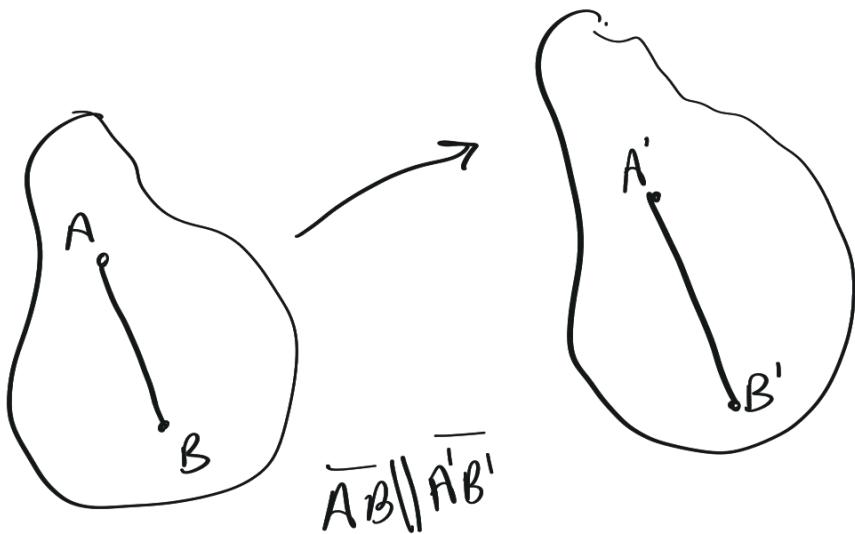
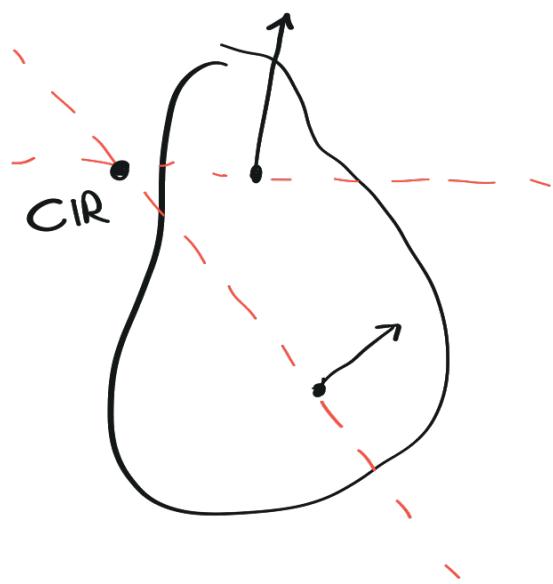


## Esercitazione



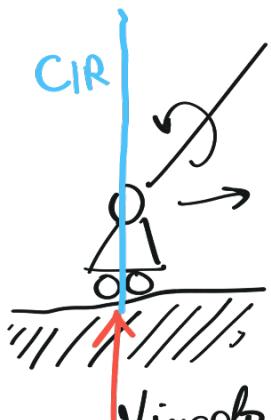
Traslazione

CIR

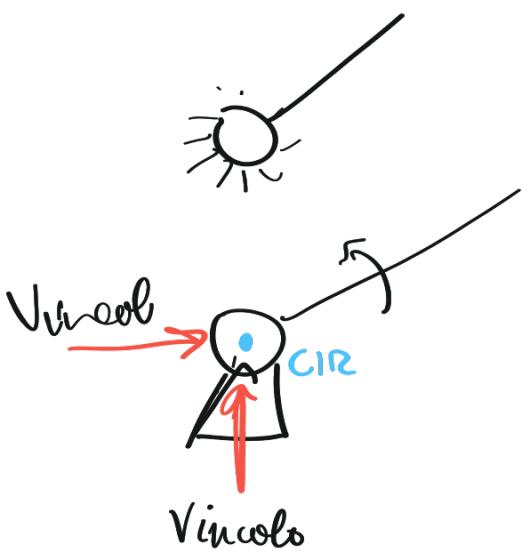


Se i vettori sono paralleli allora  $CIR = \infty$

Analisi Cinematica  $\rightarrow$  Studio del CIR



CIR : corollo ogni punto lungo d'asse che passa per il corolle



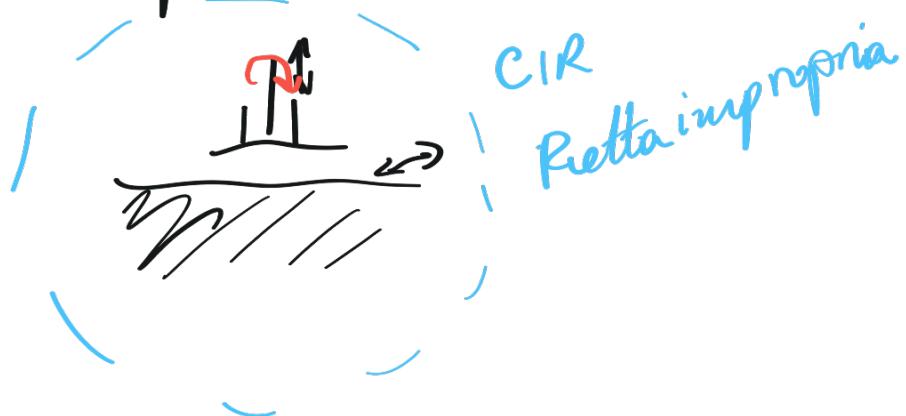
## Pattino / Cerniere impropria

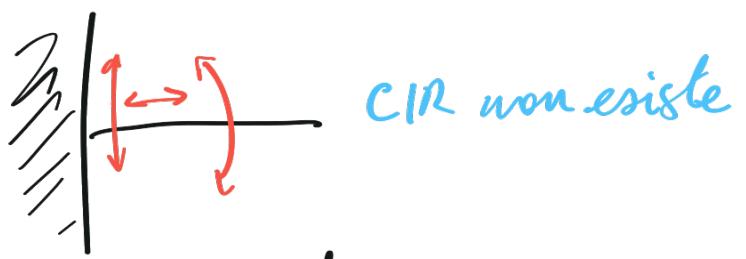


## Manicotto



## Bipattino





	gdlr
Cotello	1
Cerniere	2
Pattino	2
Manicotto	2
Bipattino	1
Incastro	3

$gdl_{\text{r}} \rightarrow$  gradi di libertà residui

$$gdl_{\text{r}} = gdl \cdot \sum gdl_{\text{ver}}$$

efficienza

$$\sum gdl_{\text{ver,eff}} = \sum gdl$$

efficienza

$$\sum gdl_{\text{ver,eff}} = gdl$$

$$\sum gdl_{\text{ver,eff}} < gdl$$

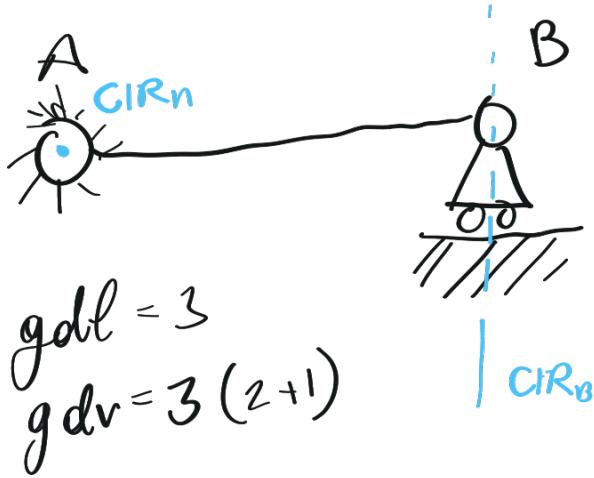
isostatica

ipostatica

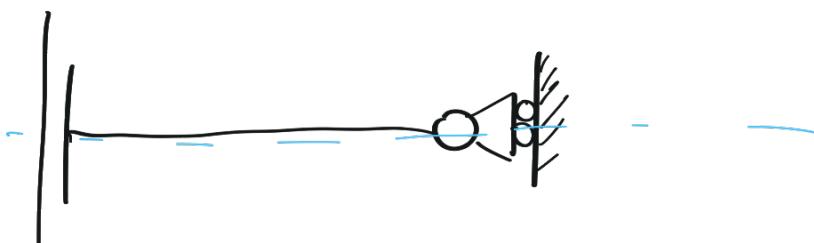
$$\sum gdl_{\text{ver,eff}} > \sum gdl$$

