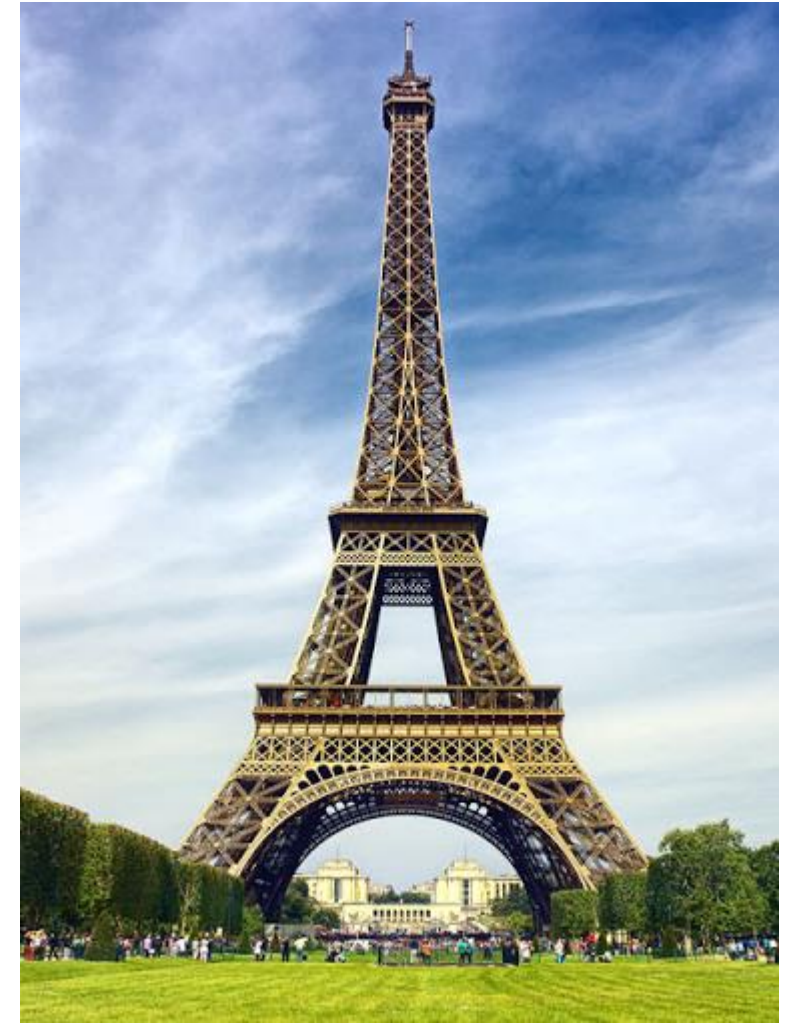


TB036 - Estática

Estructuras Reticuladas 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 - Suíza Basilea

Río Rhin – 128 m





Puente Nicolás Avellaneda - Riachuelo - Bs As





Puente levadizo basculante BARRACA PEÑA - 1913
Riachuelo – Buenos Aires

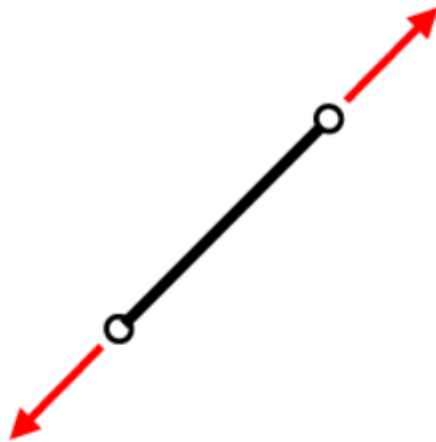




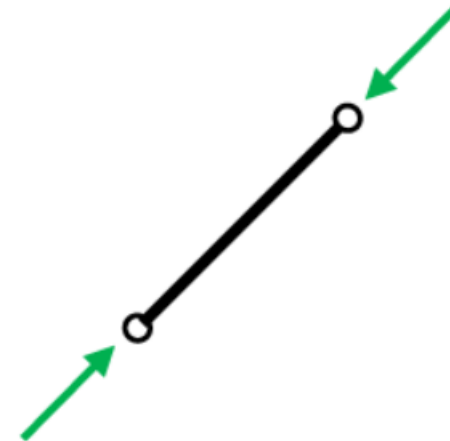
ENTRADA AL PUERTO DE ROTTERDAM

Ventajas

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



Tracción



Compresión

Comparación

Alma Llena

➤ Fotos:

