TB036 Estática

Reticulados
Y
Sistemas Mixtos

Universidad de Buenos Aires - Facultad de Ingeniería
Departamento de Estabilidad

Definición

- Estructuras formadas por barras vinculadas entre sí en sus extremos por articulaciones, constituyendo un sistema rígido e indeformable.

- Barra: Cuerpo rígido e indeformable con una dimensión predominante respecto de las otras dos.

- Nudo: Punto donde se unen entre sí las barras.

Tren de la Costa


Ferrocarril Belgrano
Quebrada de Humahuaca

Tren a las Nubes

Salta


Pte. Dreirosen - Suiza Basilea
Río Rhin – 128 m

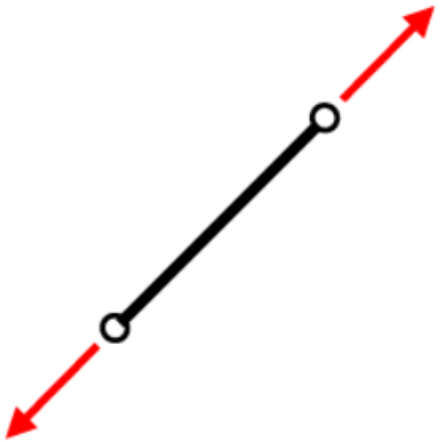
Puente Nicolás Avellaneda - Riachuelo - Bs As

Puente levadizo basculante BARRACA PEÑA - 1913
Riachuelo – Buenos Aires

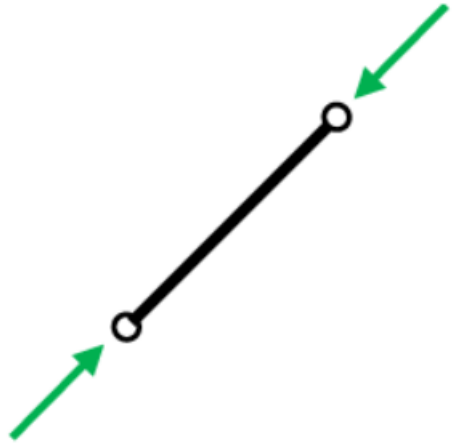
ENTRADA AL PUERTO DE ROTTERDAM

Ventajas

- Sólo tienen esfuerzos normales (siempre y cuando las cargas estén aplicadas en los nodos)



Tracción



Compresión

Comparación

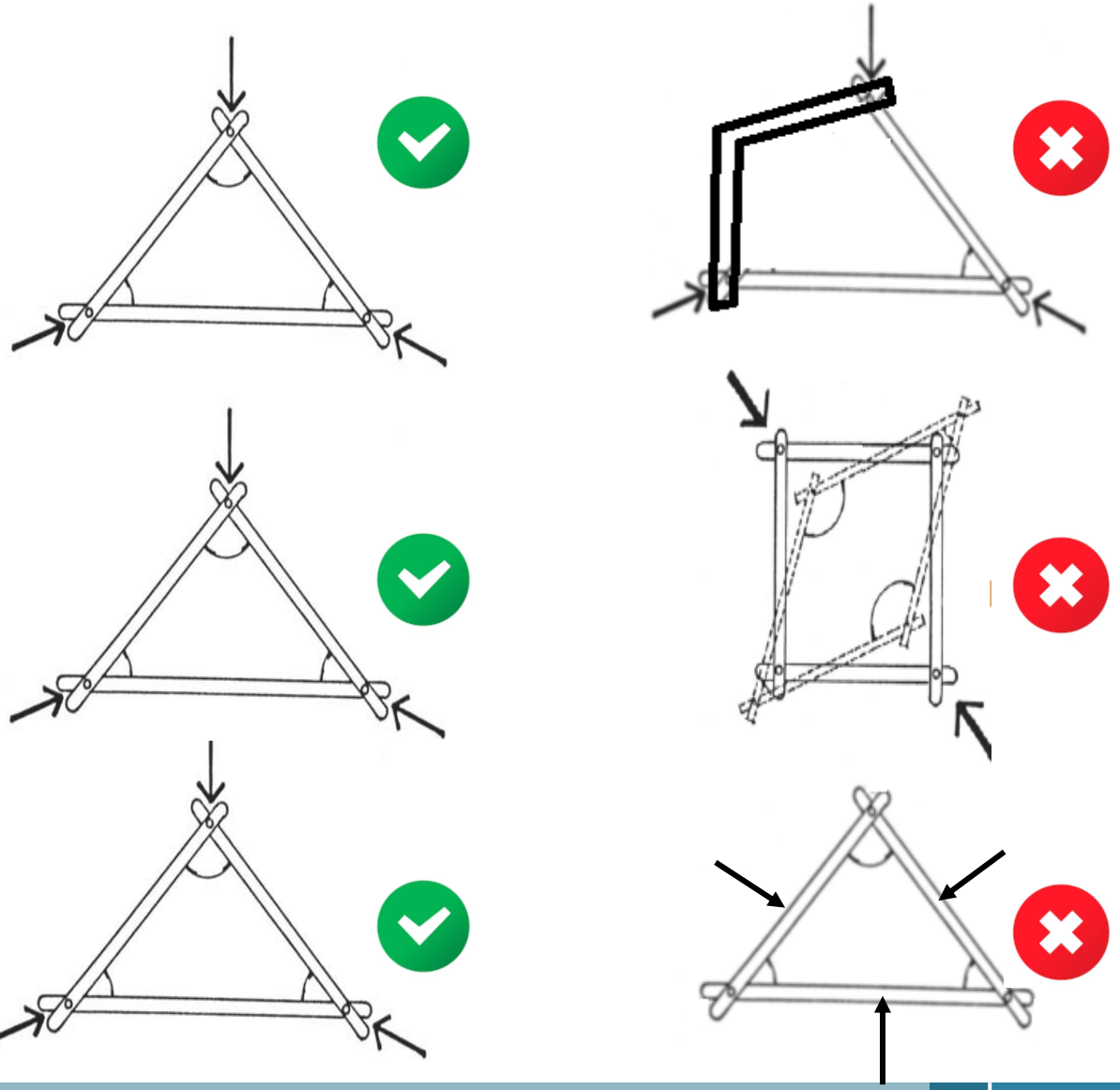
Alma Llena

Alma Calada

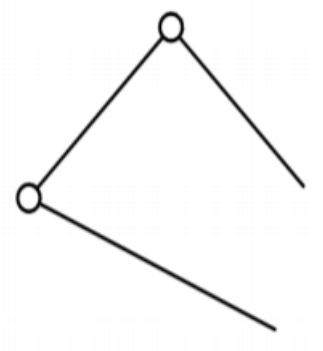
- Fotos:

Hipótesis

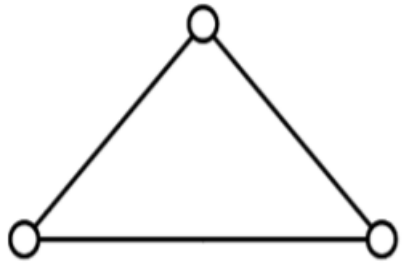
- Barras rectas.
- Cadenas formando triángulos.
- Cargas en los nudos.



