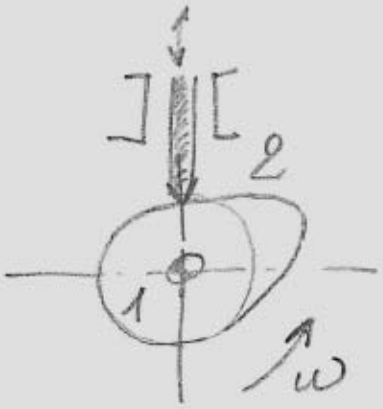
FONDAMENTI DI MECCANICA E BIOMECCANICA [IN/0165]

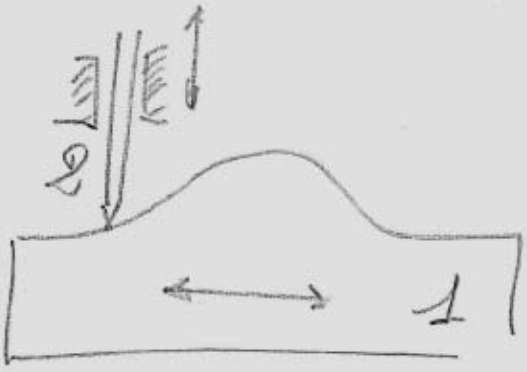
Lezione del 06 ottobre 2017.

Titolo:
Cinematica di meccanismi, conteggio di gradi di libertà, meccanismo biella-manovella.

Contenuti:
Gradi di libertà, vincoli: incastro cerniera, carrello.
Valutazione dei gradi di libertà di un meccanismo.
Braccio umano in fase di lavorazione al banco con pialla.
Meccanismo biella-manovella, velocità ed accelerazioni di punti del meccanismo, velocità ed accelerazioni angolari dei membri del meccanismo.

Riferimento:
Ferraresi C., Raparelli T. "Meccanica applicata - Terza edizione", CLUT, 2007.
Cap. 1 - Elementi di cinematica.
Pagg. 22 – 25

