

Equazione dei Lavori Virtuali

- travature ad asse rettilineo a tratti
- con sconnessioni
- carichi diffusi e concentrati
- variazioni di temperatura
- deformazioni di tipo estensionale, flessionale, di scorrimento e torsionale

lavoro virtuale interno = lavoro virtuale esterno

$$\{N, T, M, M_t\}$$

$$\{q, r, c, m\}, \{Q, P, C, C_t\}$$

che soddisfano

$$N' + q = 0, T' + r = 0$$

$$M' - T + c = 0, M_t' + m = 0$$

$$[N] = -Q, [T] = -P$$

$$[M] = -C, [M_t] = -C_t$$

sistema di c. dis.
e di carichi esterni
EQUILIBRATO

$$\{\bar{\varepsilon}, \bar{\chi}, \bar{\psi}, \bar{\psi}_t\}$$

$$\{\bar{w}, \bar{v}, \bar{\varphi}, \bar{\theta}\}$$

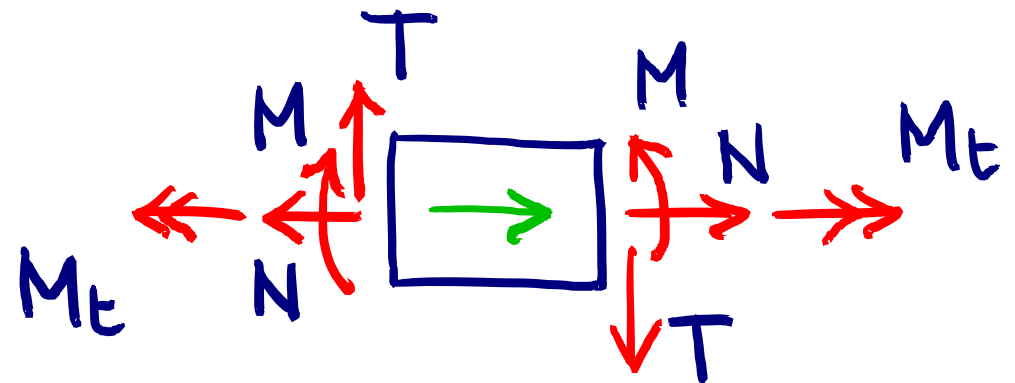
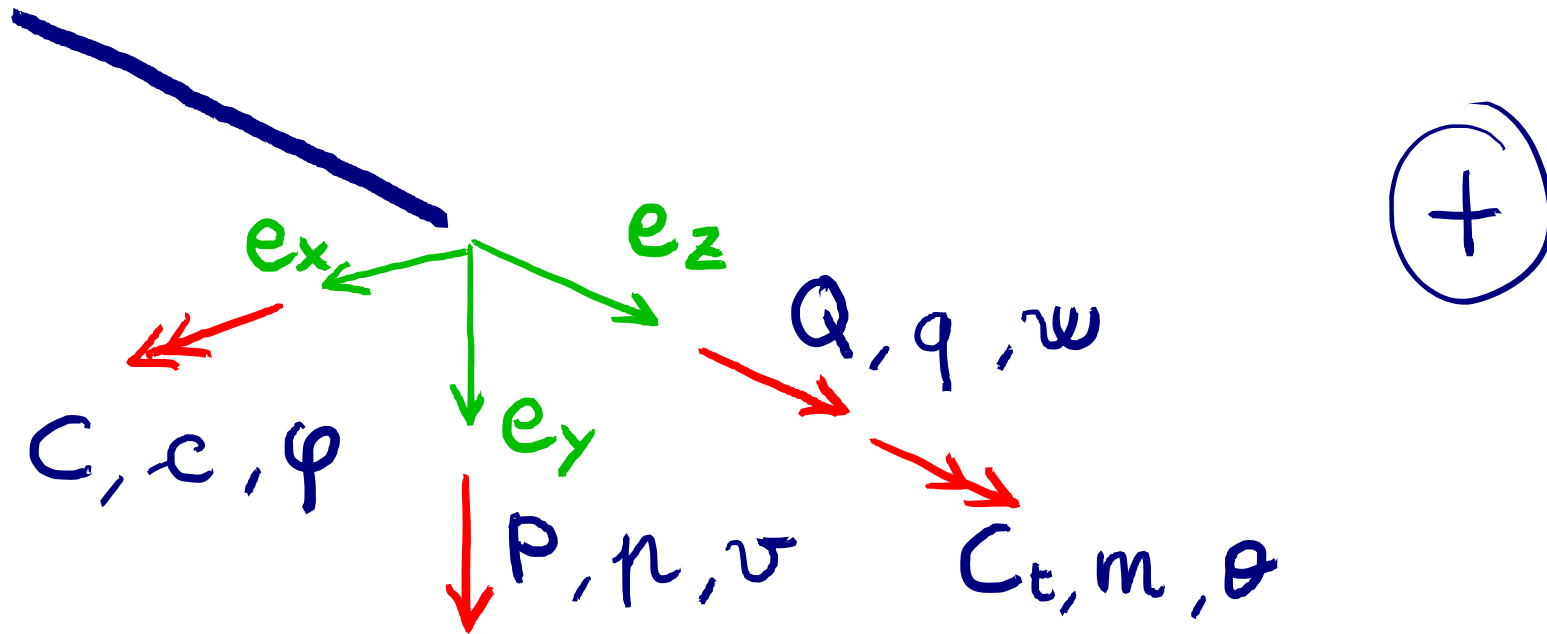
che soddisfano

