VINCOLI PIANI ESTERNI

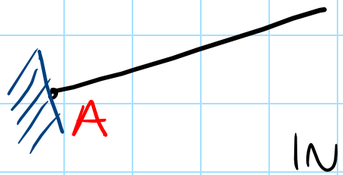
29/10/25

In queste lezioni introdurrò mano a mano dei simboli che ci aiutano a chiarificare il "PROBLEMA STRUTTURALE"

- VINCOLO TRIPLO ($v = 3$)

INCASTRO

PREST. CINEM. $\begin{cases} \underline{u}_A = \underline{0} \\ \varphi = 0 \end{cases}$



CORPO "BLOCCATO" DAL SOLO INCASTRO $\Rightarrow \nexists$ C.I.R. (C)

IL N° DI G.D.L. CHE IL VINCOLO SOTTRAE AL SISTEMA

← v: molteplicità del vincolo

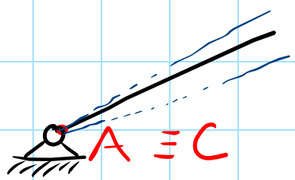
g: N° di G.D.L. del SIST. MECCANICO LIBERO DA VINCOLI

(1 C.R. $g = 3$)

- VINCOLI DOPPI ($v = 2$)

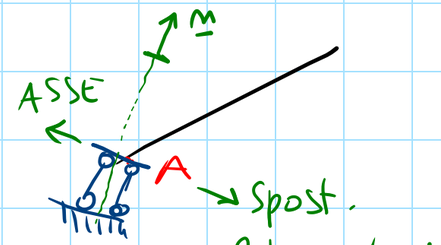
- CERNIERA

$\underline{u}_A = \underline{0}$ } PREST. CINEMATICA (φ: LIBERA) $\begin{cases} u_{Ax} = 0 \\ u_{Ay} = 0 \end{cases}$ 2 EQ. SCALARI



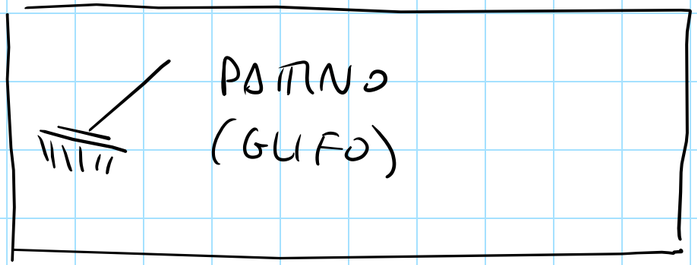
C.I.R. (C) ≡ A

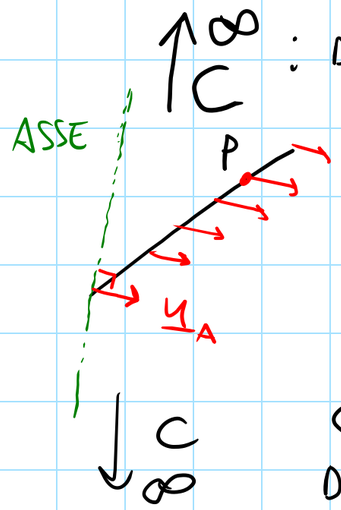
– DOPPIO PENDOLO



$\underline{u}_A \perp \underline{m}$

$\left.\begin{array}{l} \underline{u}_A \cdot \underline{m} = 0 \\ \varphi = 0 \end{array}\right\}$ 2 EQ. SCALARI





: DOPPIO PENDOLO

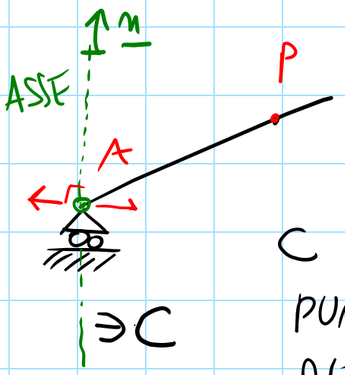
TRASLAZIONE

$\underline{u}_P = \underline{u}_A \ , \forall P$

C CORRISP CON LA DIREZ. DELL'ASSE

– VINCOLI SEMPLICI ($\nu = 1$)

