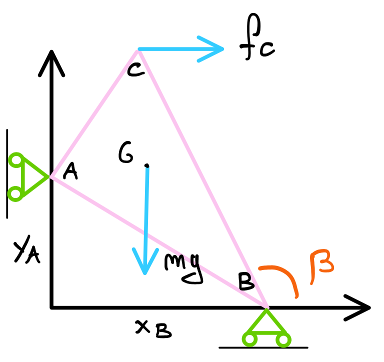
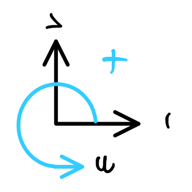
Es 3

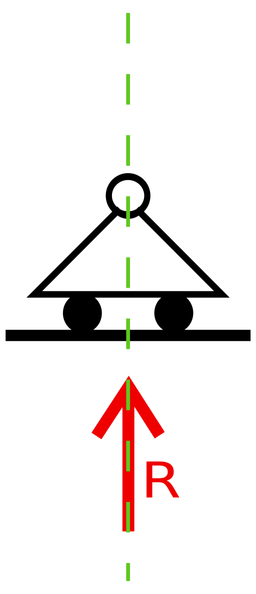
Tuesday, 25 January 2022 00:35

DINAMICA

CORPO RIGIDO, 1 GRADO LIBERTA' (ASTA VINCOLATA A 2 CARRELLI)







NOTA

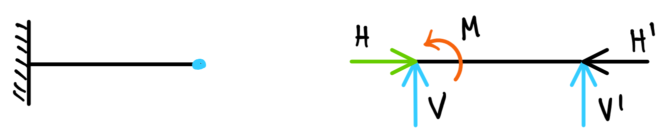
$(B-O) = 2.7 \hat{\imath}$ m
$(A-O) = y_A \hat{\jmath}$ m
$(A-G) = -1 \hat{\imath}$ m
$(C-G) = 2 \hat{\jmath}$ m

$|A-B| = L = 4$ m
$\dot{x}_B = 5$ m/s
$\mathcal{S} = 2$ kg/m²
$f_c = f_c \hat{\imath}$ N

CALCOLA $f_c \Big| \frac{d\dot{x}_B}{dt} = 0$ $\quad \phi_A \quad \phi_B$

IL VINCOLO DI CARRELLO BLOCCA 1 SPOSTAMENTO
POSSO SOSTITUIRE I CARRELLI CON FORZE

SOSTITUIRE VINCOLI CON FORZE
CINEMATICA → DINAMICA



CHE FORZE? QUELLE PER CUI IL VINCOLO NON MI PERMETTE IL MOVIMENTO

CINEMATICA

MODULI ED ANOMALIA

	$\|\cdot\|$	$\angle$
$(A-O)$	$y_A(t)$	COST
$(B-O)$	$x_B(t)$	COST
$(A-B)$	COST	$\beta(t)$

RISOLVO PER $y_A(t)$, $\beta(t)$

POSIZIONI

CHIUSURA $(A-O) = (B-O) + (A-B)$

$y_A \hat{\jmath} = x_B \hat{\imath} + L(\cos\beta\, \hat{\imath} + \sin\beta\, \hat{\jmath})$

SISTEMA

$$\begin{cases} 0 = x_B + L\cos\beta \\ y_A = L\sin\beta \end{cases} \longrightarrow \quad \beta = \arccos(-x_B/L) = 2{,}31 \text{ RAD} \qquad y_A = L\sin\beta = 2{,}95 \text{ m}$$

VELOCITA'

DERIVO IL SISTEMA

$$\begin{cases} 0 = \dot{x}_B - L\dot{\beta}\sin\beta \\ \dot{y}_A = L\dot{\beta}\cos\beta \end{cases} \longrightarrow \quad \dot{\beta} = \frac{\dot{x}_B}{L\sin\beta} = 1{,}7 \text{ RAD/s} \qquad \dot{y}_A = L\dot{\beta}\cos\beta = -4{,}57 \text{ m/s}$$