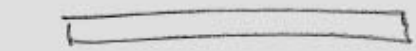




SISTEMI
CAMMA-PUNTERIA

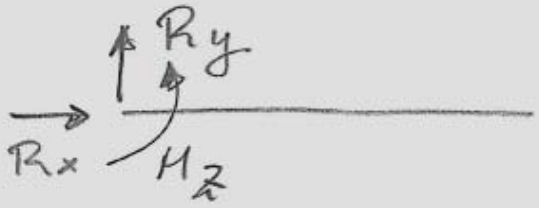
PIANO

3 g d l



INCASTRO

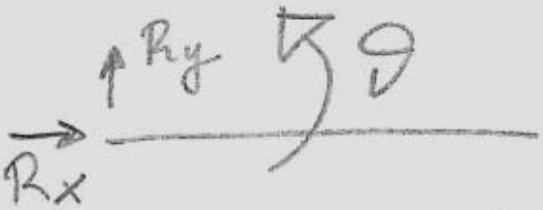
0 g d l



Rx Ry Mz REAZIONI

CERNIERA

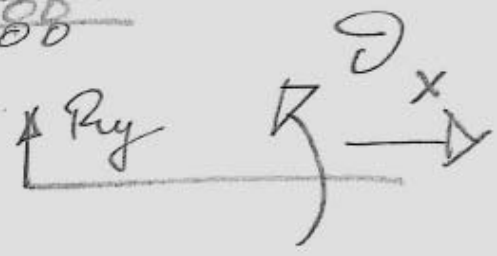
1 g d l



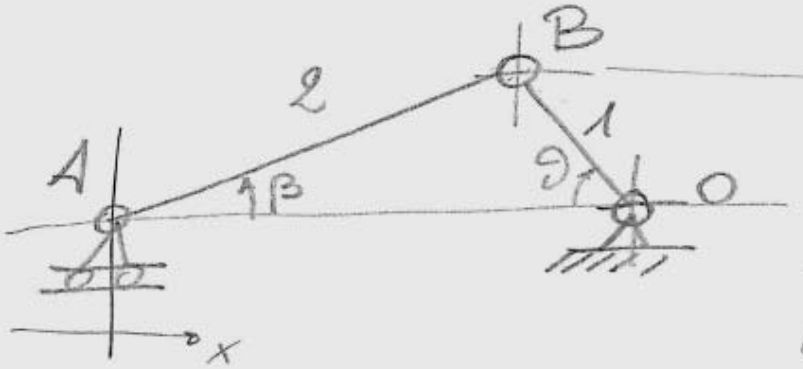
Rx Ry REAZIONI

CARRELLO APPOGGIO

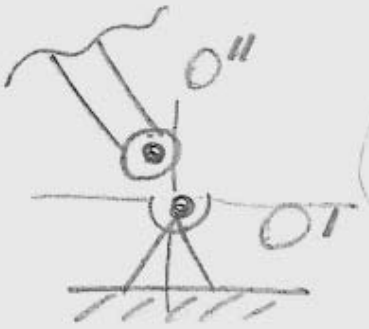
2 g d l



Ry REAZIONE



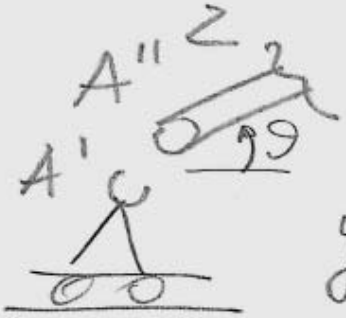
3+3
6 gdl



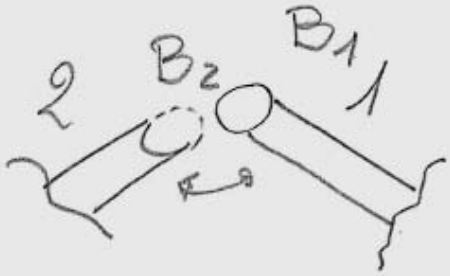
TELAIO

$x_{O'} = 0$
$y_{O'} = 0$

$x_{O''} = x_{O'}$
$y_{O''} = y_{O'}$



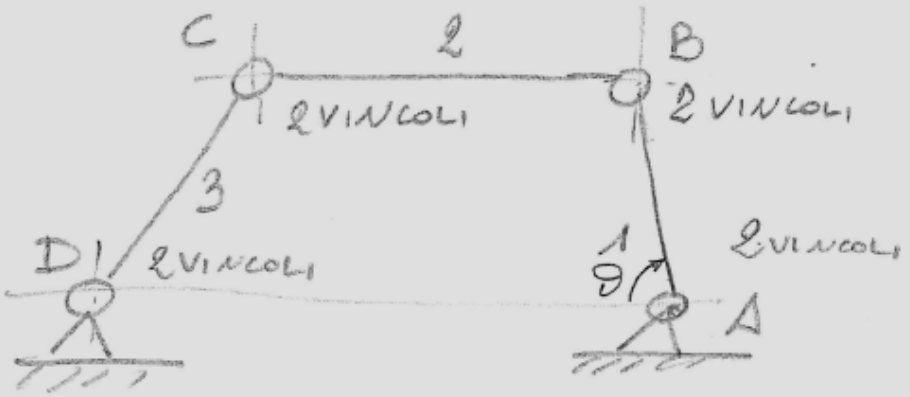