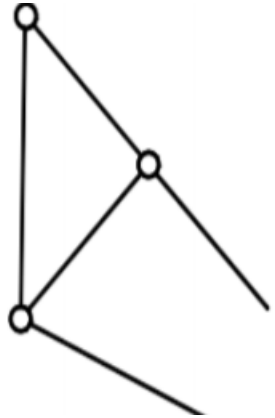
Condición de Rigidez



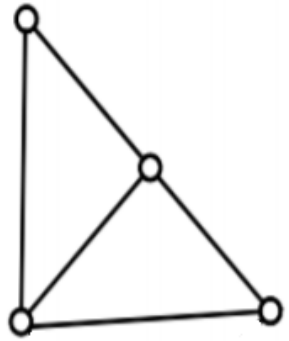
GL=5



GL=5-2=3



GL=5



GL=5-2=3

$B = 3 + 2P$

$N = 3 + P$

$\boxed{B = 2N - 3}$

B = N° de Barras

P = N° de Pares de barras que se agregan

N = N° de Nudos

Análisis cinemático

- Si B < 2 N – 3 => Mecanismo

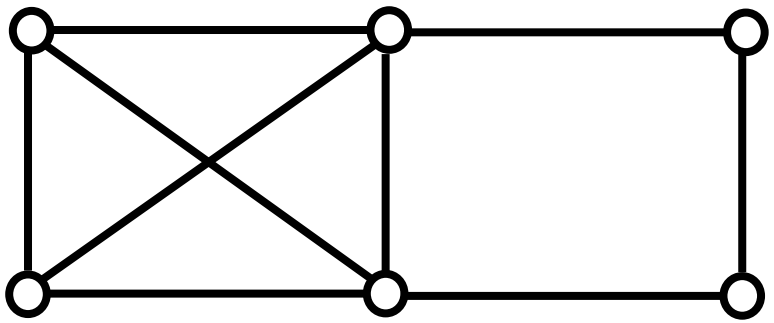
- Si B = 2 N – 3 => Isostático

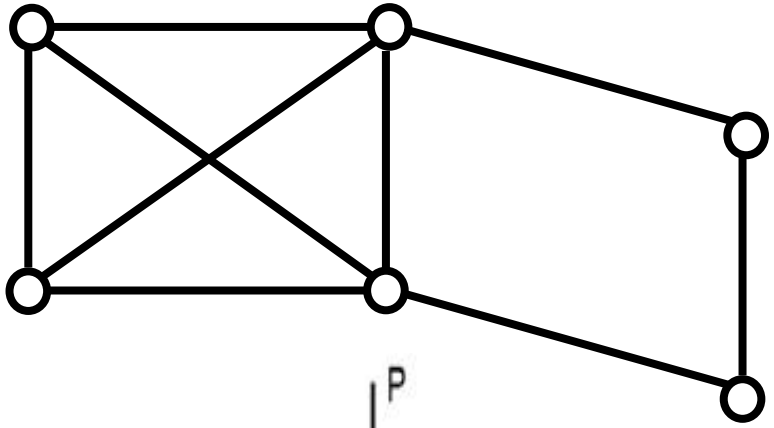
Condición necesaria, no suficiente.
Verificar que no haya vinculación aparente

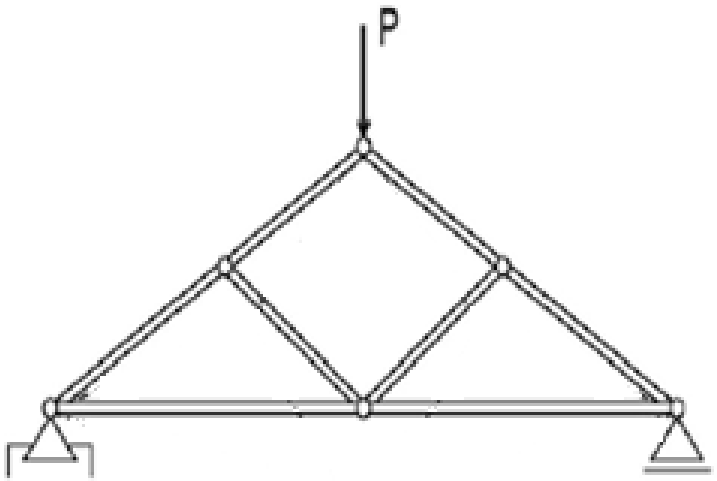
- Si B < 2 N – 3 => Hiperestático por vínculo interno.