ACCELERAZIONI

DERIVO 2 VOLTE IL SISTEMA
$\ddot{x}_B = 0$ PER IPOTESI

$$\begin{cases} 0 = \cancel{\ddot{x}_B}^{=0} - L(\ddot{\beta}\sin\beta + \dot{\beta}^2\cos\beta) \\ \ddot{y}_A = L(\ddot{\beta}\cos\beta - \dot{\beta}^2\sin\beta) \end{cases} \longrightarrow \quad \ddot{\beta} = \frac{\cos\beta\,\dot{\beta}^2}{\sin\beta} = 2{,}63 \text{ RAD/s}^2 \qquad \ddot{y}_A = \dots = -15{,}6 \text{ m/s}^2$$

STUDIO IL BARICENTRO

PER IL TEOREMA DI RIVALS

$$a_A = \cancel{a_B}^{=0} + \ddot{\beta}\hat{k} \times (G-B) - \dot{\beta}^2 (G-B) = -2{,}87\,\hat{\imath} - 12{,}93\,\hat{\jmath}$$

DINAMICA

EQUILIBRIO DINAMICO

$\bar{R} = \sum_i f_i$ FORZE ESTERNE

$\bar{M}_C = \sum_i (P_i - G) \times f_i$ BRACCIO × FORZA

$\bar{F}_{IN} = \sum_i -m_i a_i$ FORZE D'INERZIA

$\bar{C}_{IN} = \sum_i \mathcal{S}_i \ddot{\theta}_i$ COPPIE D'INERZIA

PER IL PRINCIPIO D'ALAMBERT

$\bar{R} + \bar{F}_{IN} = 0$ ESTERNE + INERZIA = 0

$\bar{M}_C + \bar{C}_{IN} = 0$ MOMENTI + COPPIE = 0

FORZE ESTERNE

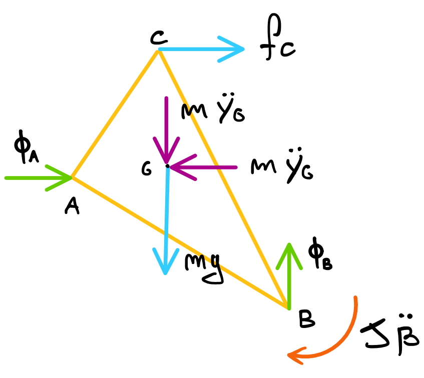
ATTIVE CORPO RIGIDO $mg \quad f_c$

REATTIVE VINCOLI CINEMATCI $\phi_A \quad \phi_B$

INERZIA

FORZE $-m\ddot{x}_c\,\hat{\imath} - m\ddot{y}_c\,\hat{\jmath}$

COPPIE $-\mathcal{S}_c\,\ddot{\beta}\,\hat{k}$

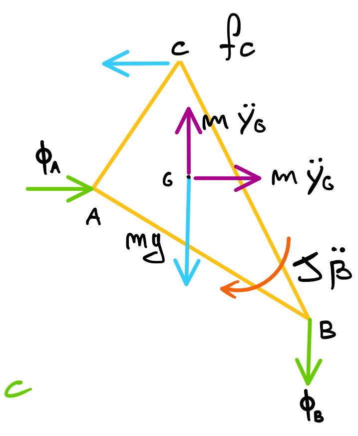


EQUILIBRIO

$R + F_I = 0 \longrightarrow f_c\,\hat{\imath} + \phi_A\,\hat{\imath} - mg\,\hat{\jmath} - m\ddot{y}_G\,\hat{\jmath} - m\ddot{x}_G\,\hat{\imath} + \phi_B\,\hat{\jmath} = 0$

$f_c + \phi_A - m\ddot{x}_G = 0$ FORZE $\hat{\imath}$

$\phi_B - mg - m\ddot{y}_G$ FORZE $\hat{\jmath}$



$(G-C) \times f_c + (B-G)\hat{\imath} \times \phi_B\,\hat{\jmath} - \mathcal{S}_G\,\ddot{\beta}\,\hat{k} = 0$

$-2 f_c + 1{,}7\,\phi_B - \mathcal{S}_c\,\ddot{\beta} = 0$ MOMENTI C

RIFACCIO LA FIGURA CON LE FORZE ORIENTATE CORRETTAMENTE