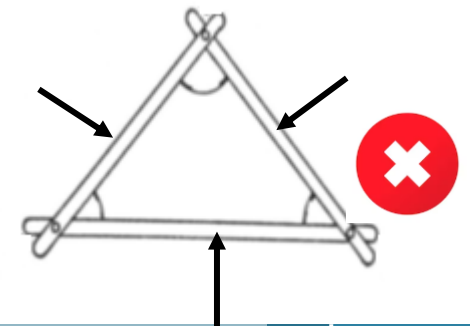
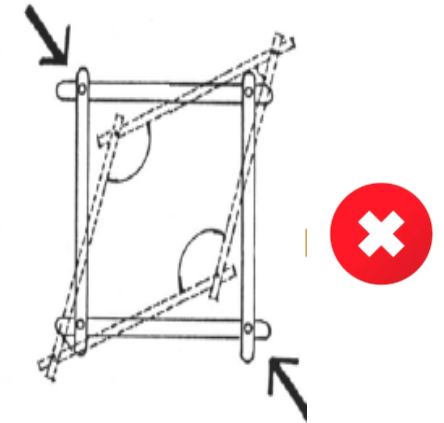
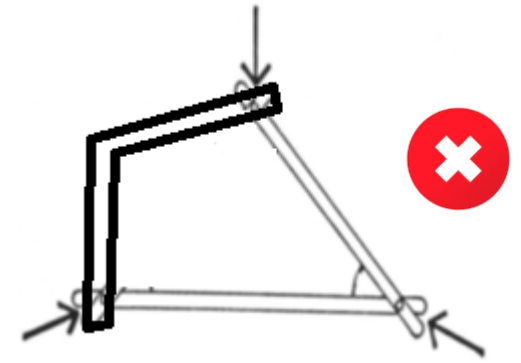
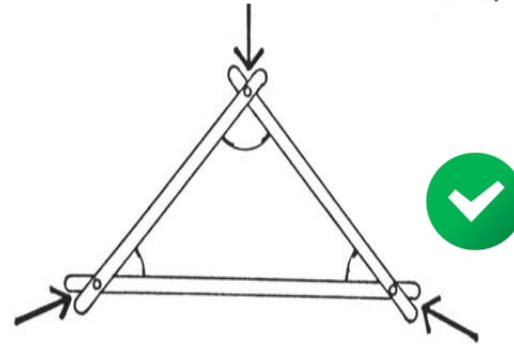
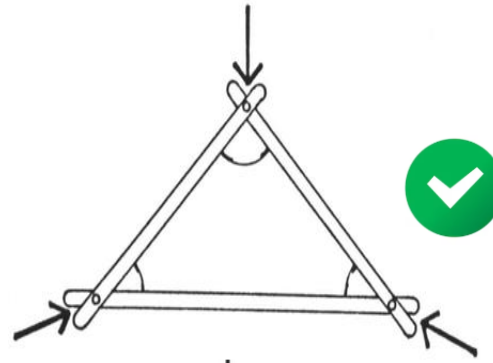
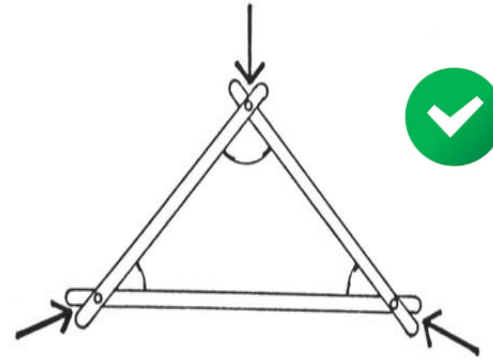


Alma Calada

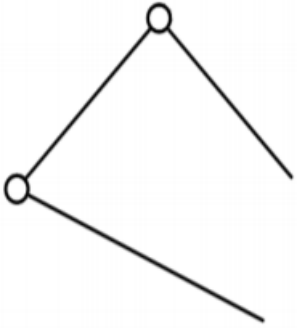


Hipótesis

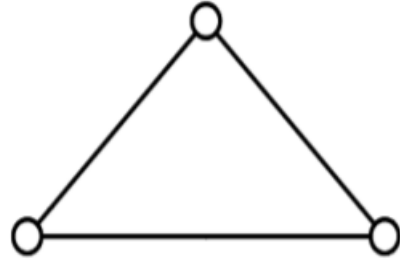
- Barras rectas.
- Cadenas formando triángulos.
- Cargas en los nudos.