Inefficienza

labile

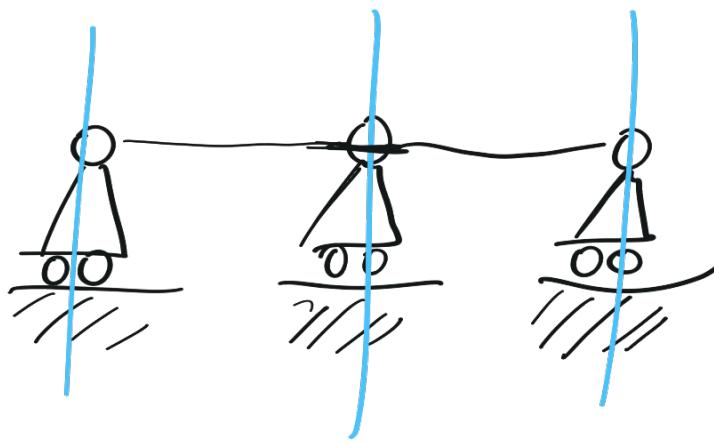


$\nexists \text{CIR}$  non si incontrano quindi non esiste CIR



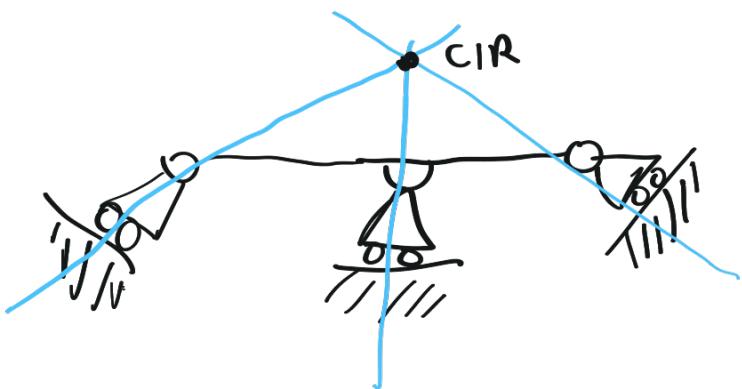
$3\text{gdl}$   
 $3\text{gdv}$   
 labile, perché si può muovere sia su e giù anche in grande





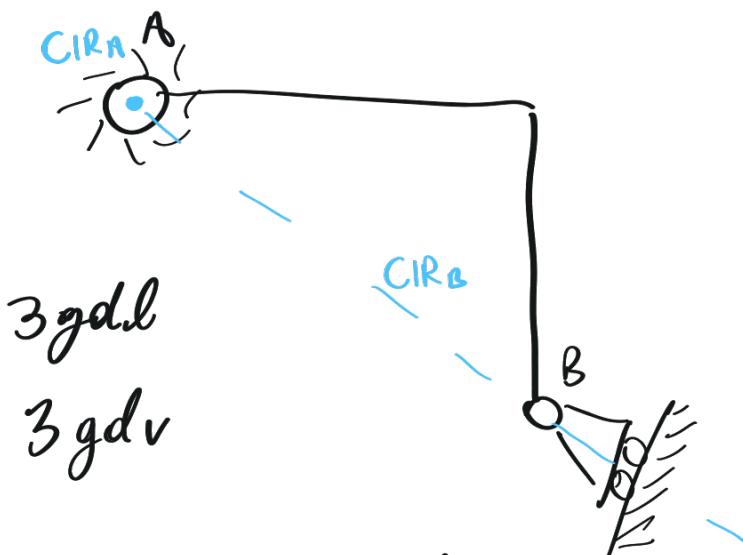
Ammette CIR a  $\infty$   
quindi è labile

$3gdl \rightarrow$  3 aste  
 $3gdr$  basta

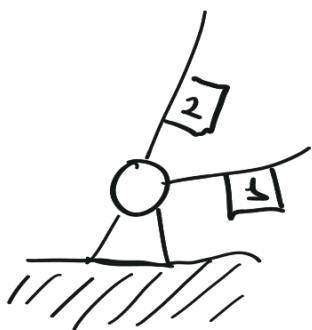


$3gdr$  labile  
 $3gdl$

Labile, esiste CIR comune



Vincoli Interni  
cercheremo n aste, per semplicità solo 2 viste



$$gdl = 3n$$

$$gdl_r = n$$

$$gdr = gdl - gdl_r = 2n$$

Cornello + n aste

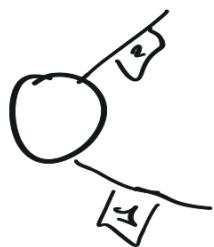


$$gdl = 3n$$

$$gdl_r = n+1$$

$$gdv = 2(n-1)$$

Cerniera non a terra + n aste

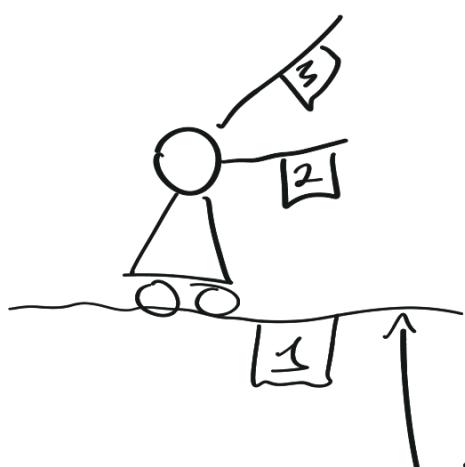


$$gdl = 3n$$

$$gdl_r = n+2$$

$$gdv = 2(n-1)$$

n rotazione  
+2 traslazione  
assolute



$$gdl = 3n$$

$$gdl_r = n+2+1$$

$$gdv = 2(n-1)-1$$

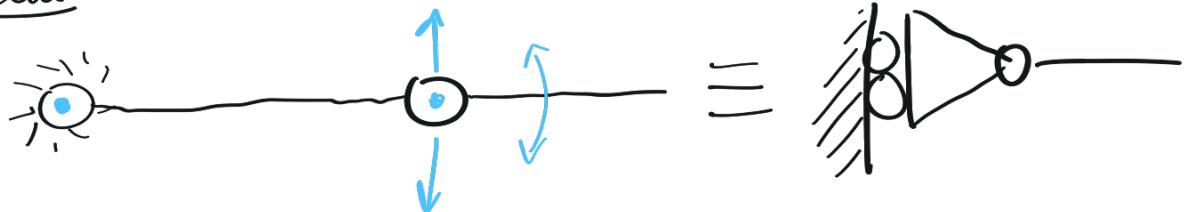
n rotazioni  
2 traslazioni  
assolute, di  
asta e  
1 traslazione  
relativa all'asta 1

Asta su cui  
cavetto si può  
muovere

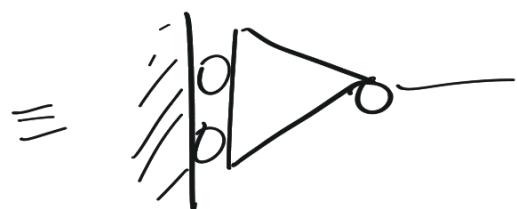
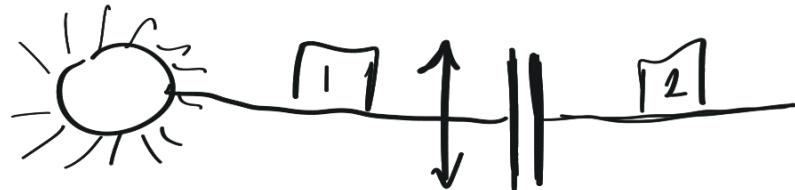
Asta 1 agisce  
come la terra,  
ma si può muovere