$y_{A''} = y_{A'}$



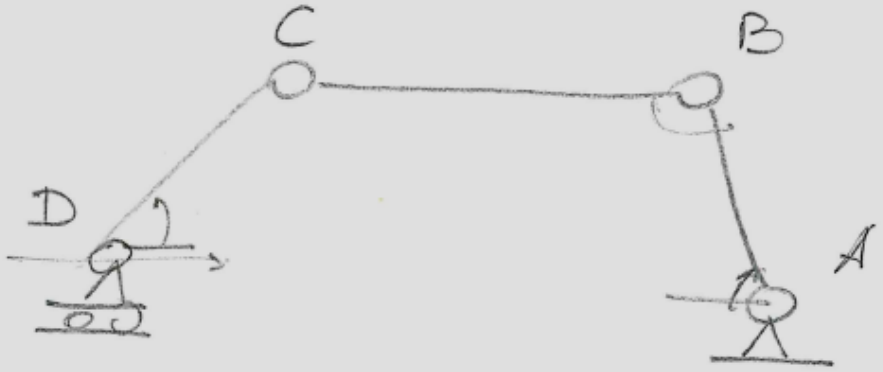
$x_{B_1} = x_{B_2}$
$y_{B_1} = y_{B_2}$

6 − 5 = 1 gdl

4



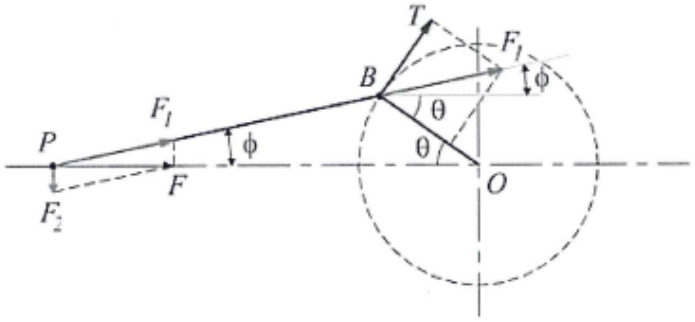
3 CORPI × 3 gdl = 9 VINCOLI 8

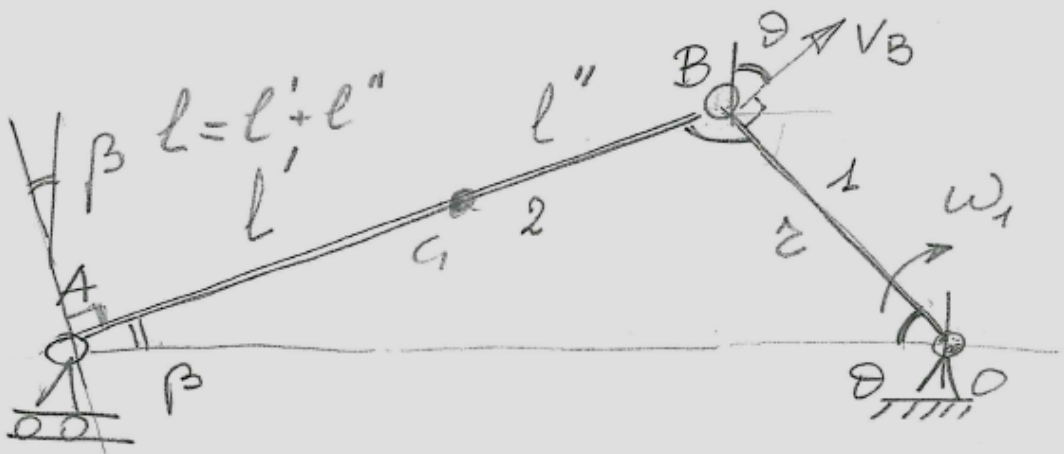


9 gdL VINCOLI 7

4 bis

Biella manovella





$\omega_1 = 1500\ g/1'$ COST $\quad \vartheta = 60°$

$OB = r = 0{,}125\ m$

$l' = 0{,}250\ m$

$l'' = 0{,}100\ m$

$\omega_1 = \frac{1500 \cdot 2\pi}{60} = 157{,}08\ \frac{rad}{s}$

$\bar{\omega}_1 = \omega_1(-k)$

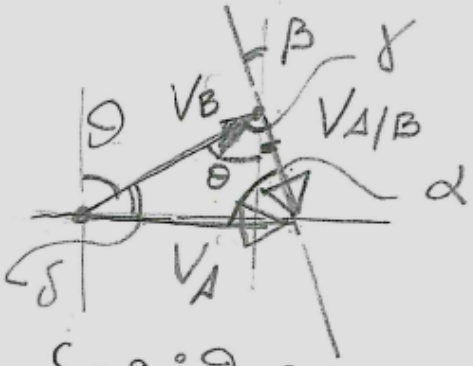
$\frac{r}{\sin\beta} = \frac{l}{\sin\vartheta}$