Condición de Rigidez



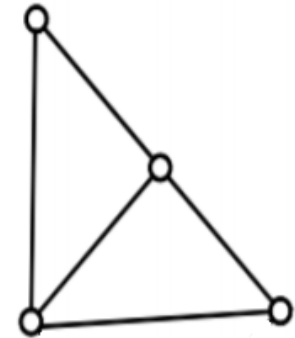
$$GL=5$$



$$GL=5-2=3$$



$$GL=5$$



$$GL=5-2=3$$

$$B = 3 + 2P$$

$$N = 3 + P$$

$$B = 2N - 3$$

$$B = N^{\circ} \text{ de Barras}$$

$$P = N^{\circ} \text{ de Pares de barras que se agregan}$$

$$N = N^{\circ} \text{ de Nudos}$$

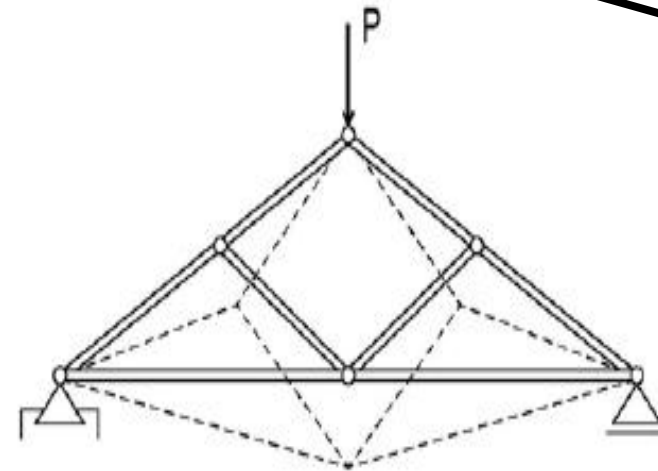
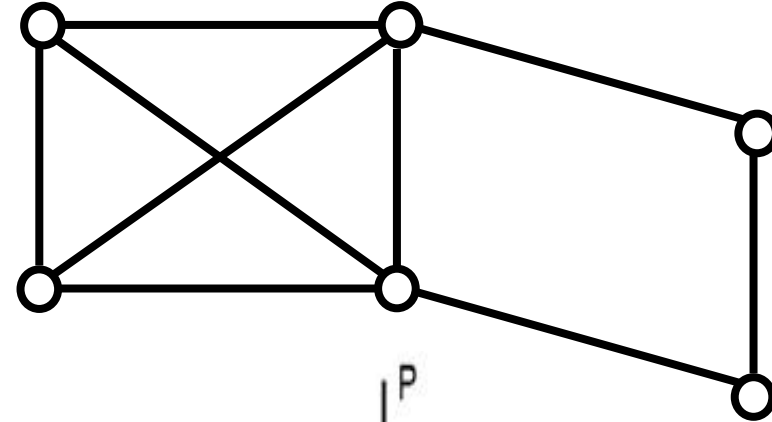
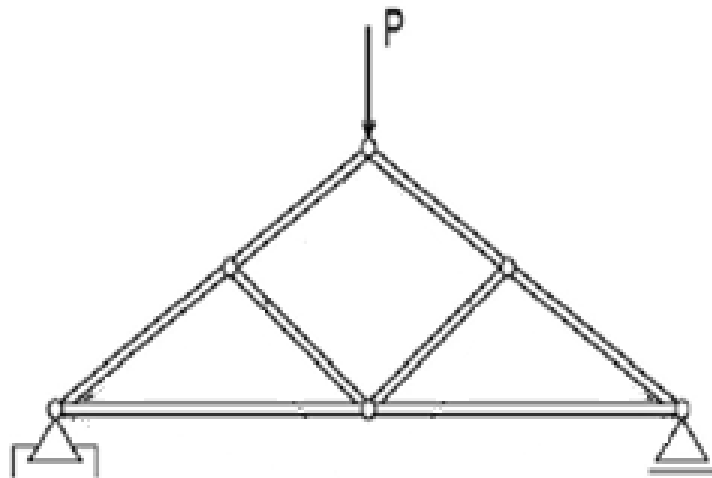
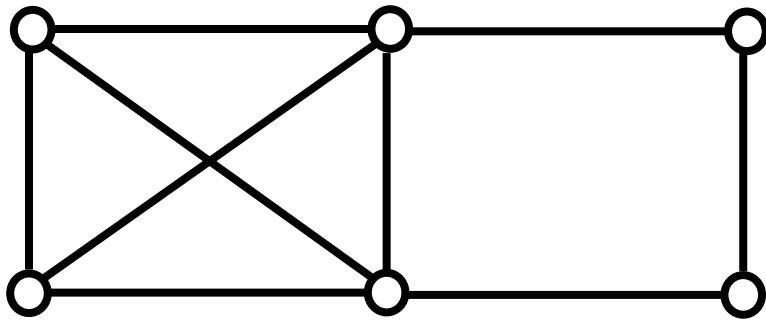
Análisis cinemático