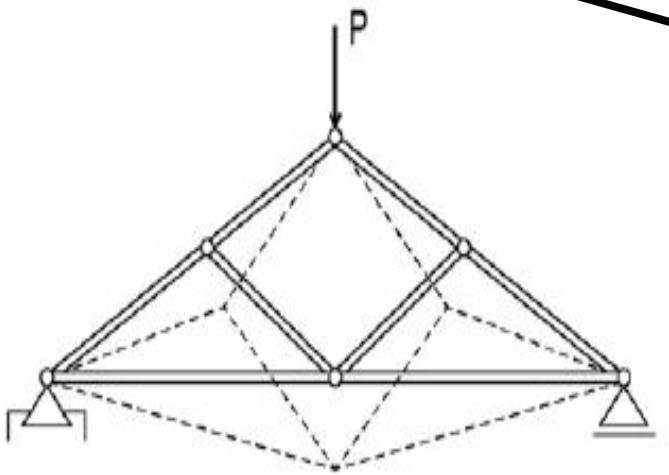
Análisis cinemático

$$B = 2\,N - 3$$

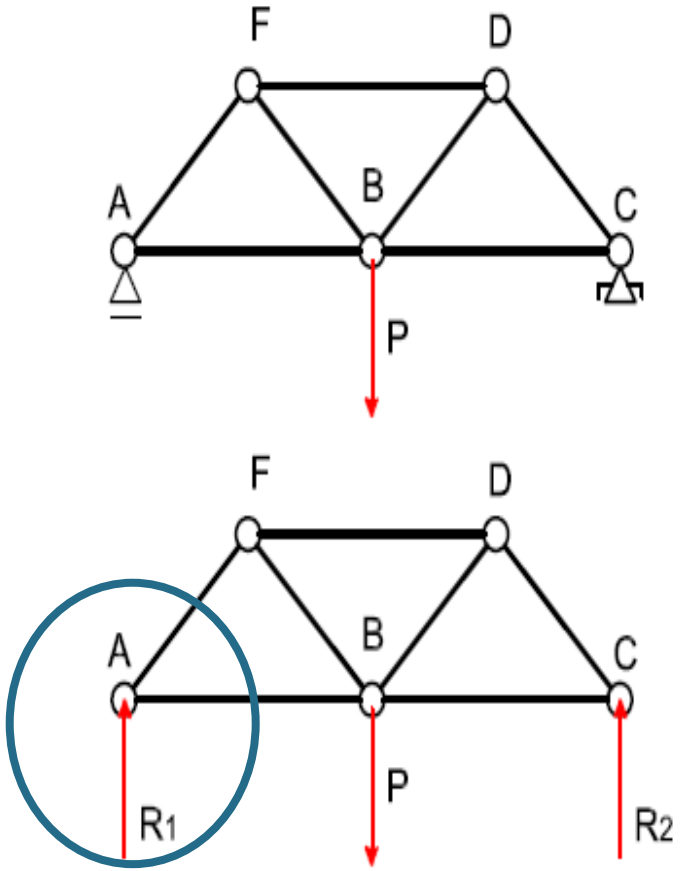




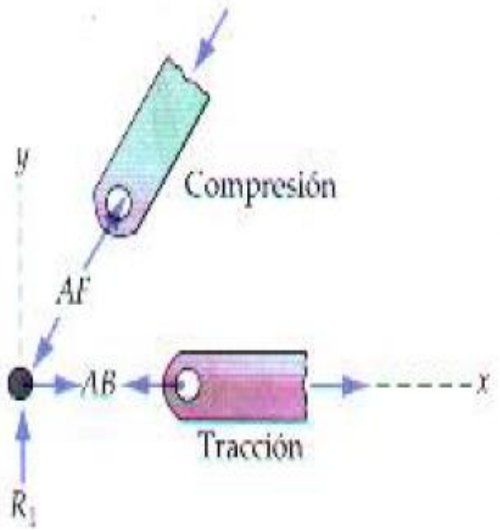




Resolución: Método de los Nudos



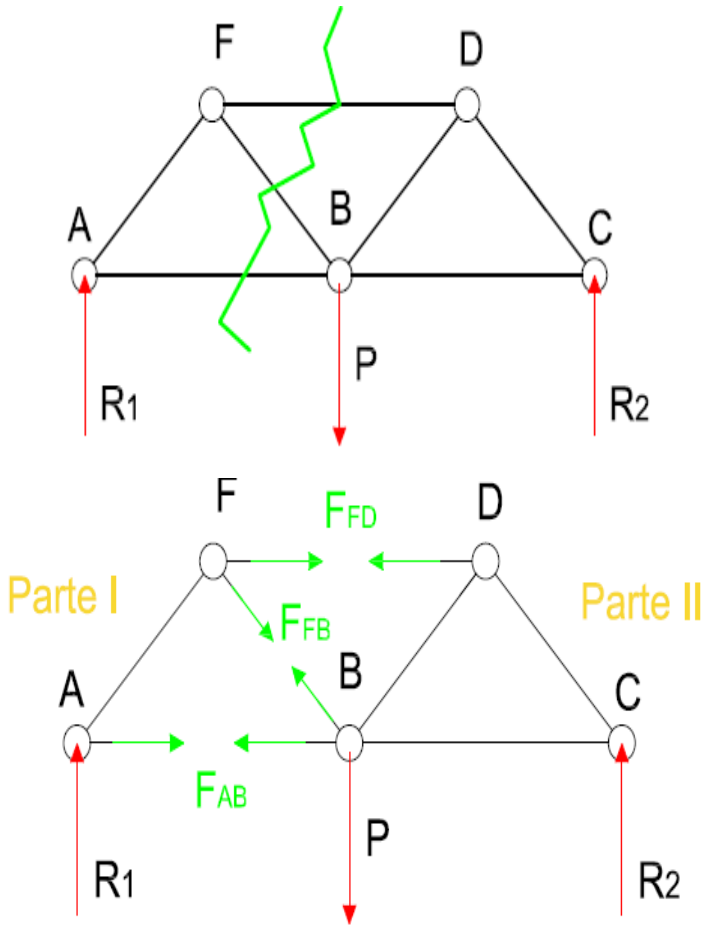
- Planteamos equilibrio del Nodo A



$$\sum Fx = 0$$

$$\sum Fy = 0$$

Resolución: Método de las Secciones



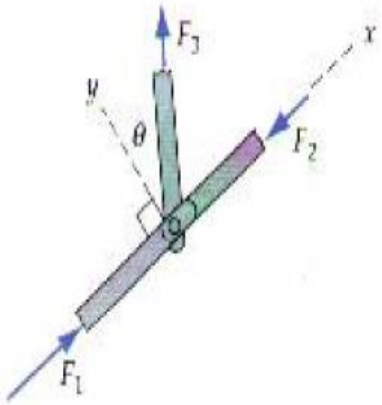
- Planteamos equilibrio de la parte 1

$$\sum M^F = 0 \Rightarrow \quad F_{AB}$$

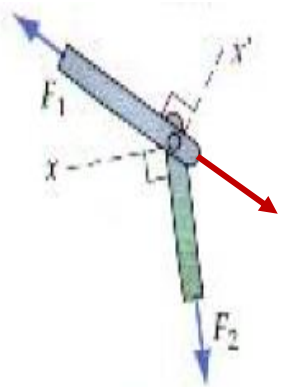
$$\sum M^B = 0 \Rightarrow \quad F_{FD}$$

$$\sum Proy^{n-n} = 0 \Rightarrow \quad F_{FB}$$

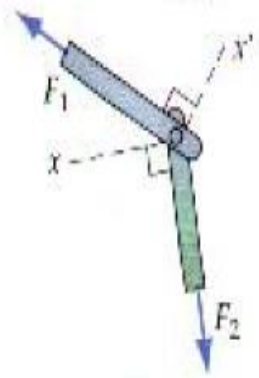
Barras inactivas y casos especiales:



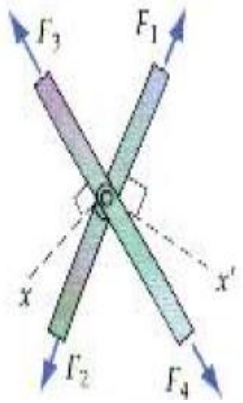
F1=F2
F3=0



F1= P
F2=0

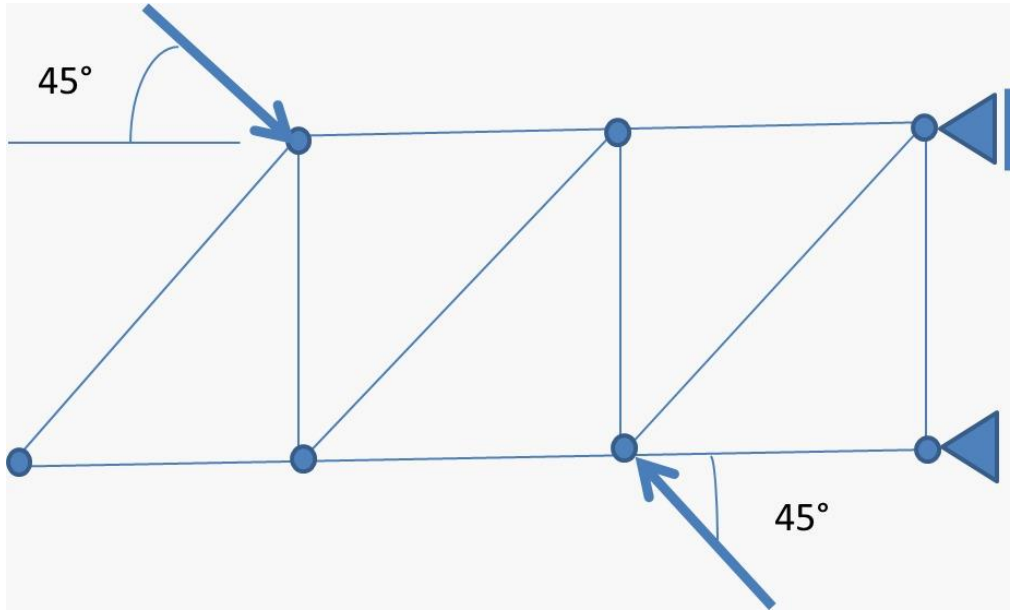


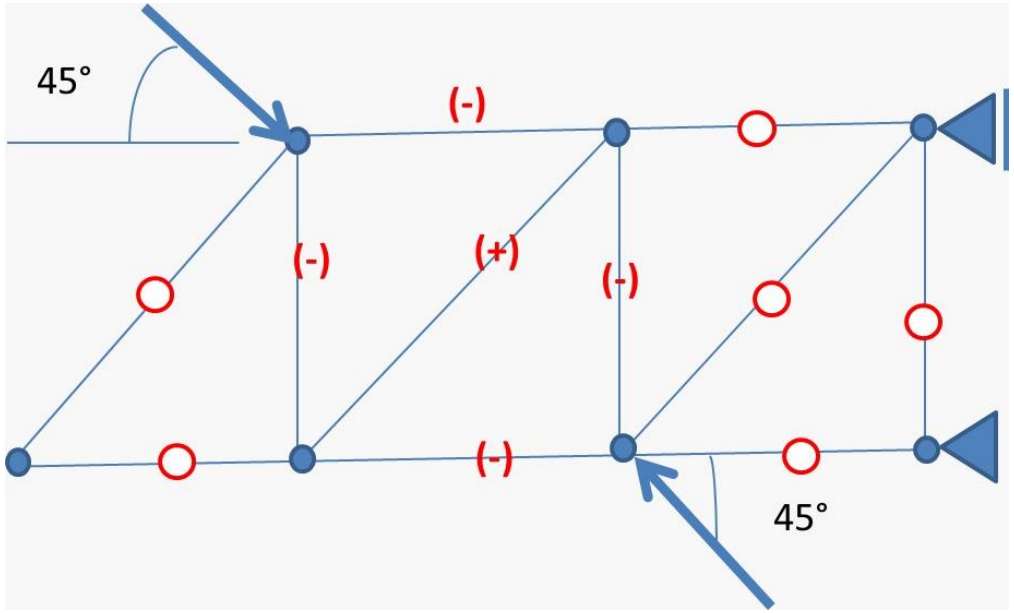
F1=0
F2=0



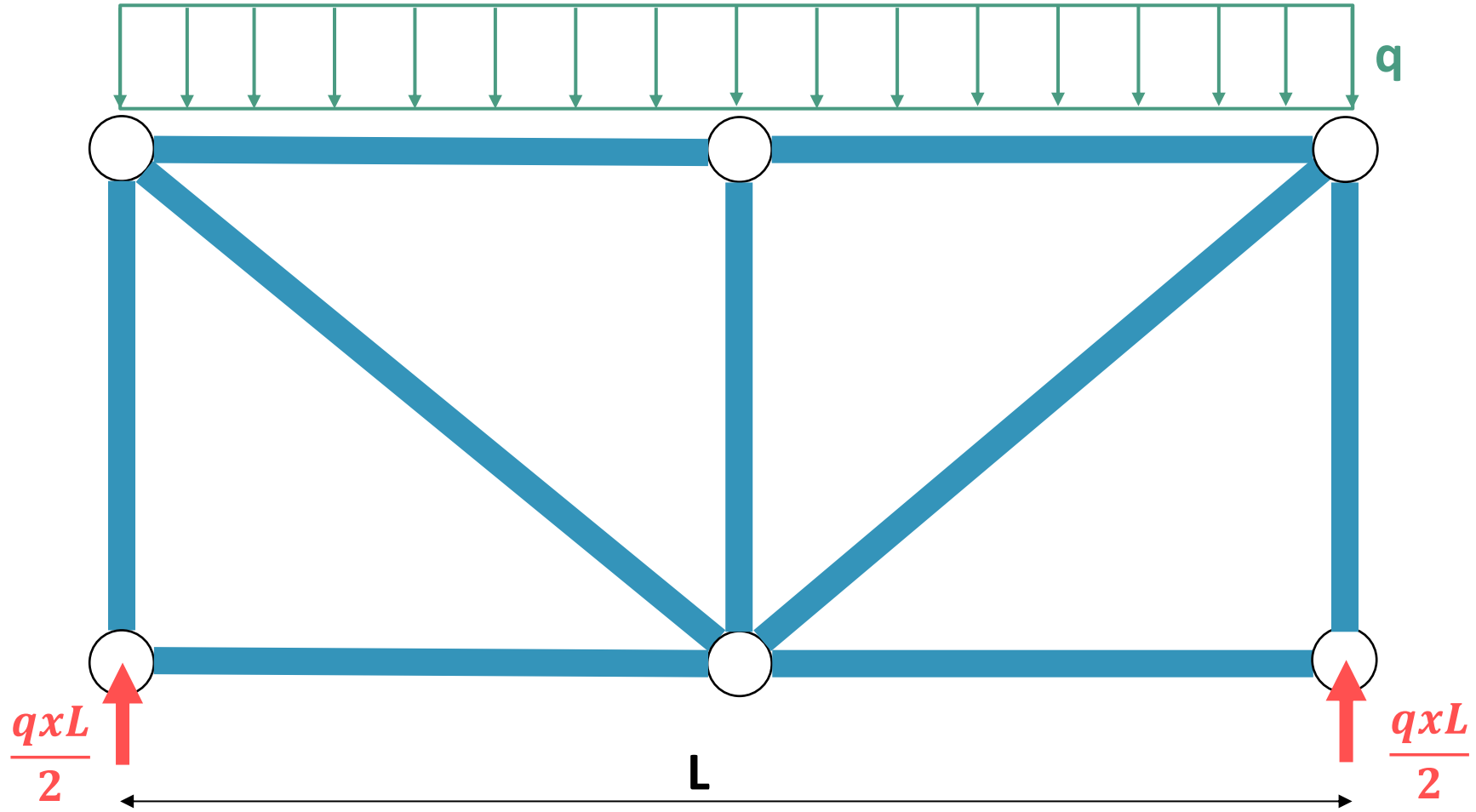
F1= F2
F3= F4

Barras Inactivas:

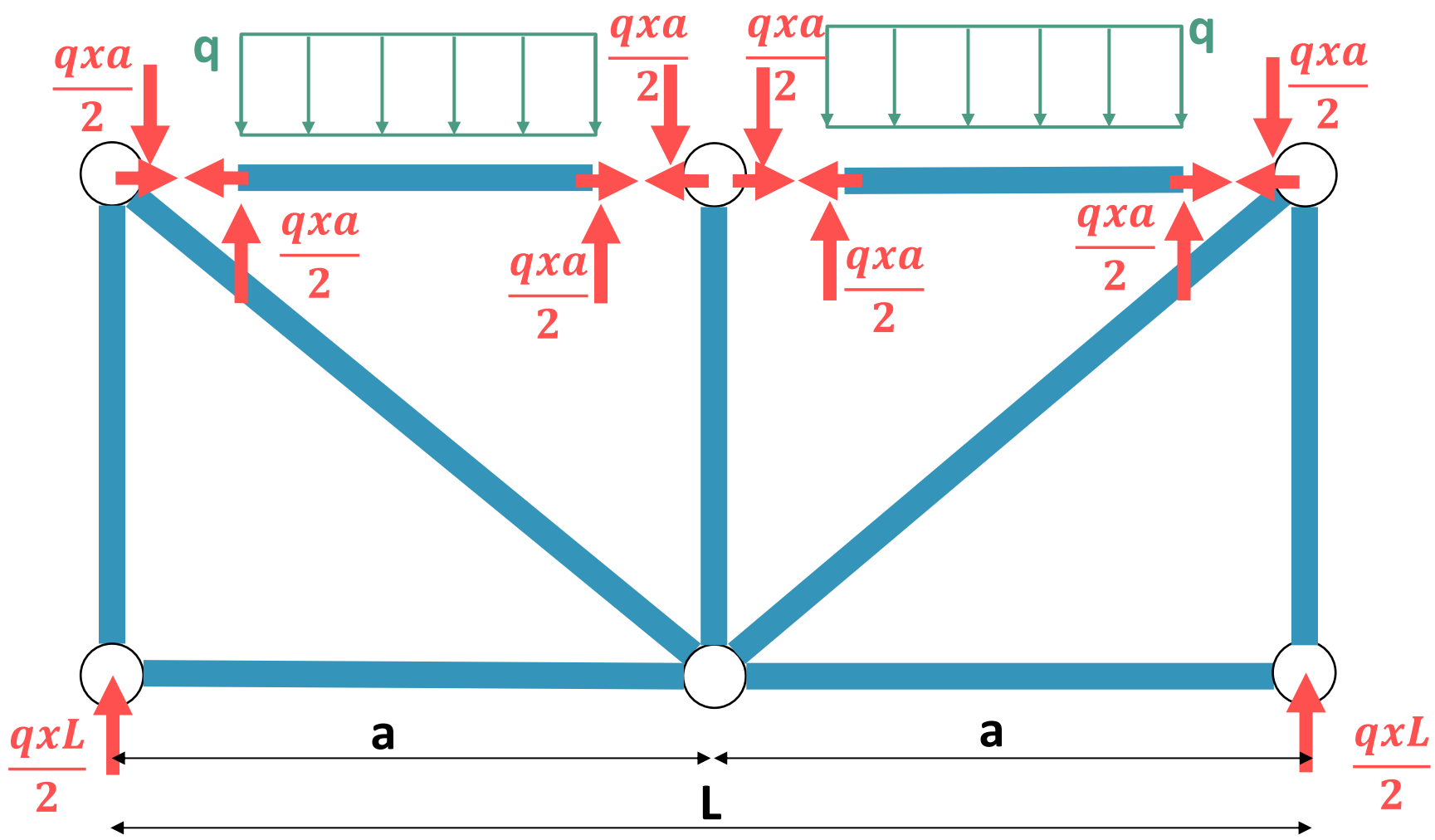




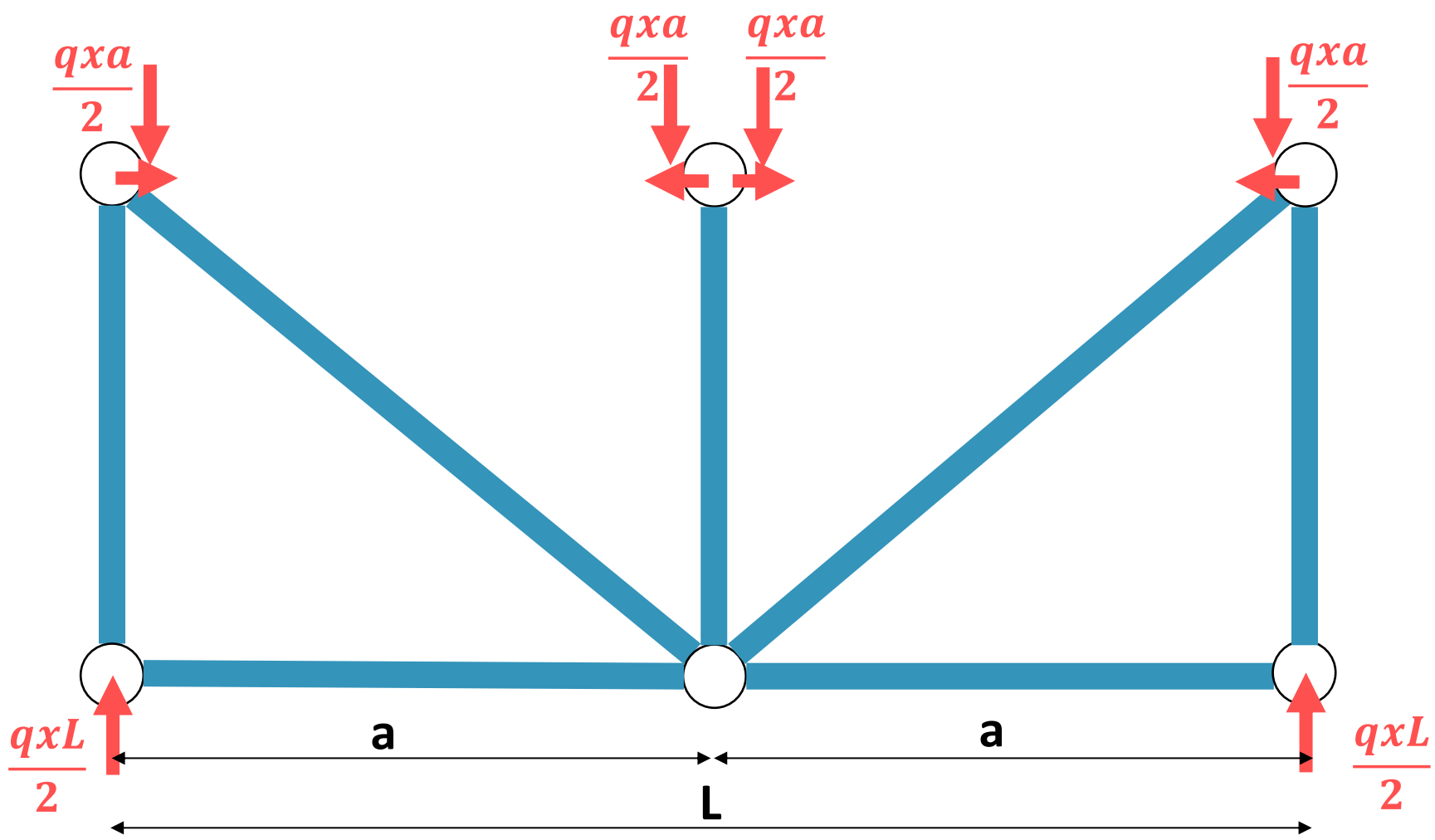
¿Y si hay cargas en las barras?



