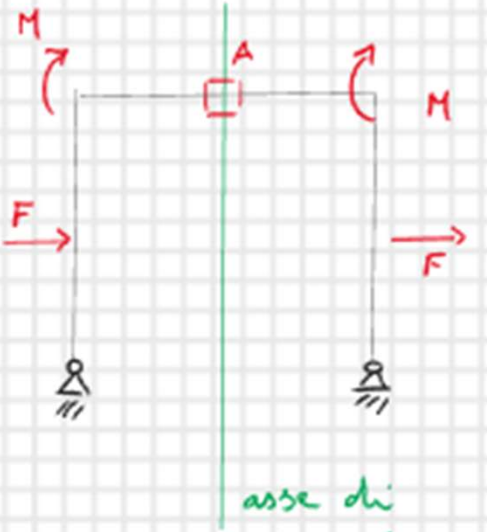
Reazioni vincolari
Spostamenti
CdS
} simmetrici

Taglio in A = 0



Possiamo semplificare la struttura

Struttura ridotta

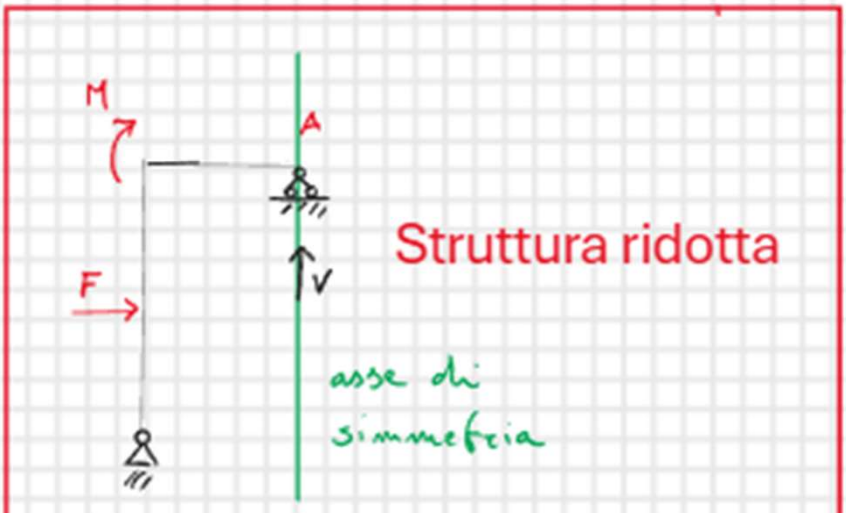


1) Struttura simmetrica
2) Carichi antisimmetrici

↓

solo azioni antisimmetriche

M = 0 e N = 0



Struttura ridotta

Carichi concentrati sull'asse di simmetria