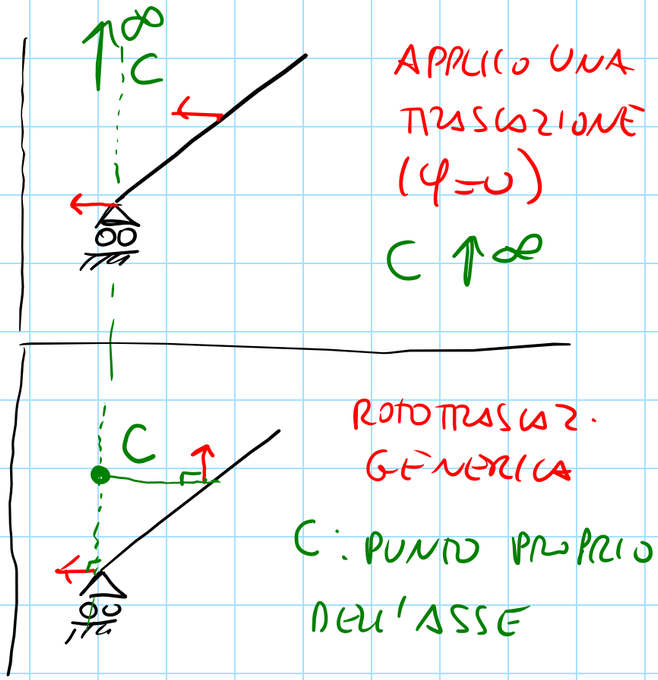
– CARRELLO (PENDOLO)



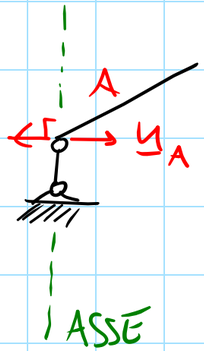
$\underline{u}_A \cdot \underline{m} = 0$ } 1 EQ. SCALARE (φ LIBERA)

$\left(\underline{u}_P = \underline{u}_A + \omega \times AP\right)$

C PUÒ ESSERE UN PUNTO QUALSIASI DELL'ASSE.



(PENDOLO)
(BIELLA)



INCASTRO : FIXED-END
BUILT-IN CONSTRAINT

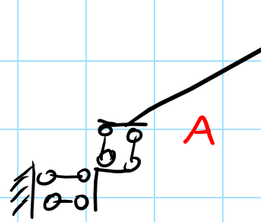
CERNIERA : HINGE, PIN

D. PENDOLO : SLIDER

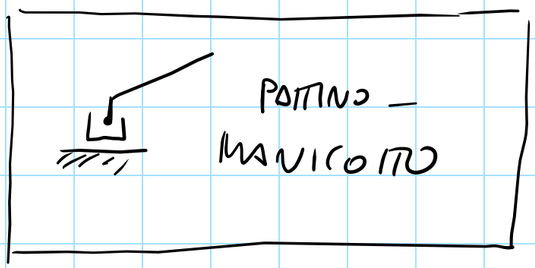
CARRELLO : ROLLER

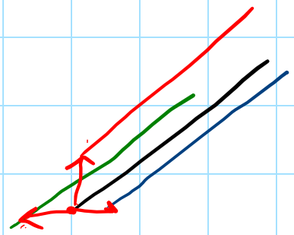
— DOPPIO - DOPPIO PENDOLO

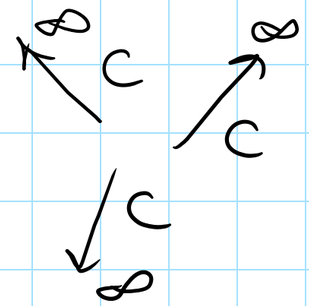
$\varphi = 0\}$ ($\underline{u}_A$ libero)