$$\bar{\varepsilon} = \bar{w}', \bar{\chi} = \bar{v}' + \bar{\varphi}'$$

$$\bar{\psi} = \varphi', \psi_t = \theta'$$

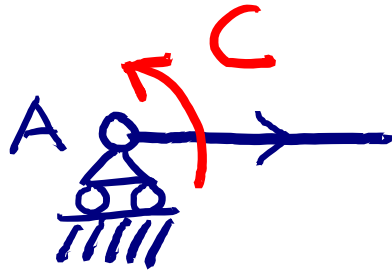
sistema di misure
di deformazione e
di spost. e rotazioni
CONGRUENTE

convenzioni di segno



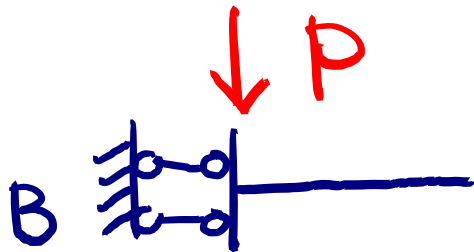
vincoli

esempi:



$$N_A = 0, M_A = -C$$

$$v_A = 0$$

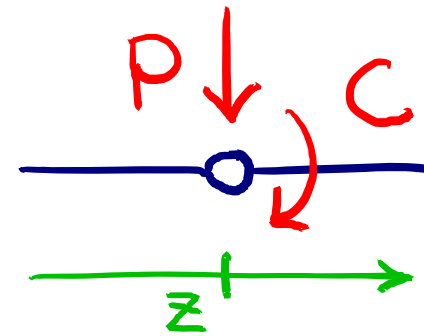


$$T_B = -P$$

$$w_B = 0, \varphi_B = 0$$

e

sconnessioni



$$[T]_z = -P, [N]_z = 0$$

$$M(z^-) = 0, M(z^+) = C$$

$$[w]_z = 0 = [v]_z$$

$$L_{\text{vint}}(\ell) = L_{\text{vest}}(\ell) \quad \begin{array}{l} \text{per ogni } \ell \in \mathcal{L}, \\ \text{per ogni sist. equilibrato e} \\ \text{per ogni sist. congruente} \end{array}$$

$$L_{\text{vint}}(\ell) := \int_{\ell} (N \bar{E} + T \bar{\delta} + M \bar{\psi} + M_t \psi_t)$$

$$L_{\text{vest}}(\ell) := \int_{\ell} (q \bar{\psi} + p \bar{v} + c \bar{\varphi} + m \bar{\theta}) +$$

$$+ \sum_{i=1}^I (Q \bar{\psi})_i + \sum_{j=1}^J (P \bar{v})_j + \sum_{k=1}^K (C \bar{\varphi})_k + \sum_{h=1}^H (c_t \theta)_h$$