$\beta = \arcsin\left(\frac{r}{l}\sin\vartheta\right)$

$\beta = 18°$

$\vec{V}_A = \vec{V}_B + \vec{V}_{A/B}$

?	$\omega_1 r$ 19,63 m/s	$\omega_2 l$?	H
// AO	⊥ OB	⊥ AB	D
?	↗	?	V



$\frac{V_B}{\sin\alpha} = \frac{V_A}{\sin\gamma} = \frac{V_{A/B}}{\sin\delta}$

$\delta = 90° - \vartheta = 30°$

$\gamma = \vartheta + \beta = 78°$

$\alpha = 180° - (\delta + \gamma) = 72°$

$V_A = V_B \frac{\sin\gamma}{\sin\alpha} = 19{,}63 \frac{\sin 78°}{\sin 72°}$

$V_A = 20{,}2\ m/s$

$V_{A/B} = V_B \frac{\sin\delta}{\sin\alpha} = 19{,}63 \frac{\sin 30°}{\sin 72°}$

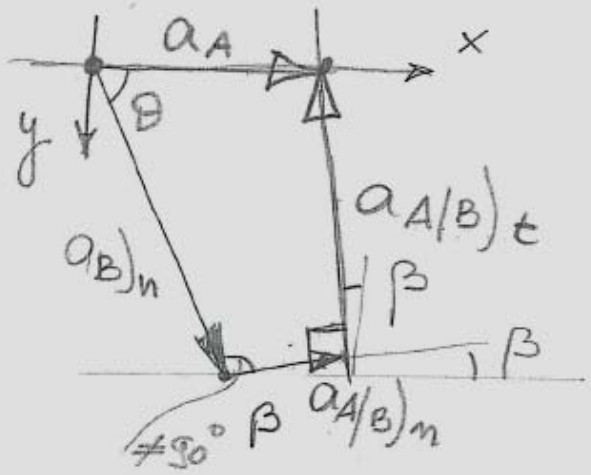
$V_{A/B} = 10{,}32\ m/s$

$\omega_2 = \frac{V_{A/B}}{l} = \frac{10{,}32}{0.350} = 29{,}5\ \frac{rad}{s}$; $\bar{\omega}_2 = \omega_2 \bar{k}$

$$\bar{a}_A = \bar{a}_B + \bar{a}_{A/B}$$

$$\vec{a}_A = \bar{a}_{B)n} + \vec{a}_{B)t} + \bar{a}_{A/B)n} + \bar{a}_{A/B)t}$$

?	$\omega_1^2 r$ $3084{,}3\ \frac{m}{s^2}$	$\dot{\omega}_1 r$ 0	$\omega_2^2 l$ $304{,}6\ \frac{m}{s^2}$	$\dot{\omega}_2 l$?	M
$\parallel_{AO}$	$\parallel OB$	A	$\parallel AB$	$\perp AB$	D
?	$B \to O$	A	$A \to B$	?	V



x) $a_{B)n}\cos\vartheta + a_{A/B)n}\cos\beta - a_{A/B)t}\sin\beta - a_A = 0$

y) $a_{B)n}\sin\vartheta - a_{A/B)n}\sin\beta - a_{A/B)t}\cos\beta = 0$

$$a_{A/B)t} = \left[a_{B)n}\sin\vartheta - a_{A/B)n}\sin\beta\right] / \cos\beta$$

$a_{A/B)t} = 2709{,}3\ m/s^2$; $\dot{\omega}_2 = \frac{a_{A/B)t}}{l} = 7740{,}9\ \frac{rad}{s^2}$

$\bar{\dot{\omega}}_2 = \dot{\omega}_2(-\bar{k})$

$a_A = 995\ m/s^2$

$\bar{V}_G = \bar{V}_B + \bar{V}_{G/B}$

?	$\omega_{1,2}$ $19{,}63\ \frac{m}{s}$	ω_{2GB} $2{,}95\ m/s$	M
?	$\perp OB$	$\perp GB$	D
?	↗	↘	V

$V_G = 19{,}23\ m/s$