↳ LE POSSIBILITÀ DI MOVIMENTO SONO TUTTE LE TRASLAZIONI

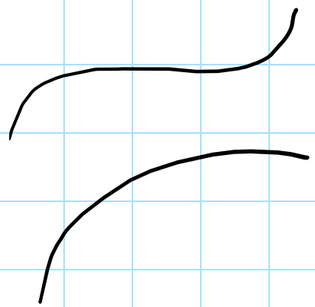






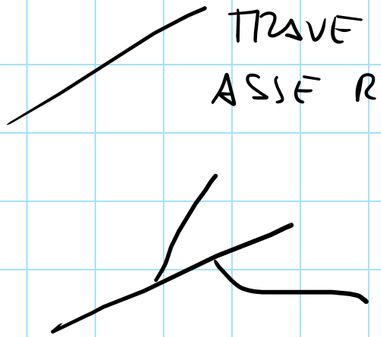
C ∈ RETTA IMPROPRIA DEL PIANO

ALCUNE TIPOLOGIE DI TRAVI E/O TRAVATURE PIANE



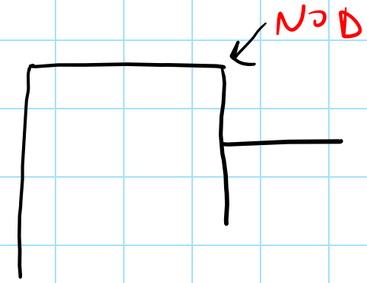
TRAVE CURVILINEA

TRAVE AD ARCO



TRAVE AD ASSE RETTILINEO

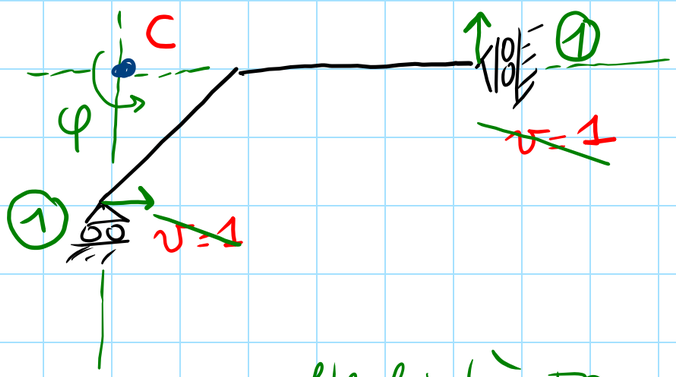
SISTEMA DI TRAVI O TRAVATURA



TELAIO

PROBLEMA CINEMATICO DELLE TRAVI / TRAVATURA

ASSEGNATA UNA STRUTTURA E UN INSIEME DI VINCOLI, QUESTI ULTIMI SONO IN GRADO DI ELIMINARE TUTTI I G.D.L. DEL SISTEMA?