Equivalenti Cinematiche

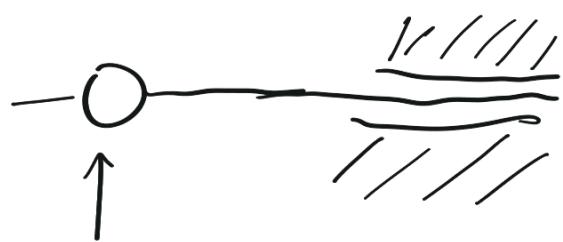
Biella



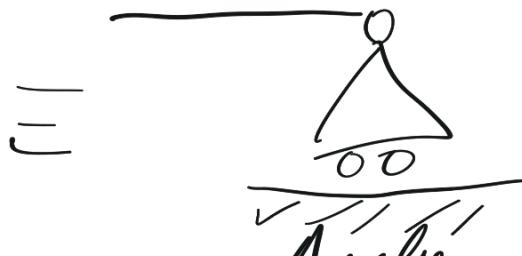
Solo per l'analisi, si può muovere  
se e giù e girare, all'interno,  
è lo stesso effettivamente



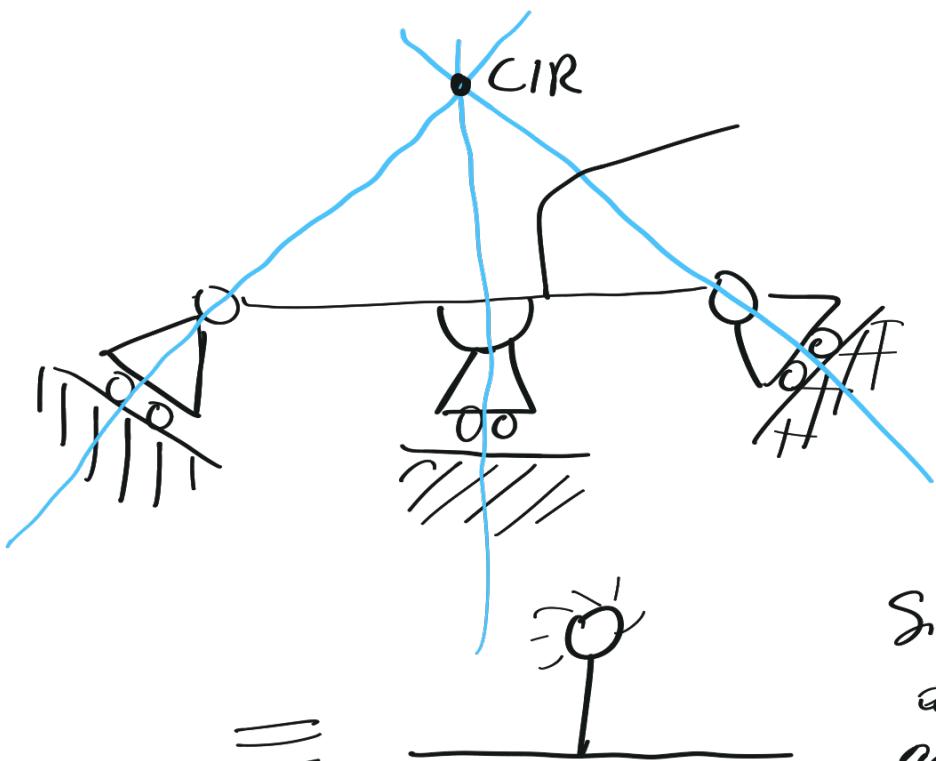
= Biella impropria,  
per c'è uno  
cerchiera e un  
cerchio improprio



Può girare questo



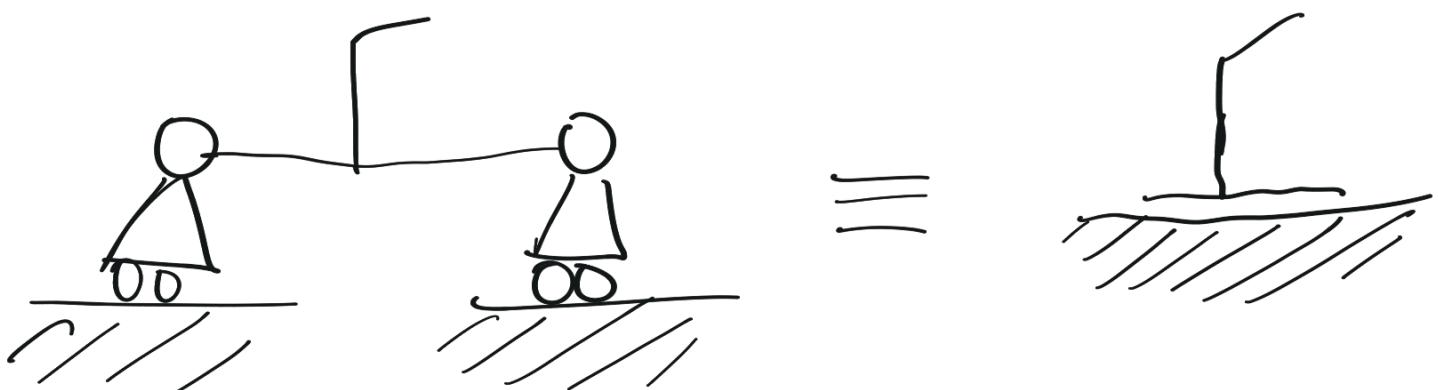
Anche  
questo  
biella  
impropria



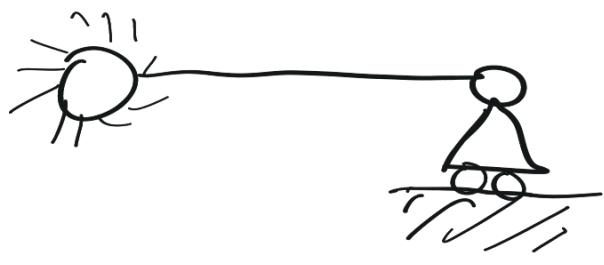
Questo sistema  
può solo  
motori

Si può semplificare  
almeno 2 cordelli  
ad una cerchiara

perché possono  
rotolare intorno  
al loro CIR



Strutture Notevoli  
Trave Gerniera Carello



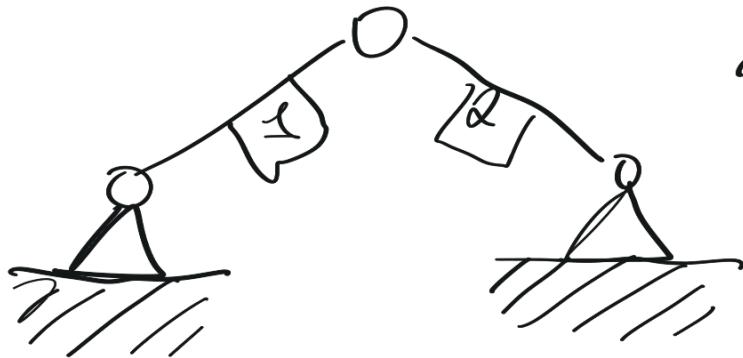
3gdl  
3gdv

~~CIR comune~~

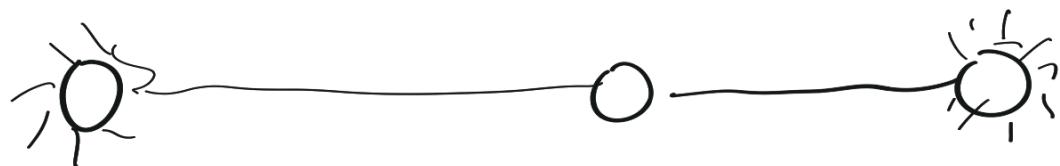
A3C

### Arco a 3 Cerniere

Non sempre  
sostitutiva, dipende  
da dove sono  
le cerniere



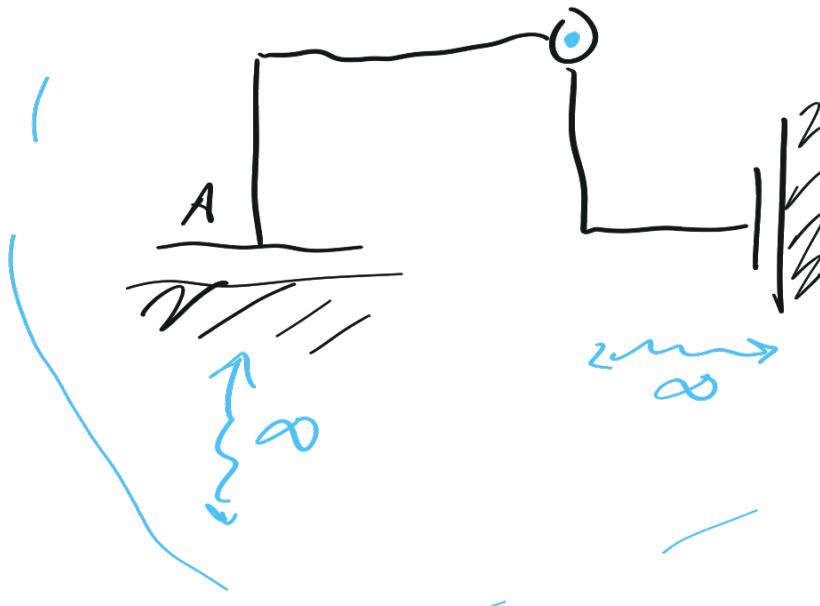
Labile se e solo se le tre cerniere solo  
allineate