- Si $B < 2N - 3$ $\Rightarrow$ Mecanismo
- Si $B = 2N - 3$ $\Rightarrow$ Isostático
Condición necesaria, no suficiente.
Verificar que no haya vinculación aparente
- Si $B < 2N - 3$ $\Rightarrow$ Hiperestático por vínculo interno.

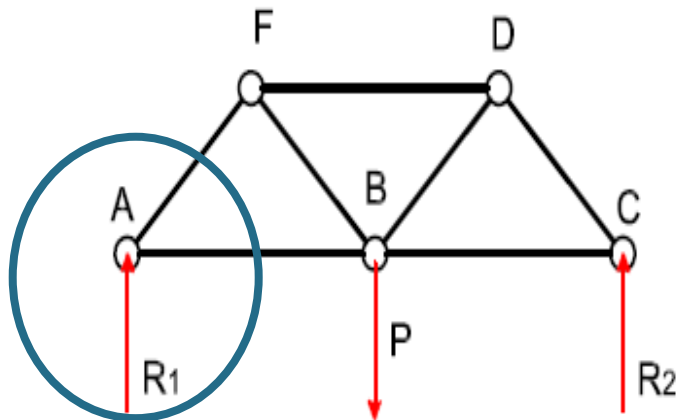
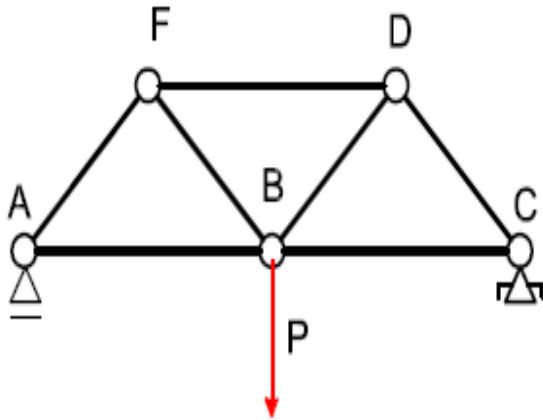