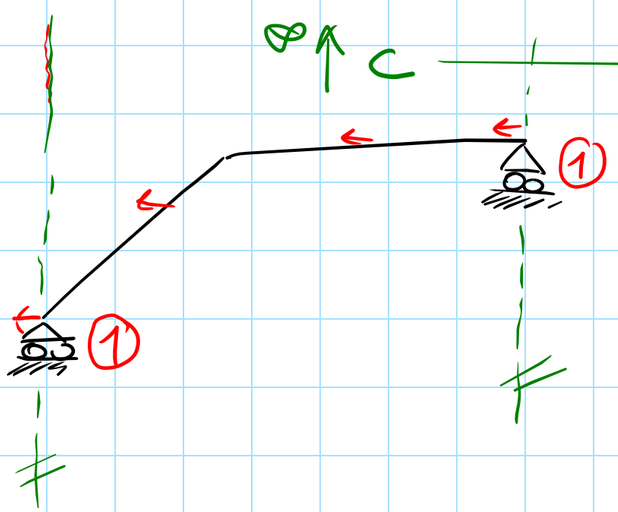
$v = 2$

$g = 3$

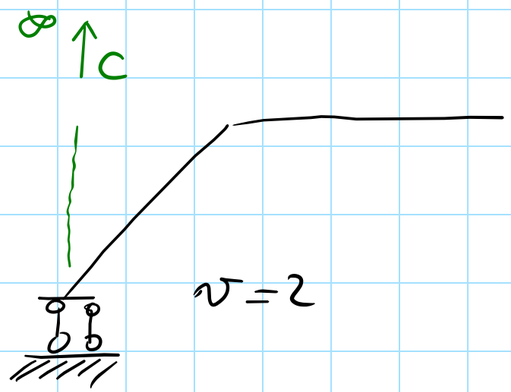
: RIMANE SICURAMENTE ALMENO UN G.D.L. RESIDUO. ⇒ ROTAZ. ATTORNO A C

v: molteplicità TOTALE DI VINCOLO PER LA STRUTTURA

C: PUNTO UNICO NELL'INTERS. DEGLI ASSI DEI DUE CARRELLI

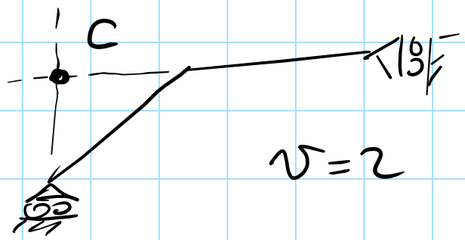


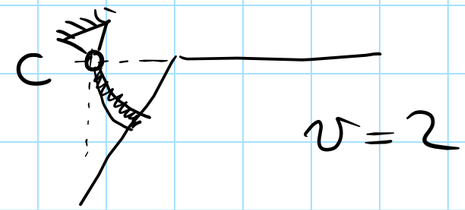
TRASLAZ. ORIZZ.
(INTERS. DEGLI ASSI)



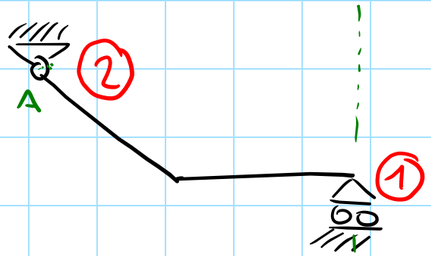
$v=2$ $(g=3)$

CINEMATICAMENTE IL DOPPIO PENDOLO DISEGNATO È EQUIV. AI DUE CARRELLI //





CINEMATICAMENTE I DUE CARRELLI SONO EQUIV. AD UNA CERNIERA IDEALE NEL PUNTO INTERS. DEI LORO ASSI



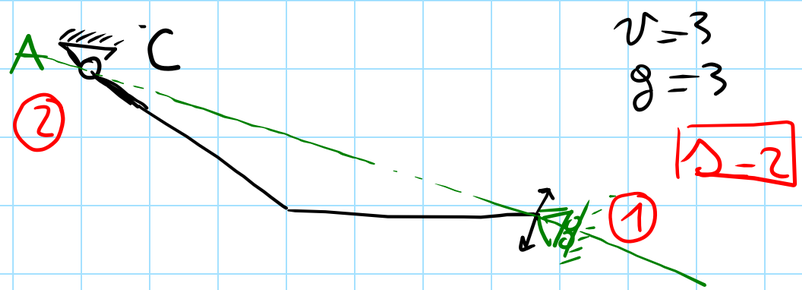
$\nu = 3$

$g = 3$

$\boxed{\Delta = 3}$

$\nexists C \Rightarrow$ IL CORPO È BLOCCATO

QUESTO PERCHÈ SE C ESISTESSE DOVREBBE SODDISFARE I REQUISITI DI OGNI SINGOLO VINCOLO. MA QUESTO NON ACCADE.



$\nu = 3$

$g = 3$

$\boxed{\Delta = 2}$

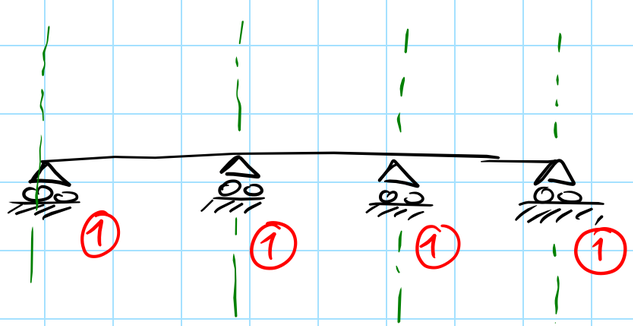
$\exists C!$ È IL PUNTO CENTRICENTRA (A)

CHE È ALL'ASSE DEL CARRELLO!