Come



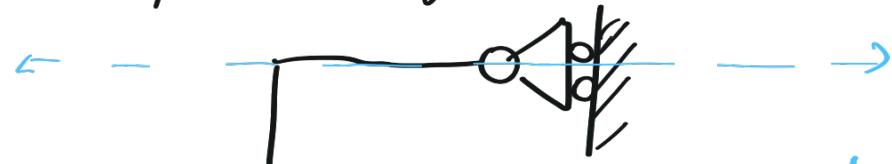
A3C perché pattino e manicotto sono  
cerniere improvvise



$\infty$

La retta  
improvvisa  
non arriva  
mai a B  
quindi ~~CIR~~

Si può ridisegnare come



non è CIR perché

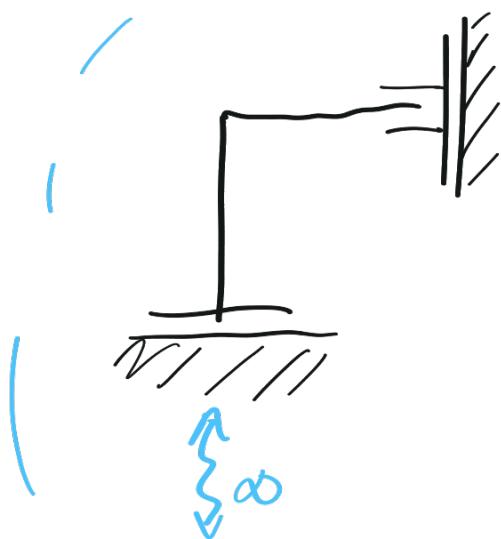
A3C



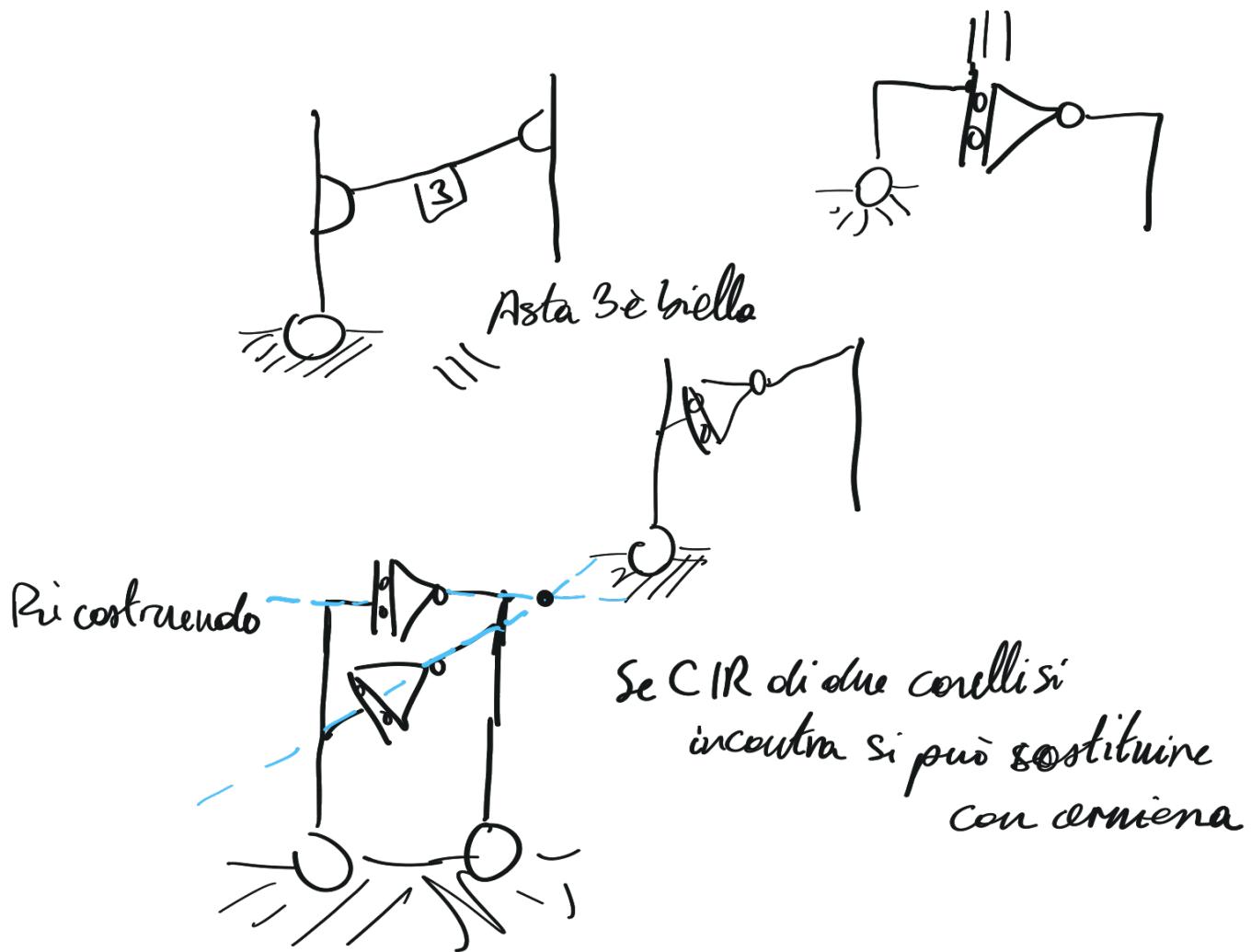
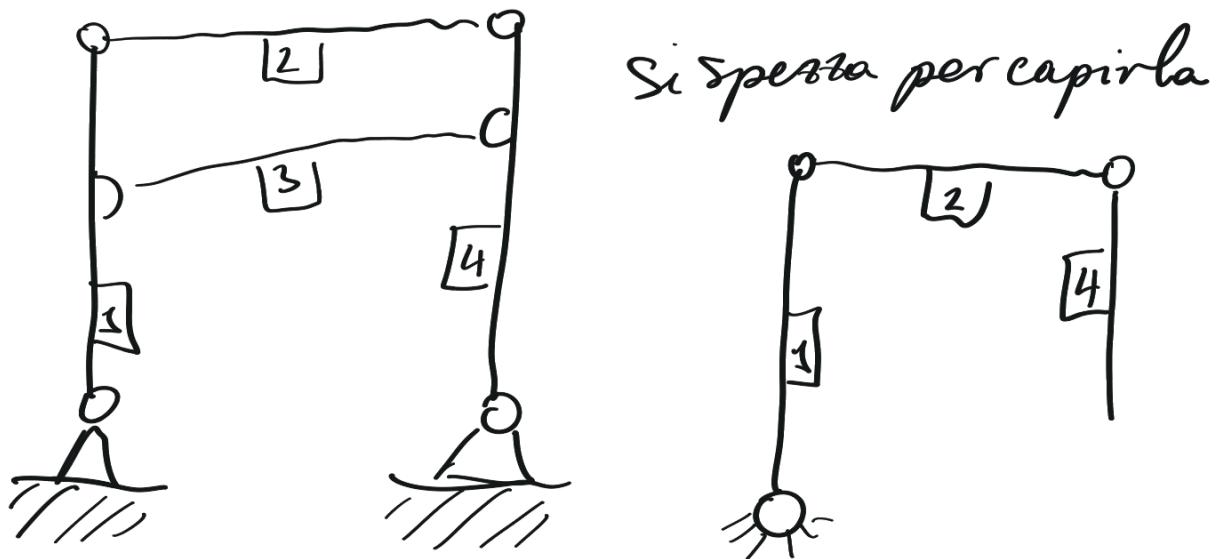
Esiste CIR perché  
la rete è inappropriata  
per un per ogni  
punto infinito

