

Politecnico di Milano - Corso di Laurea in Ingegneria Meccanica  
Anno accademico 2019-20  
**Costruzione di Macchine 1**  
(Prof. C. Sbarufatti, Prof. A. Manes, Prof. G. Prevati)

**Tema d'esame: 6 Luglio 2020**

Parte 1: Fondamenti di Costruzioni di Macchine

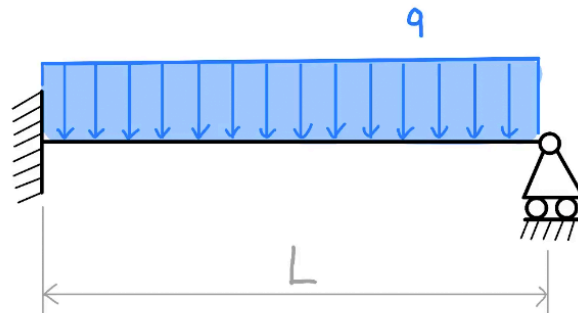
Risolvere il tema d'esame e caricare la soluzione

**NB: Riportare sulla soluzione NOME, COGNOME E NUMERO DI MATRICOLA**

**FDM: Esercizio 1.**

Considerando la seguente struttura:

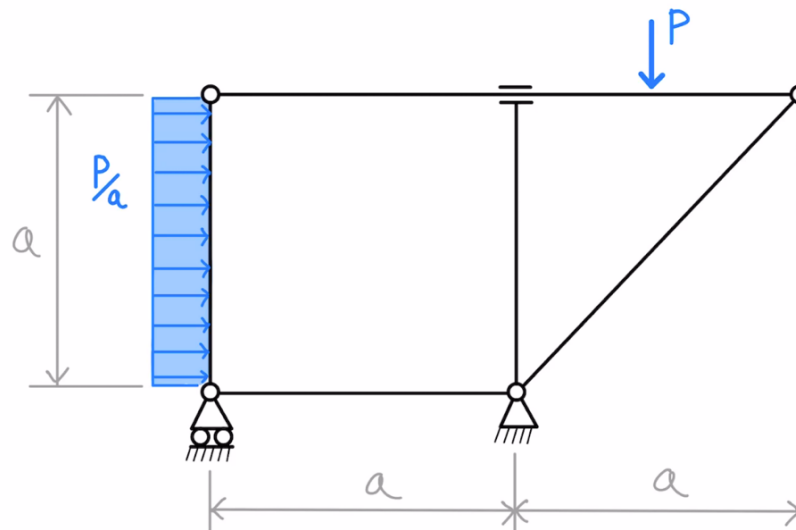
- tracciare la deformata qualitativa;
- scrivere l'equazione dello spostamento verticale  $v(x)$  completo di tutte le costanti di integrazione;
- determinare i diagrammi di momento flettente e taglio.

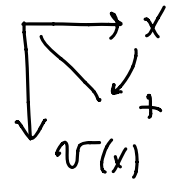
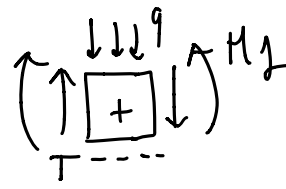
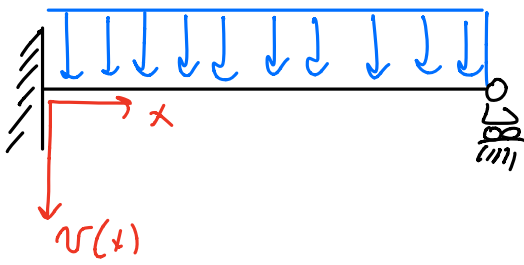


**FDM: Esercizio 2.**

Considerando la seguente struttura:

- eseguire l'analisi cinematica;
- calcolare le reazioni vincolari interne ed a terra, indicando per ogni vettore, direzione, modulo e verso;
- diagrammare le azioni interne (per i diagrammi indicare sempre la convenzione scelta).

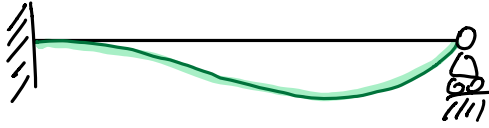




$$v'' = -\frac{M}{EJ}$$

$$T = \frac{dM}{dx}$$

$$\frac{dT}{dx} = -q$$



$$v''(x) = -\frac{M(x)}{EJ}$$

$$v'''(x) = -\frac{dT}{dx} \frac{1}{EJ} = -\frac{T}{EJ}$$

$$v^{(4)}(x) = -\frac{dT}{dx} \frac{1}{EJ} = \frac{q}{EJ}$$

$$EJ v^{(4)} = q$$

$$EJ v''' = qx + A$$

$$EJ v'' = \frac{q}{2} x^2 + Ax + B$$

$$EJ v' = \frac{q}{6} x^3 + \frac{A}{2} x^2 + Bx + C$$

$$EJ v = \frac{q}{24} x^4 + \frac{A}{6} x^3 + \frac{B}{2} x^2 + Cx + D$$

$$v(x=0) = 0 \quad D = 0$$

$$v'(x=0) = 0 \quad C = 0$$

$$v(x=l) = 0 \quad \frac{q}{24} l^4 + \frac{A}{6} l^3 + \frac{B}{2} l^2 = 0 \quad B = -\frac{A}{3} l - \frac{q}{12} l^2$$

$$v''(x=l) = 0 \quad \frac{q}{2} l^2 + Al + B = 0 \quad 6 \frac{q}{2} l^2 + Al = \frac{4A}{3} l + \frac{q}{12} l^2$$