LA STRUTTURA HA ANCORA UN G.D.L. RESIDUO (ROTAZ. ATTORNO AD $A \equiv C$)

(VINCOLI "MAL DISPOSTI" O DISPOSTI IN "MANIERA NON EFFICACE")

Δ: N° DI G.D.L. "EFFETTIVAMENTE" ELIMINATI DAI VINCOLI



$g = 3$

$v = 4$

∞

C : ∄ C, PUNTO IMPR.

DI PUNTI SUI

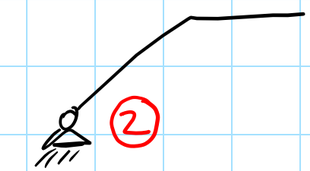
ASSI DEI CARRELLI

CLASSIFICAZ. DELLE STRUTTURE

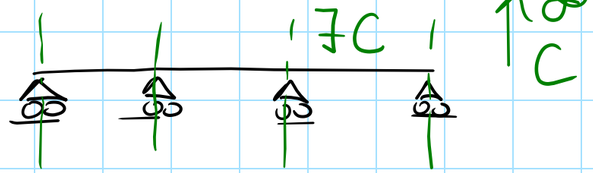
ℓ: grado di labilità (n° di G.D.L. RESIDUI)

$$\ell = g - s$$

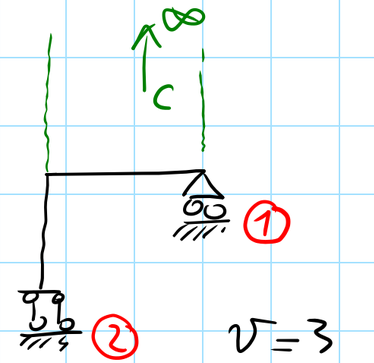
— LABILI ($\ell > 0$) : ∃ GDL RESIDUI



$v = 2$
$s = 2$
$\ell = 1$



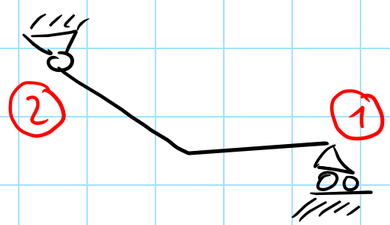
$v = 4$
$s = 2$
$\ell = 1$

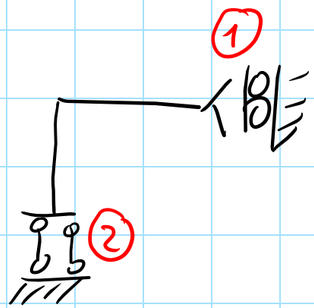


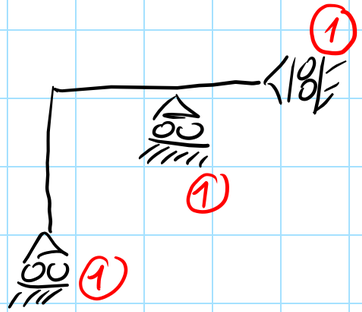
$v = 3$
$s = 2$
$\ell = 1$

DISPOSIZ. NON EFFICACE DEI VINCOLI

— ISOSTATICHE ($g = s = v$)

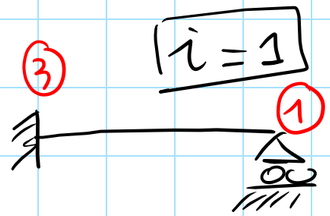






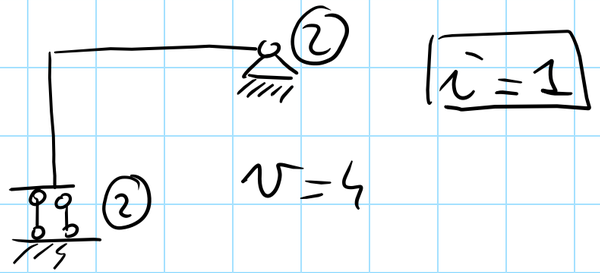
∄C

– IPERSTATICHE $(g = 3 < v)$



$v = 4$

$v = 4$



$v = 4$

GRADO DI IPERSTATICITA' $i = v - g$