III

L'abito perché esiste CIR



# Quadrilatero Articolato



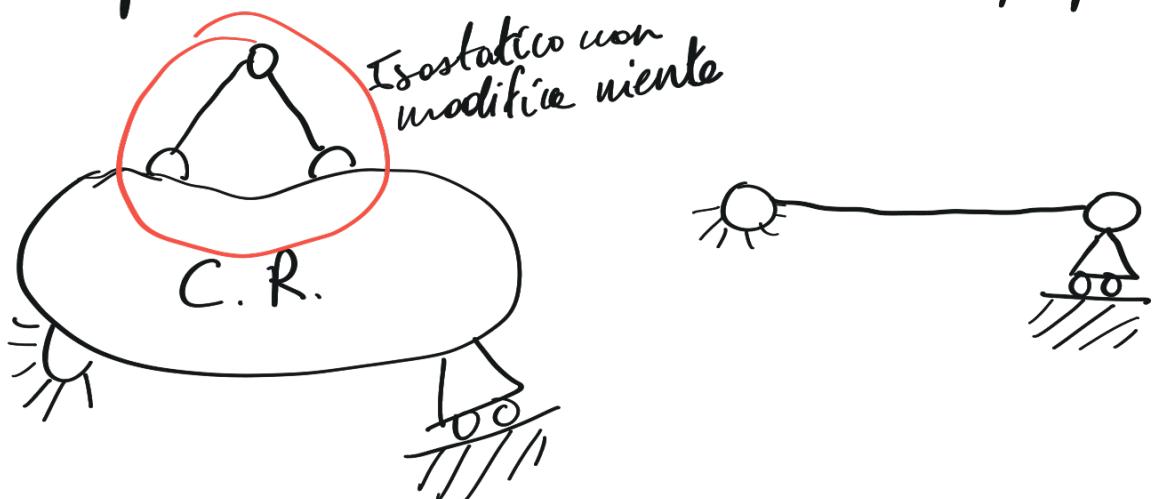
Un quadrilatero articolato



è Isostatico se il CIR del A3C generato non è tra le due cerniere, invece se è tra le due cerniere è labile.

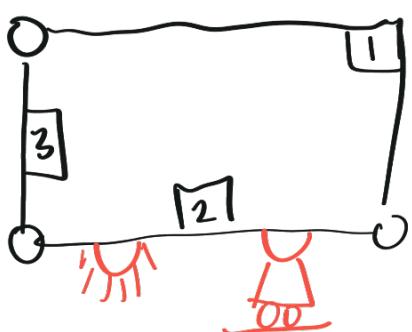
### Appendice Isostatico

Porte di struttura che non modifica le proprietà



Qualiasi porta isostatica che non cambi le proprietà

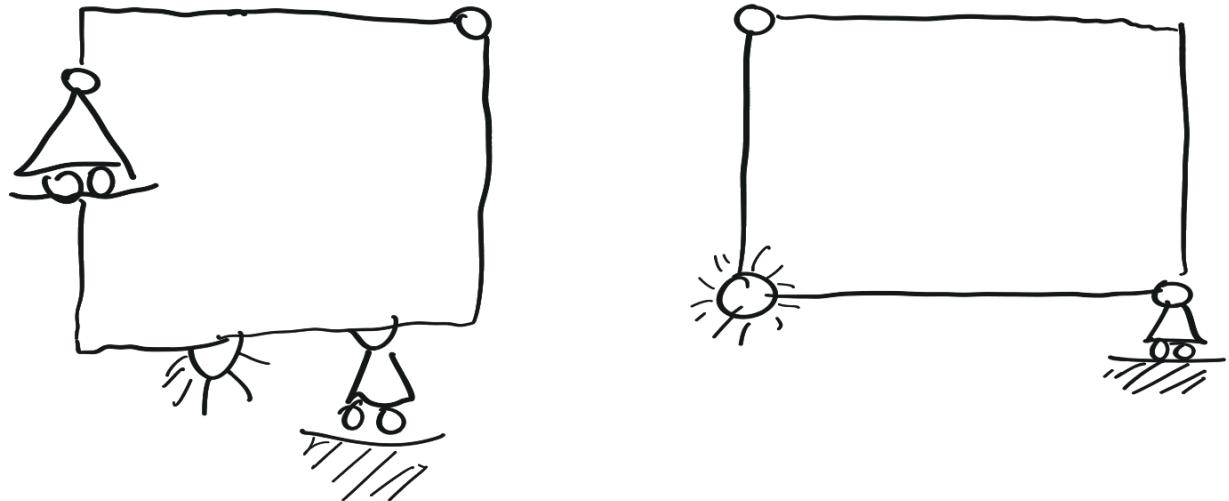
### Anello Chiuso Isostatico



9 gdl  
6 gdr  
~~gdlr - 3~~

da cerniera e il cornello  
tolgono le ultime libertà

Altra configurazione



Distingere il problema interno da esterno

con 3 giri e solo 3, si immagina che la struttura si isostatica

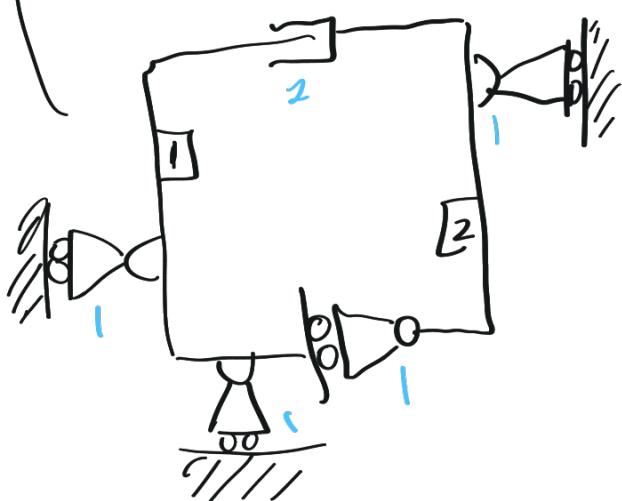


Si separa in due la raba attaccata alla terra e la raba interna, la parte interna viene considerata isostatica per la terra e viene rappresentata come l'asse, se la parte a terra è labile la struttura interna è labile, se la struttura a terra è isostatica si guarda la struttura interna, se quella è labile la struttura interna è labile, se è isostatica la struttura interna è isostatica.

Separazione per aiutare a controllare più velocemente, se un elemento è labile, è tutto labile