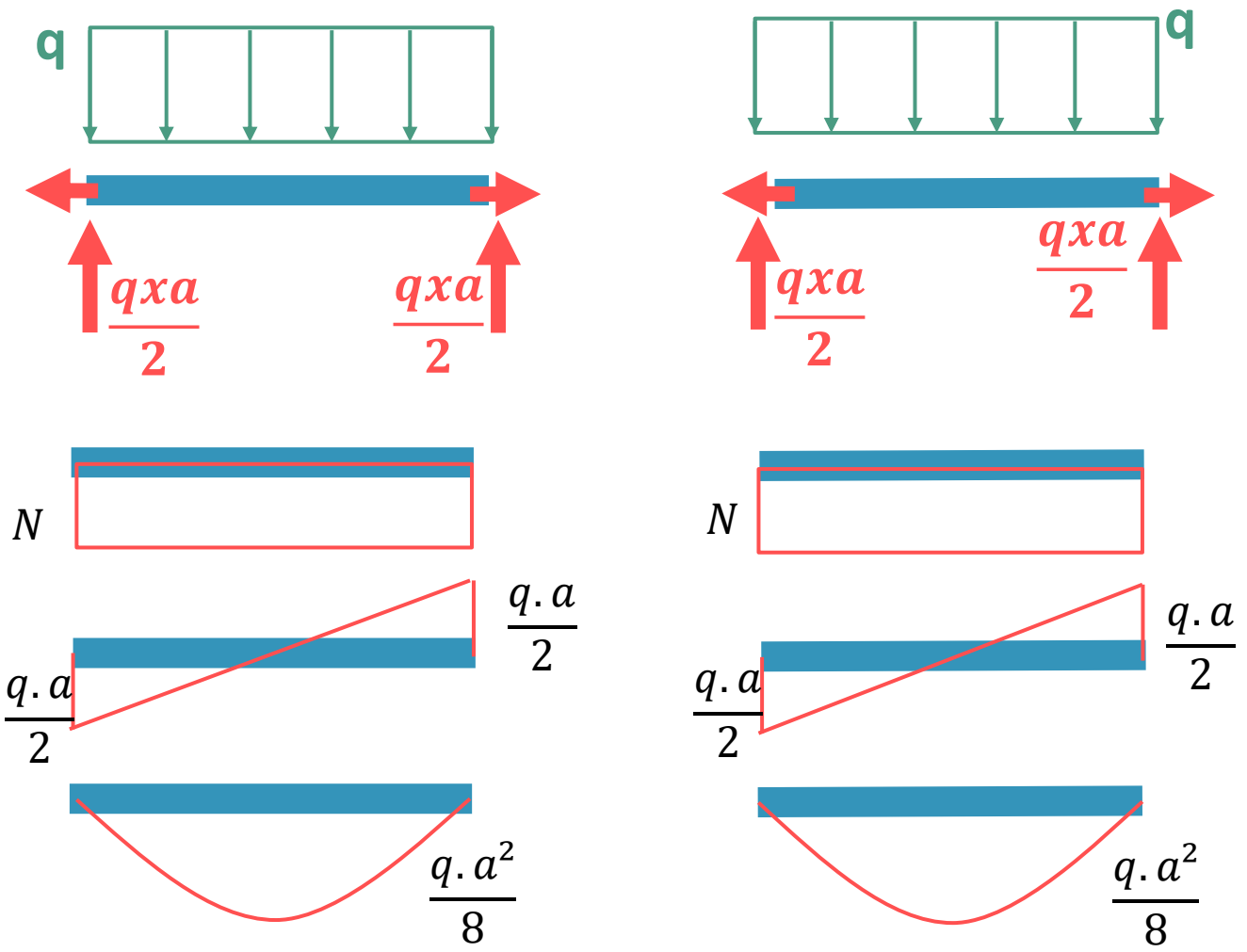
Cortamos las barras que no cumplen y las separamos del reticulado:



Resolvemos por un lado el Reticulado que tiene sólo Esfuerzo Normal:

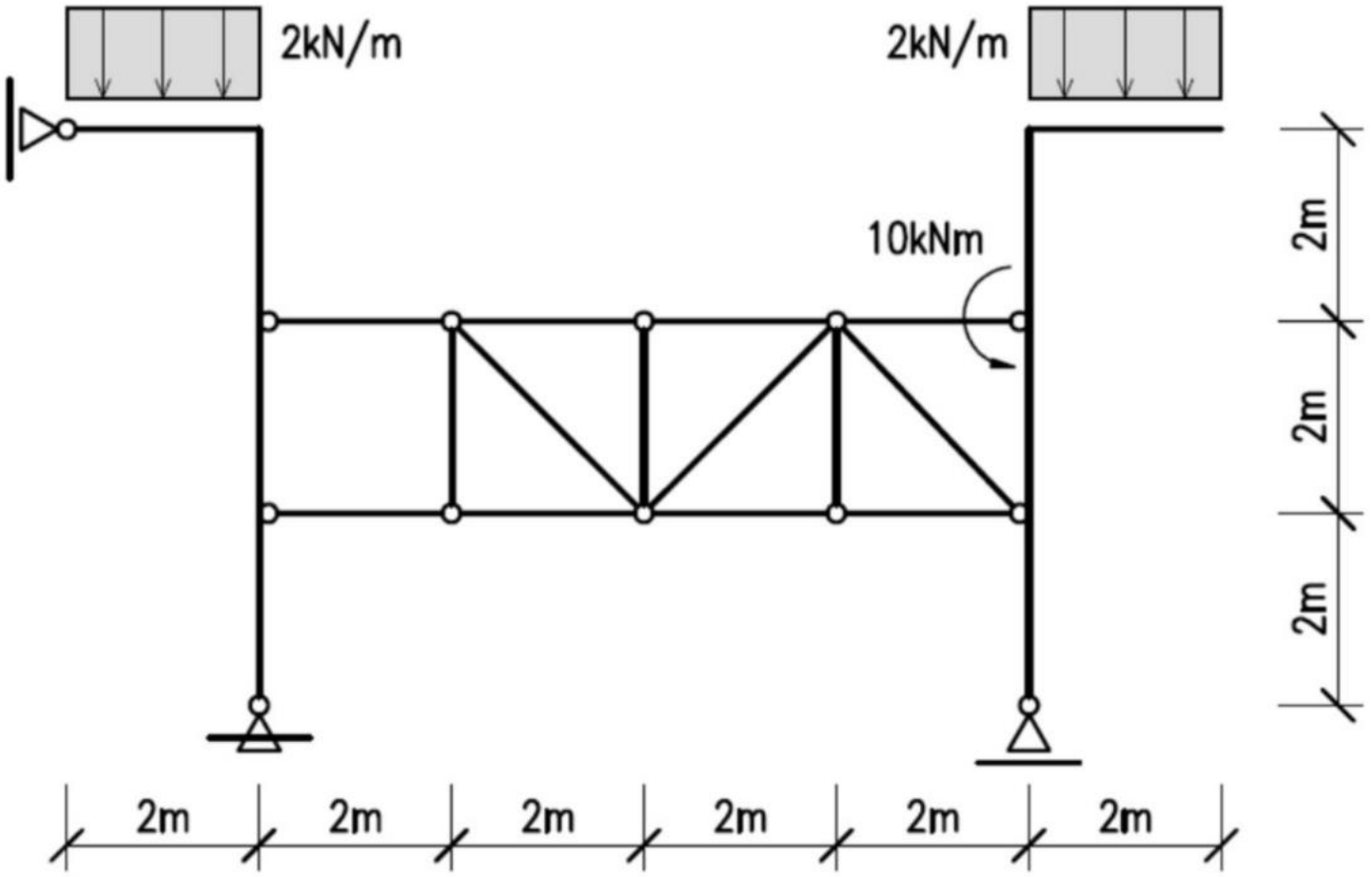


Resolvemos por otro lado las barras con cargas:



N lo calculé en el reticulado

Diagrama de caracteristicas - Estructuras Mixtas

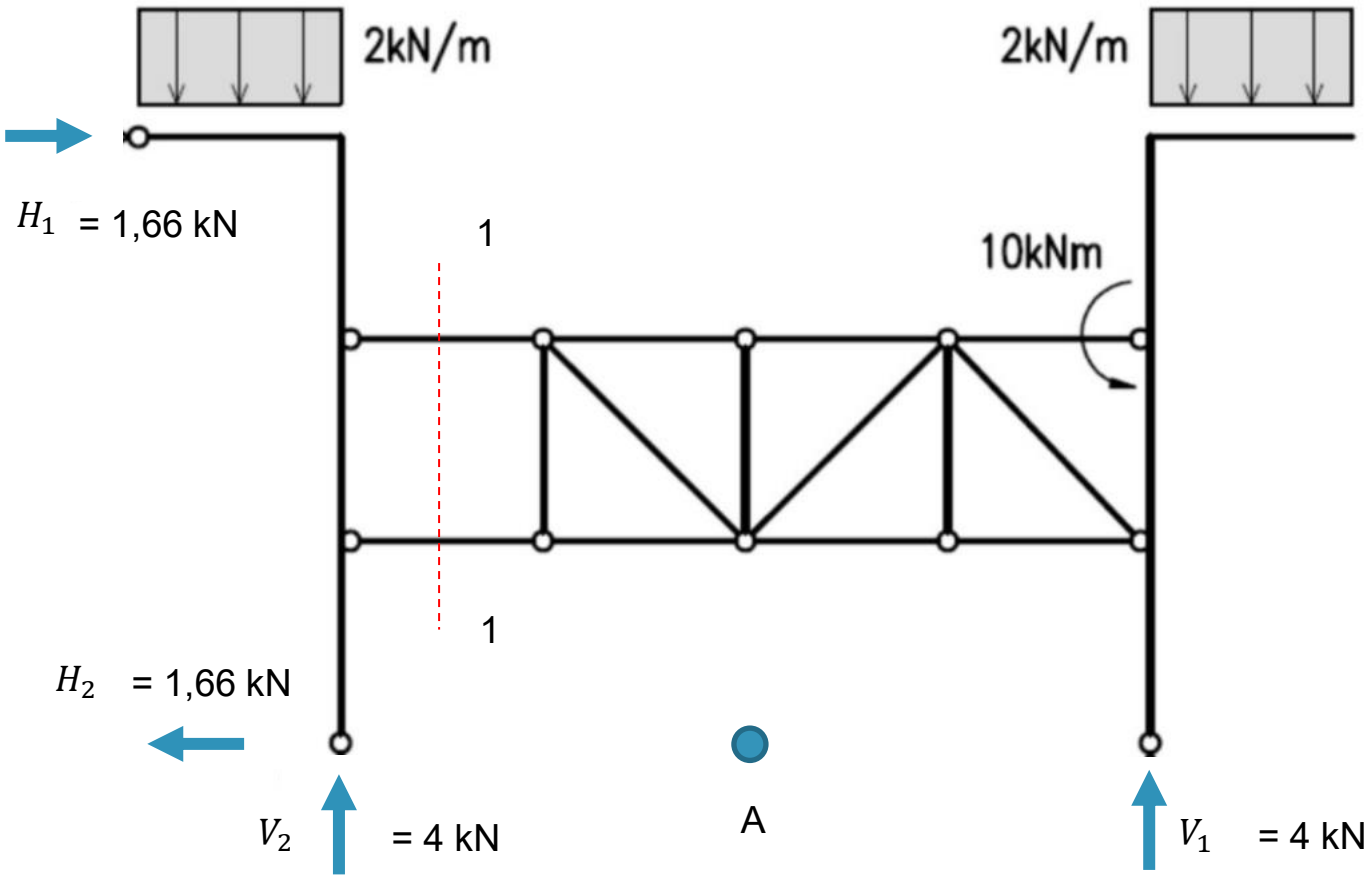


Análisis cinemático

GL = ? 4

CV = ? 4

Diagrama de caracteristicas - Estructuras Mixtas



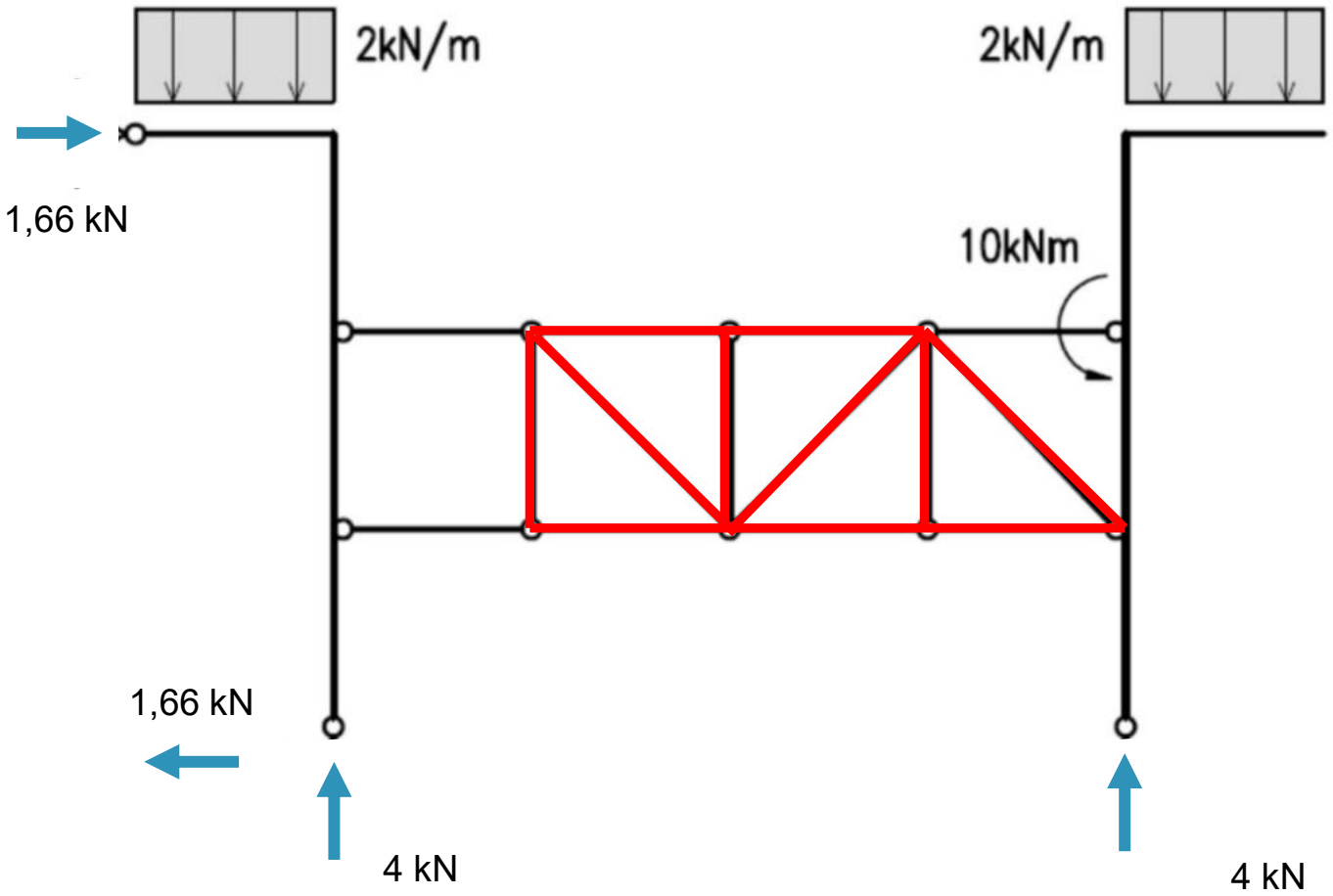
$$\sum F_v = 0 = -q * 2m - q * 2m + V_1 + V_2$$