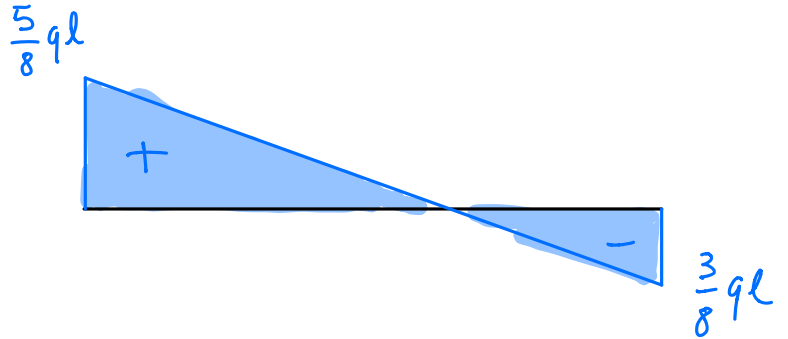
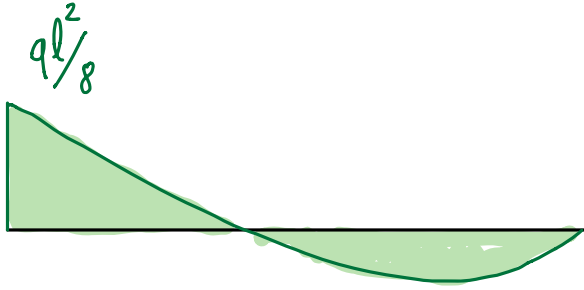
$$(12 - 4) Al = ql^2(1 - 6) \quad A = -\frac{5}{8} ql$$

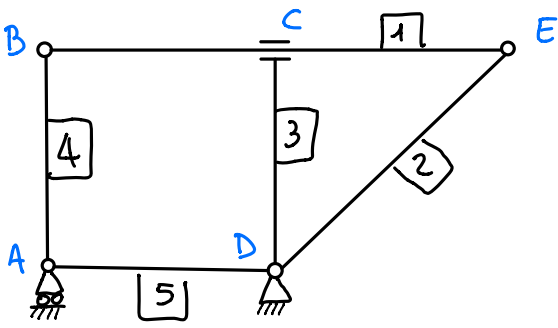
$$B = \frac{1}{8} ql^2$$

$$v(x) = \frac{1}{EJ} \left( \frac{q}{24} x^4 - \frac{5}{48} ql x^3 + \frac{1}{16} ql^2 x^2 \right)$$

$$M(x) = -EJv''(x) = -\frac{q}{2}x^2 + \frac{5}{8}qlx - \frac{1}{8}ql^2$$

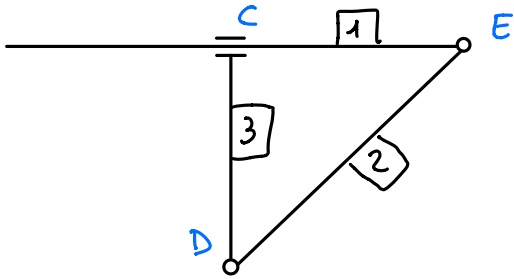
$$T(x) = -EJv'''(x) = -qx + \frac{5}{8}ql$$



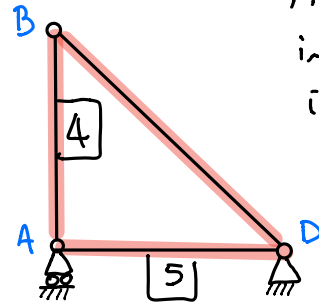
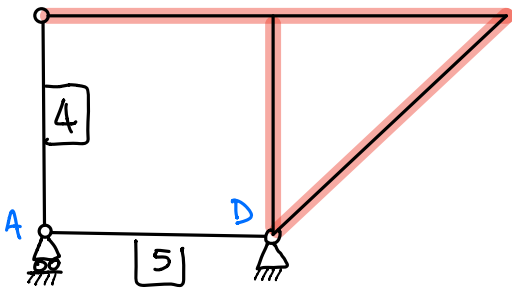


$$Gdl = 3m = 15$$

$$Gdv = 3_A + 2_B + 2_C + 6_D + 2_E = 15$$



Anello chiuso internamente  
isostatico



Anello chiuso  
internamente  
isostatico

struttura  
isostatica