Quadrato Articolato

Esercizio

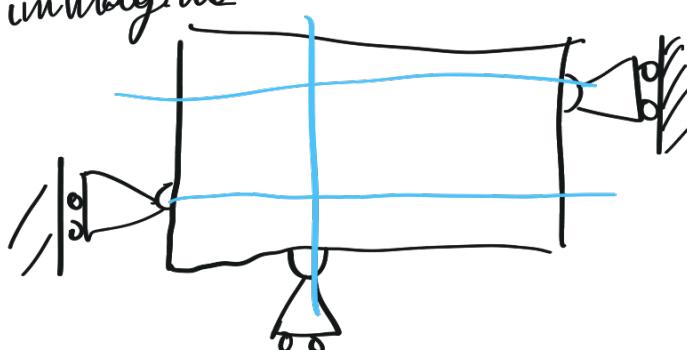


$$gdl = 6$$

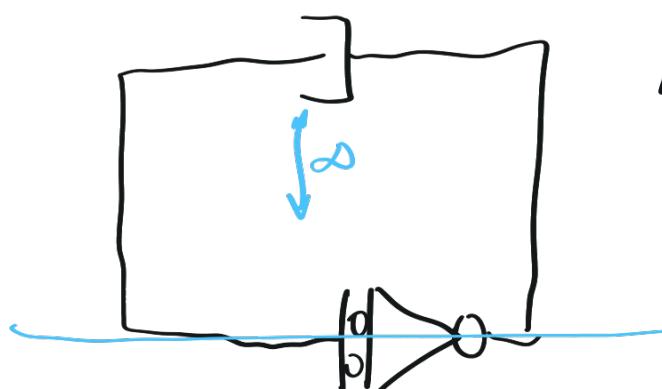
$$gdr = 6$$

$gdl_r = 0 \rightarrow$  candidato sostatico

Si immagine che la struttura interna su un corpo rigido

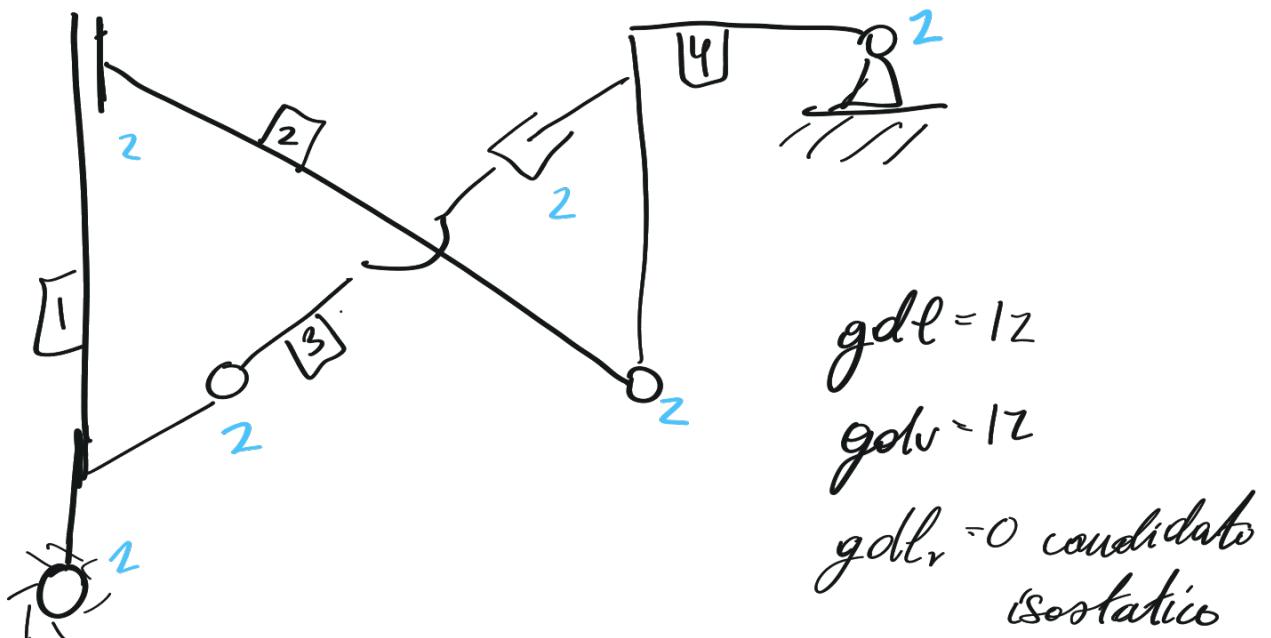


Nessun CIR, quindi perfettamente vincolato a terra, è isotatica esternamente

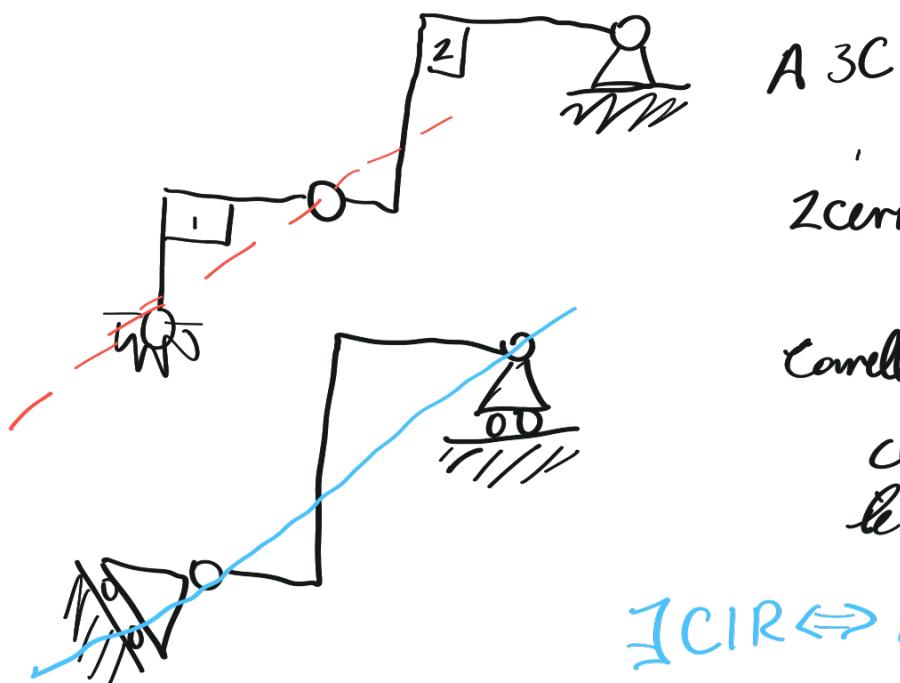
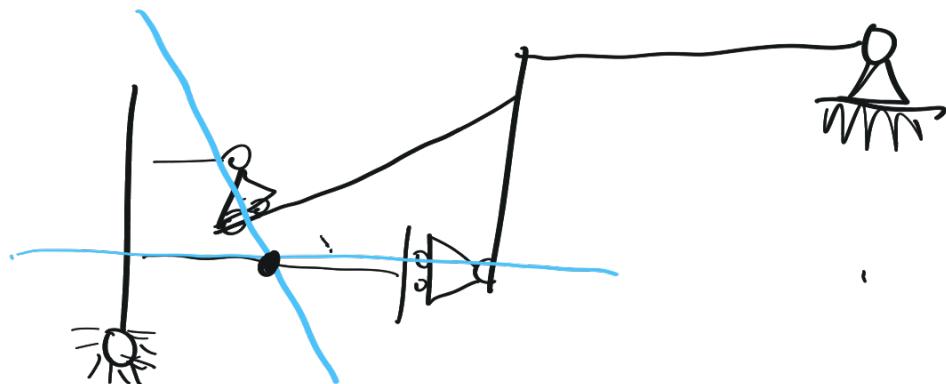


Nessun CIR comune interno, struttura è isotatica internamente

Isostatica internamente + esternamente = isotatica



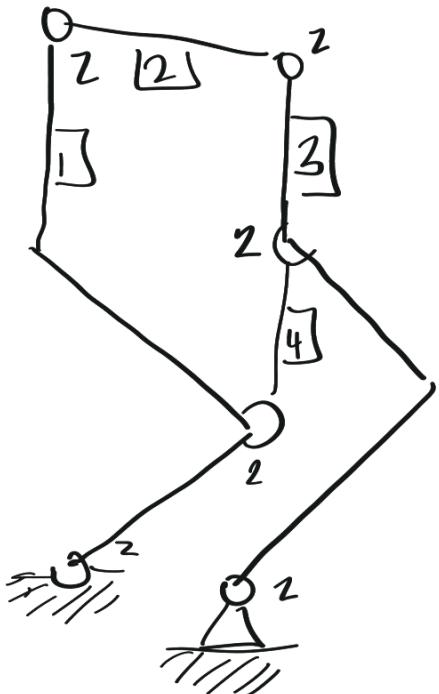
4 gdlr a terra, devono esser 3 perché si possa semplificare. Ma può esser semplificato usando bielle



2 cerniere = 1 corollo  
per bolla propria  
Corollo segue la linea  
che interseca  
le due cerniere