$$\sum F_h = 0 = H1 = H2$$

$$\sum M_A = 0 = -10kNm + H1 * 6m \rightarrow H1 = 10kNm/6m$$

$$\sum F_v^{1-1} = 0 = V2 - q * 2m$$

Diagrama de caracteristicas - Estructuras Mixtas



Diagramas de características
Despiece de estructura

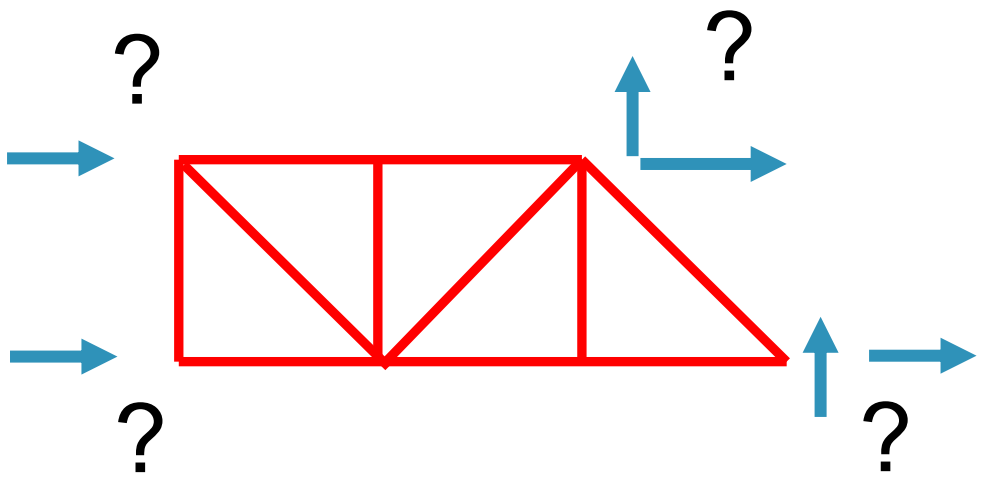


Diagrama de caracteristicas - Estructuras Mixtas

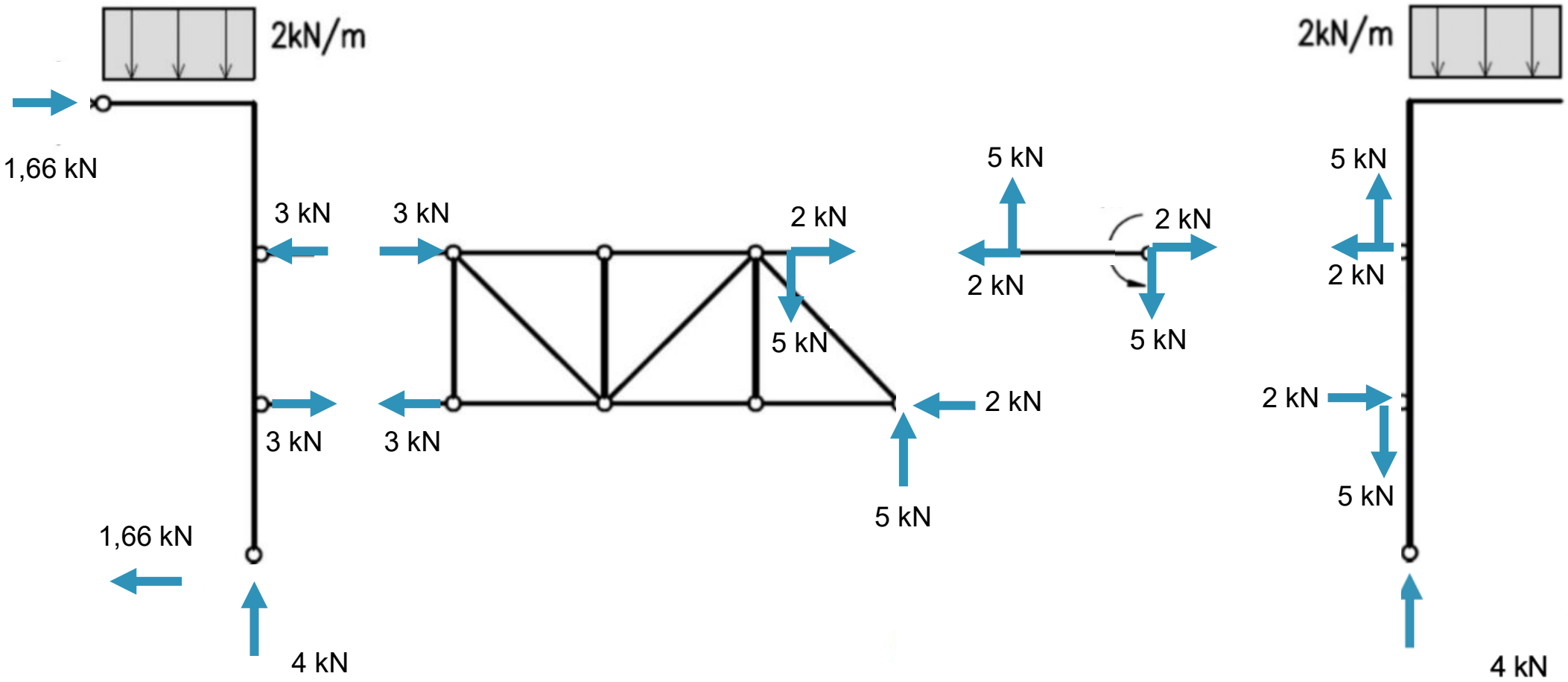


Diagrama de caracteristicas - Estructuras Mixtas

- Barras inactivas

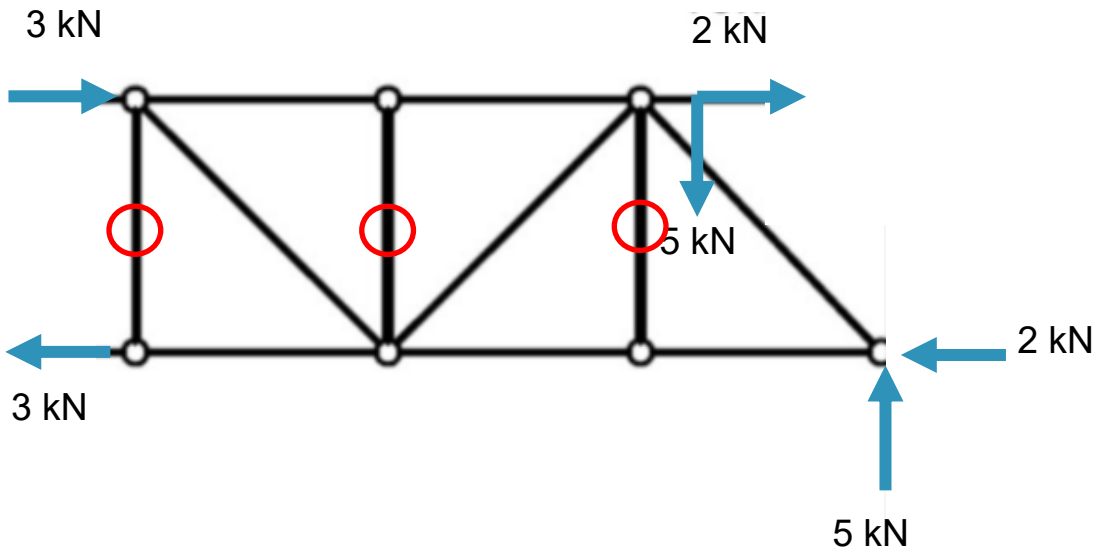
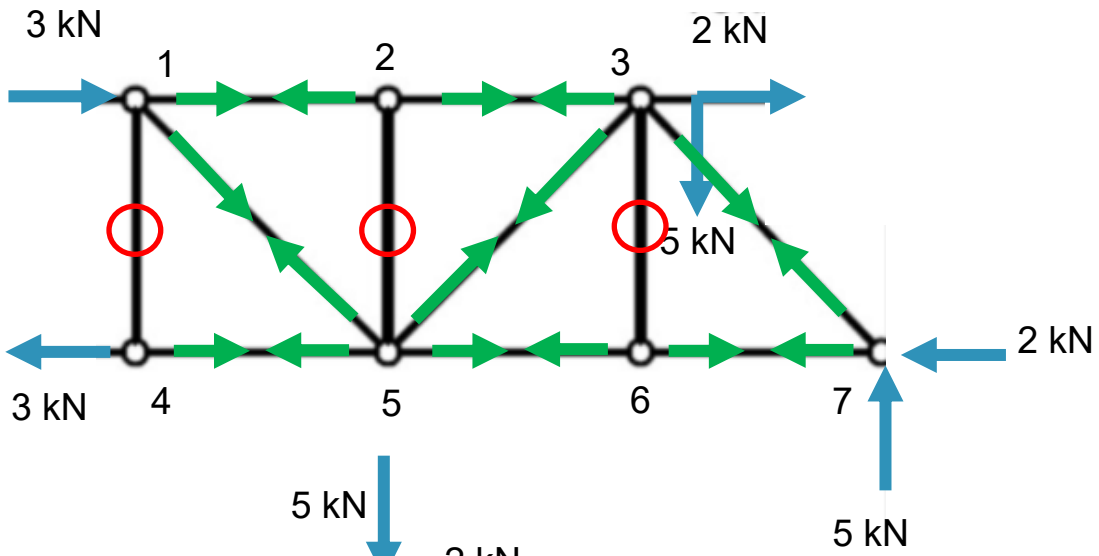