$\exists$  CIR  $\Leftrightarrow$  labile

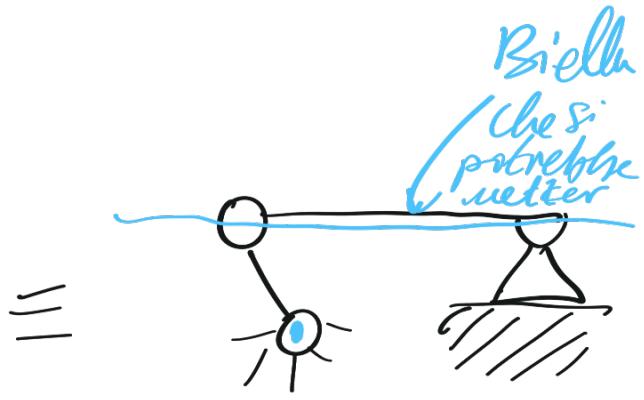
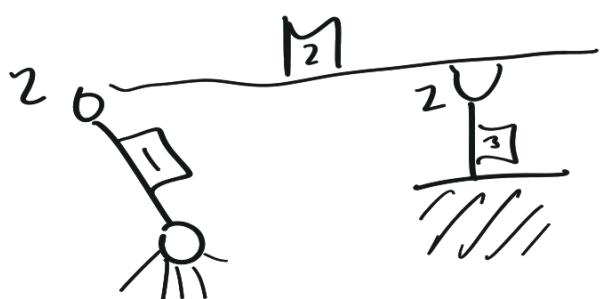
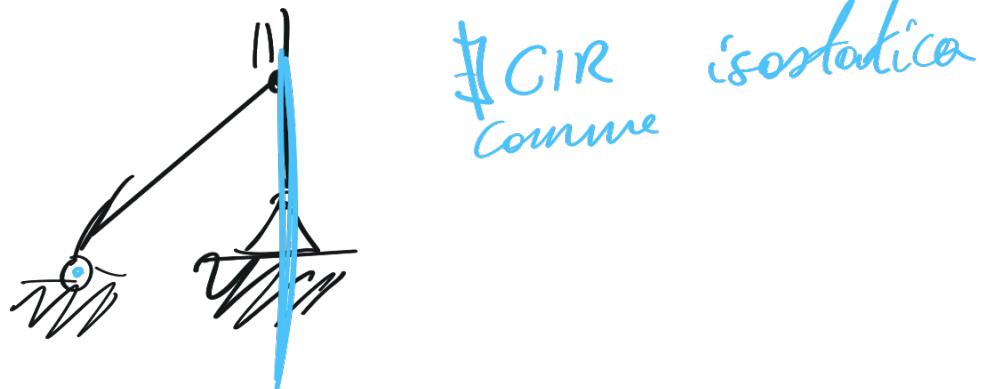
2)



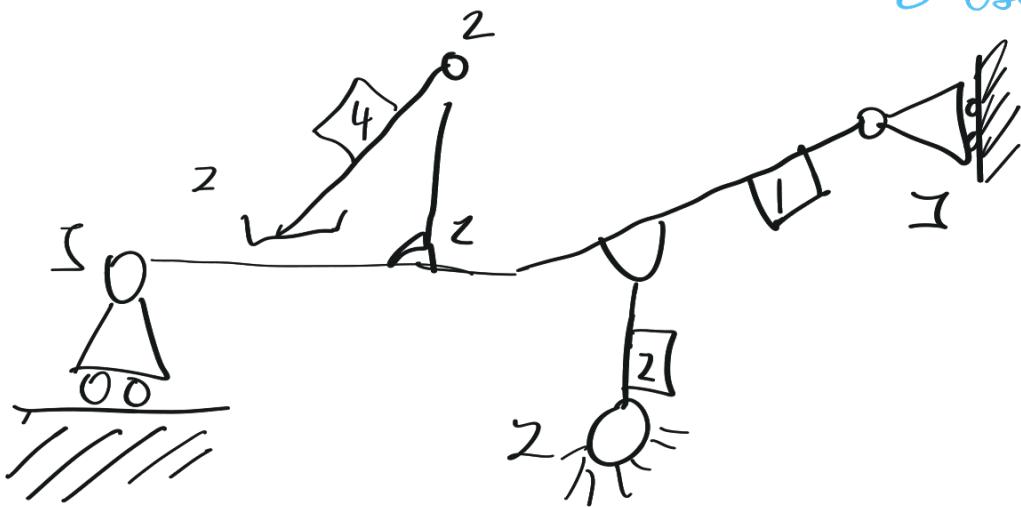
$$gdl = 12$$
$$gdv = 12$$

Quadrati Articolato,  
sostituendo per bielle

2 vincole a terra,  
e aree colleganti la  
cerchiare



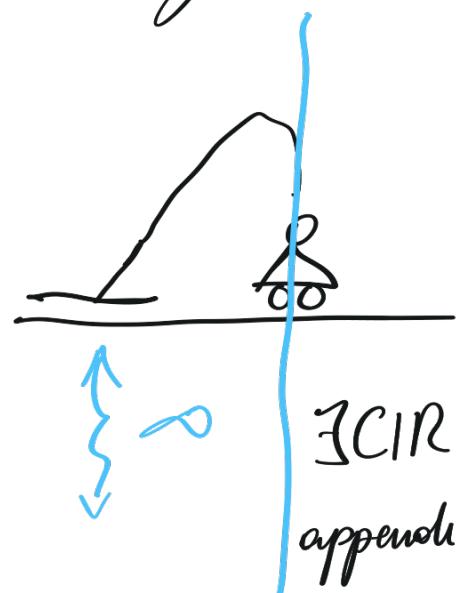
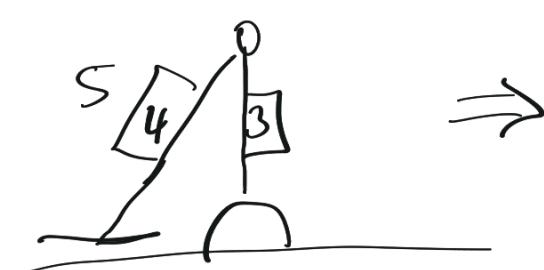
A3C senza CIR



*è usato tutto*

$$g_{ell} = 12$$

$$g_{olv} = 12$$



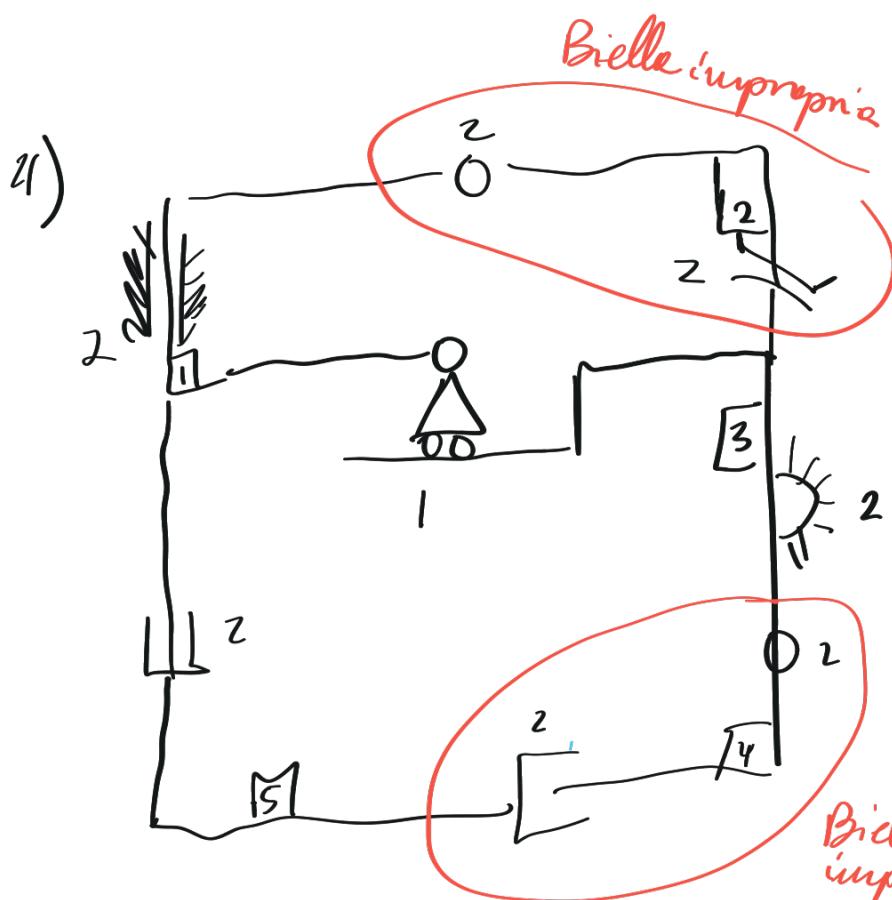
*FCIR*

*appendice*

*labile*

*quindi è tutto*

*labile*



*Bielle impropria*

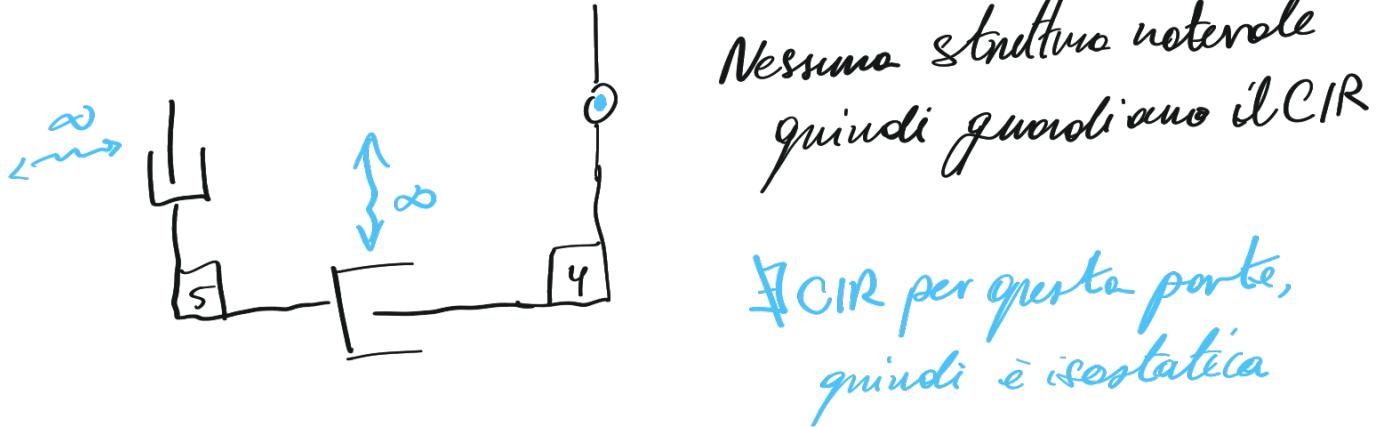
$$g_{ell} = 15$$

$$g_{olv} = 15$$

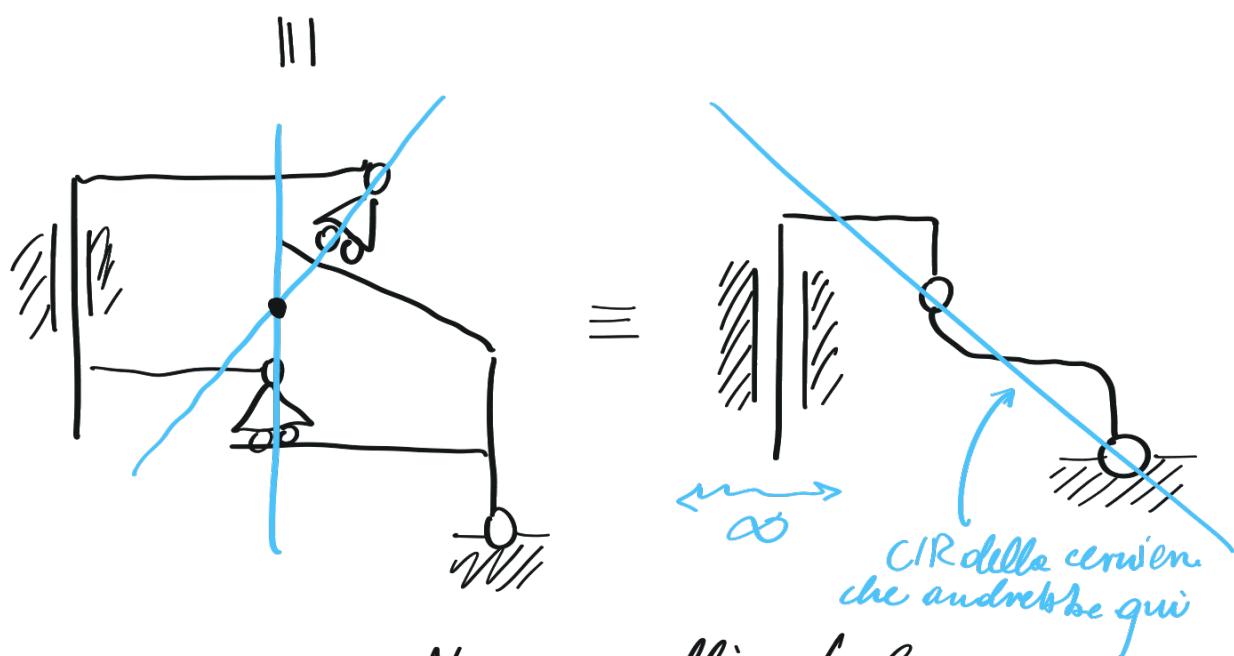
*2 vincoli doppi  
a terra*

*se non ci fosse  
4-5 sarebbe un  
quadrato  
articolato*

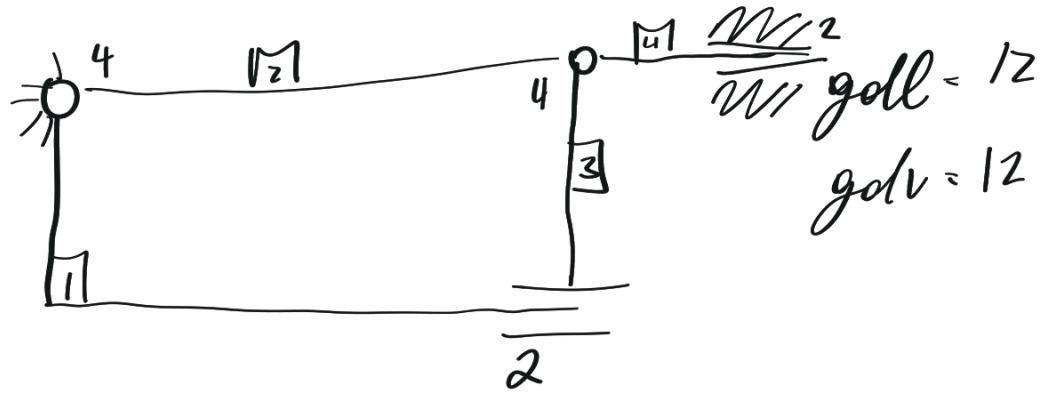
*Bielle  
impropria*



Dato che appendice è isostatico possiamo guardare  
al quadrianto articolato

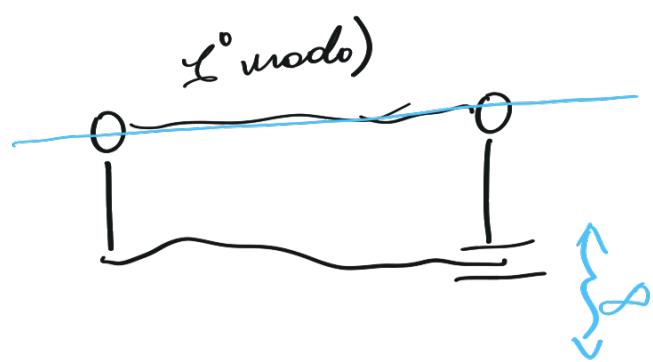


$\nexists$  CIR  $\rightarrow$  isostatico

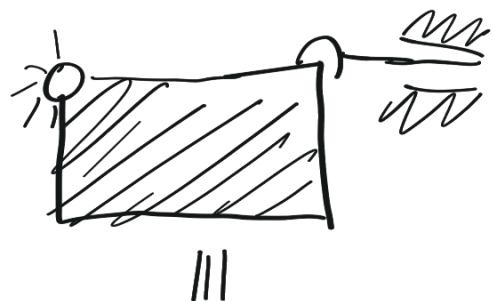


Non 3golv, non si può separare,

nessun quadrata circoletto



2° modo)



↙ CIR non labile