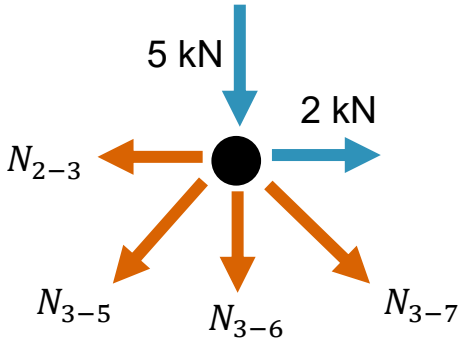
Diagrama de caracteristicas - Estructuras Mixtas

- Barras inactivas

- Equilibrio de nudos



NODO 3



4 $\sum F_x = 0 \quad N_{4-5} - 3kN = 0 \quad \rightarrow N_{4-5} = 3kN$

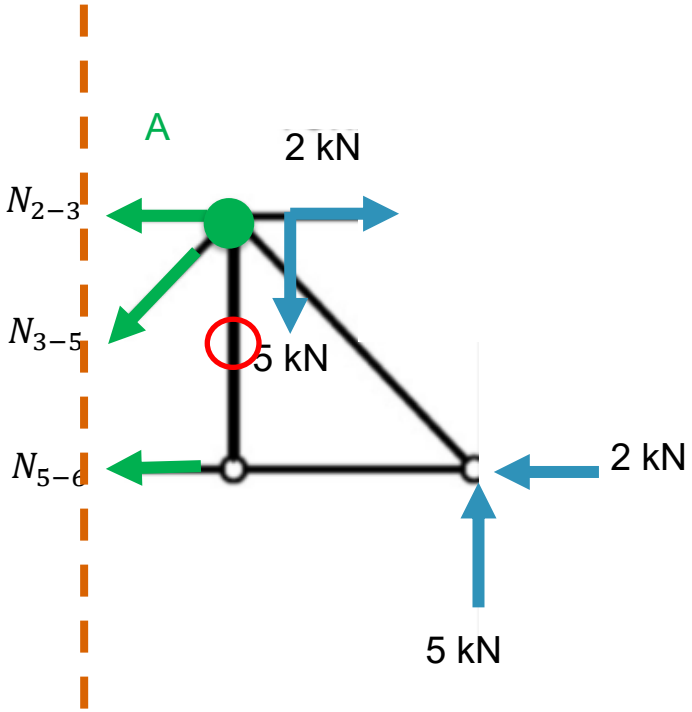
1 $\sum F_x = 0 \quad N_{1-2} + 3kN + N_{1-5} * \cos(\propto) = 0 \quad \rightarrow N_{1-2} = -3kN$

$\sum F_y = 0 \quad N_{1-5} * \sin(\propto) = 0 \quad \rightarrow N_{1-5} = 0$

7 $\sum F_x = 0 \quad -N_{6-7} - 2KN - N_{3-7} * \cos(\propto) = 0 \rightarrow N_{6-7} = 3kN$

$\sum F_y = 0 \quad N_{3-7} * \sin(\propto) + 5kN = 0 \quad \rightarrow N_{3-7} = -7.05kN$

Diagrama de caracteristicas - Estructuras Mixtas



- Barras inactivas

- Equilibrio de nudos

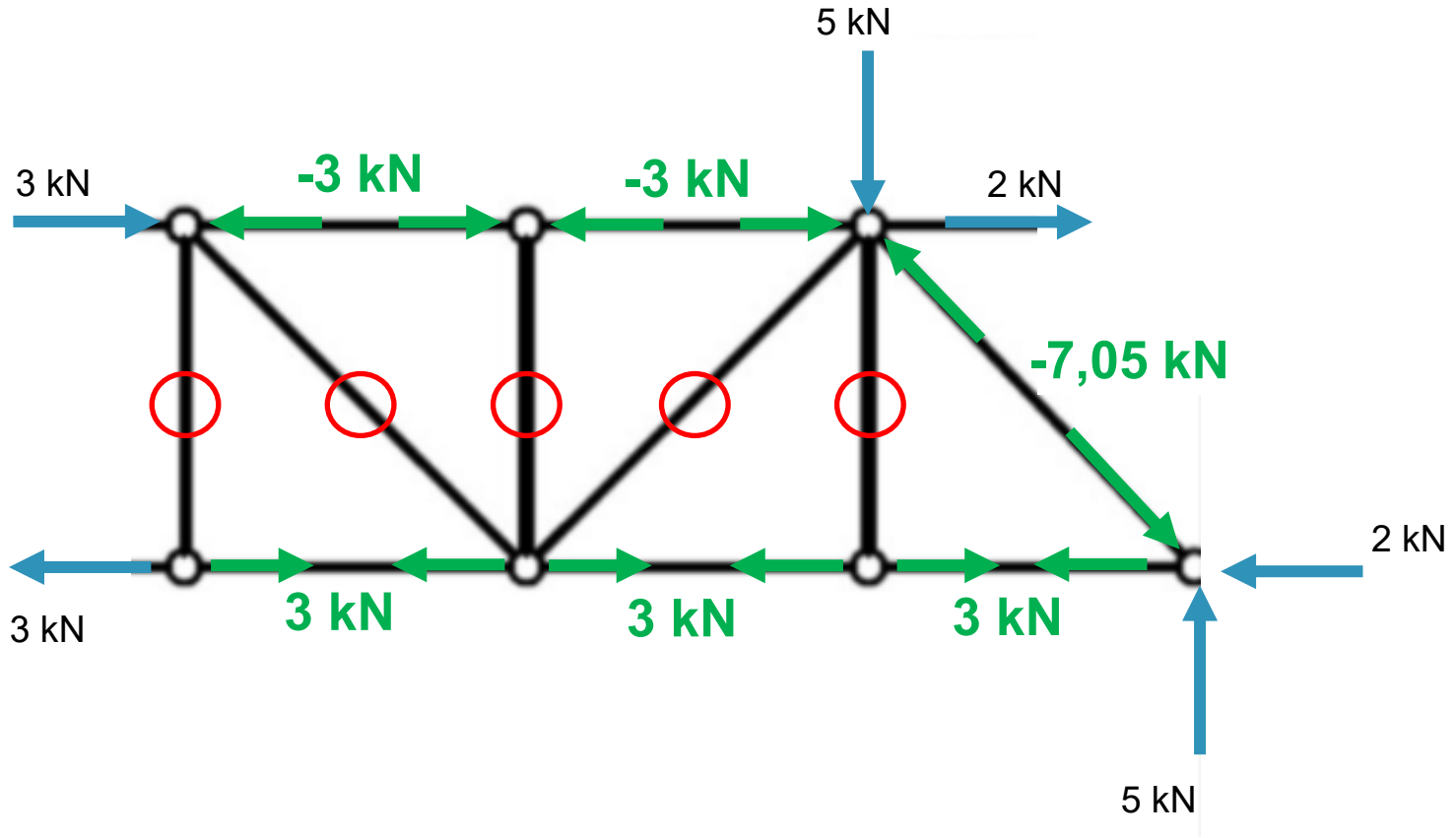
- Método de Ritter

$$\sum F_v = 0 \quad -N_{3-5} * \sin(\propto) = 0 \qquad \rightarrow N_{3-5} = 0$$

$$\sum M_a = 0 \;\; 5kN * 2m \; - 2kN * 2m \; - N_{5-6} * 2m = 0 \qquad \rightarrow N_{5-6} = 3kN$$

$$\sum F_h = 0 \;\; -N_{5-6} - N_{2-3} = 0 \qquad \rightarrow N_{2-3} = -3kN$$

Diagrama de caracteristicas - Estructuras Mixtas




Sky Gate Bridge "R" (Osaka, Japón)

GRACIAS POR SU ATENCIÓN!