Análisis cinemático

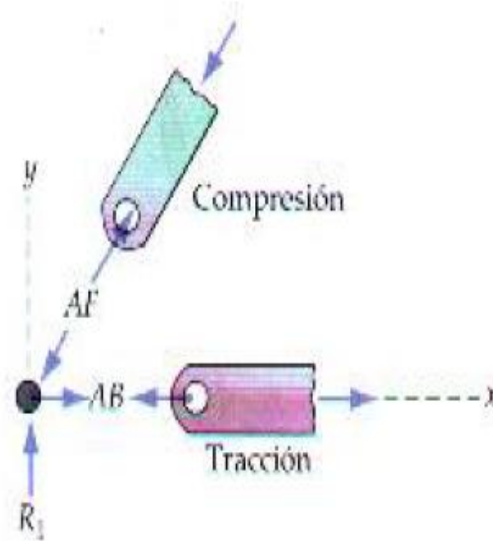
$$B = 2N - 3$$



Resolución: Método de los Nudos



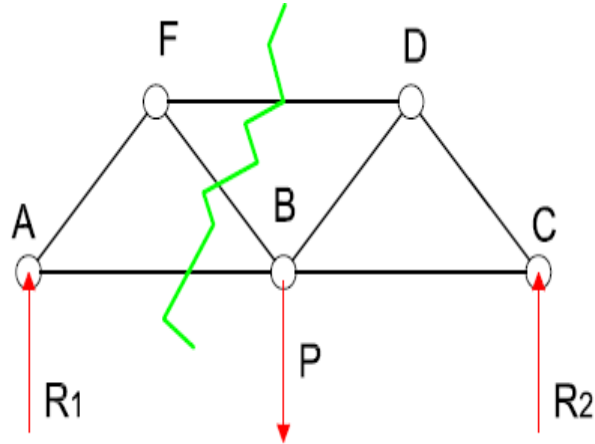
➤ Planteamos equilibrio del Nodo A



$$\sum F_x = 0$$

$$\sum F_y = 0$$

Resolución: Método de las Secciones

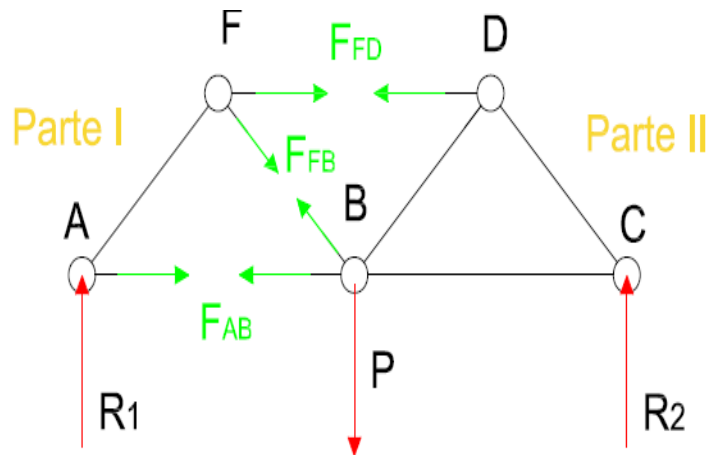


➤ Planteamos equilibrio de la parte 1

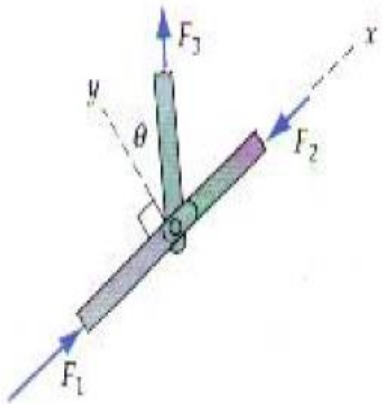
$$\sum M^F = 0 \Rightarrow F_{AB}$$

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

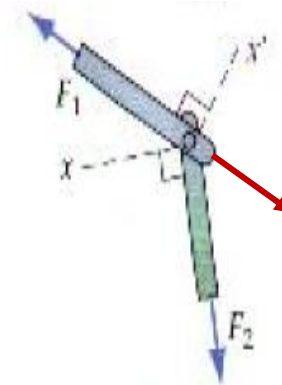
$$\sum \text{Proy}^{n-n} = 0 \Rightarrow F_{FB}$$



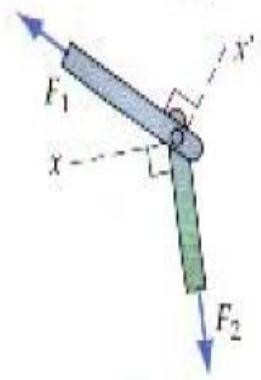
Barras inactivas y casos especiales:



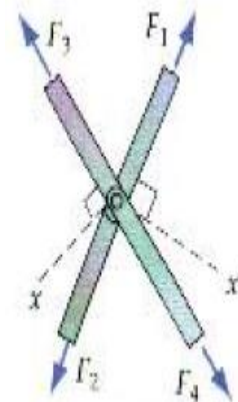
$$F_1 = F_2$$
$$F_3 = 0$$



$$F_1 = P$$
$$F_2 = 0$$



$$F_1 = 0$$
$$F_2 = 0$$



$$F_1 = F_2$$
$$F_3 = F_4$$

Barras Inactivas:

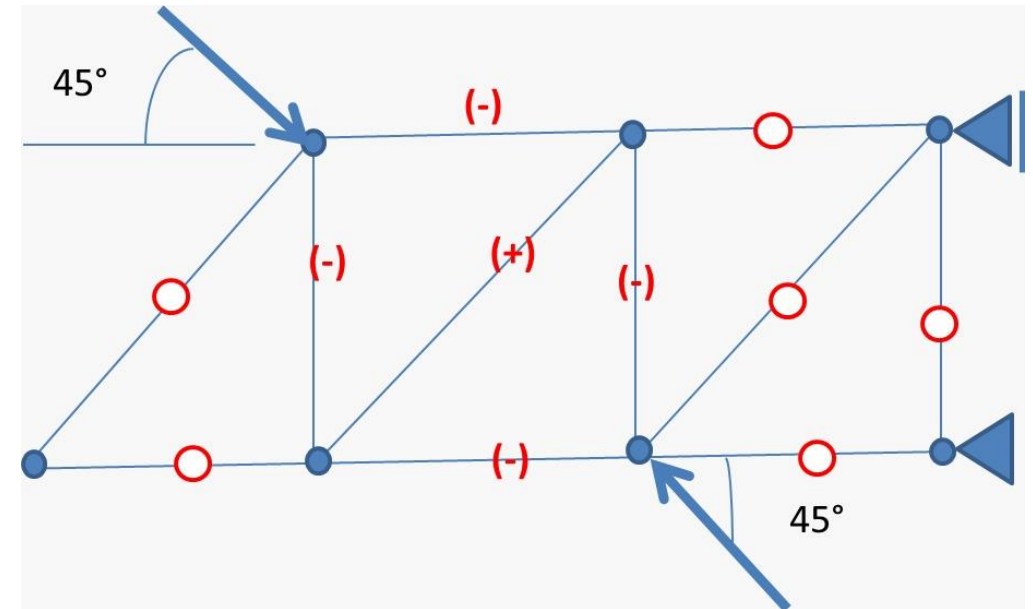
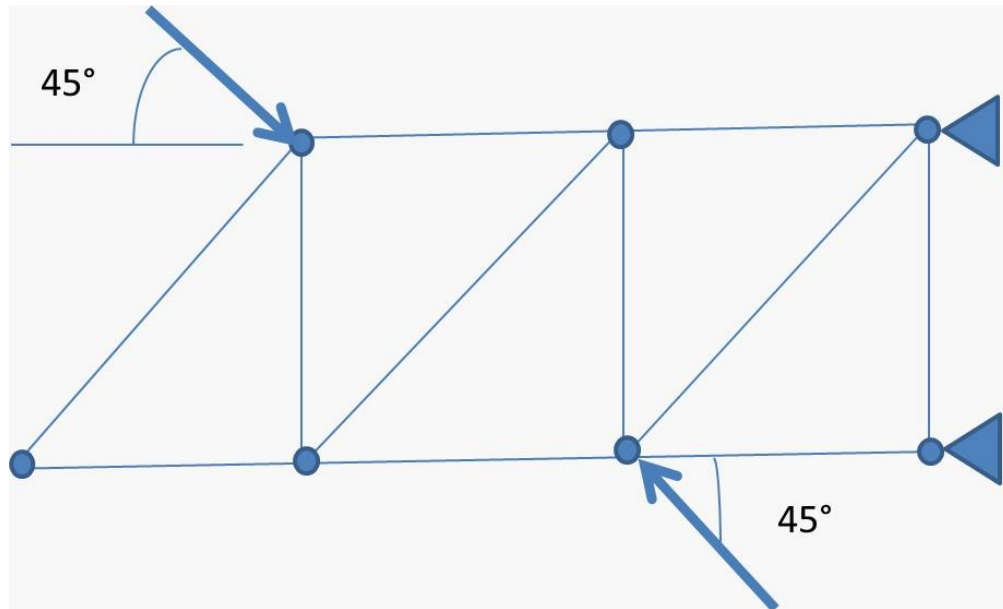
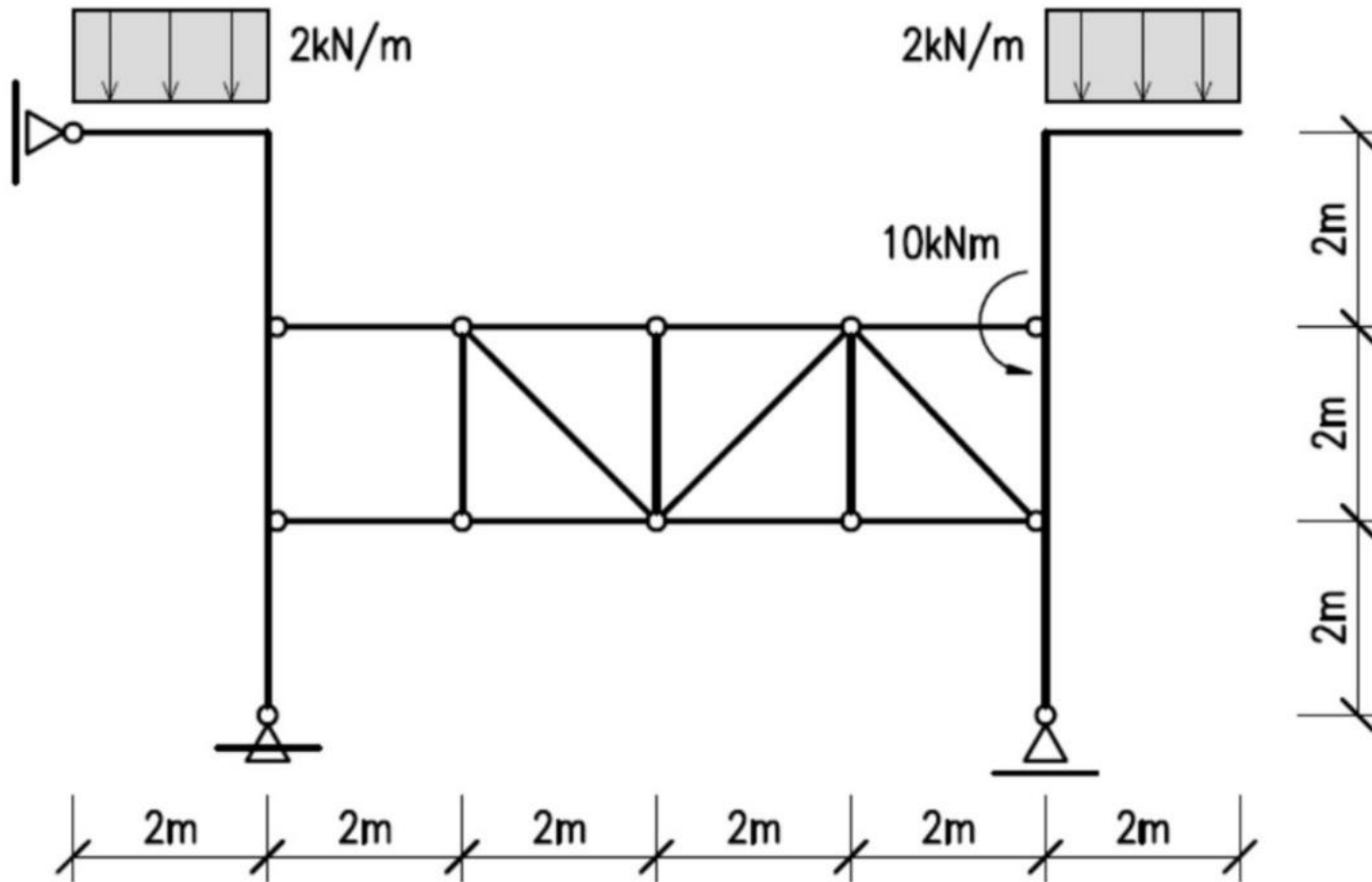


Diagrama de características - Estructuras Mixtas

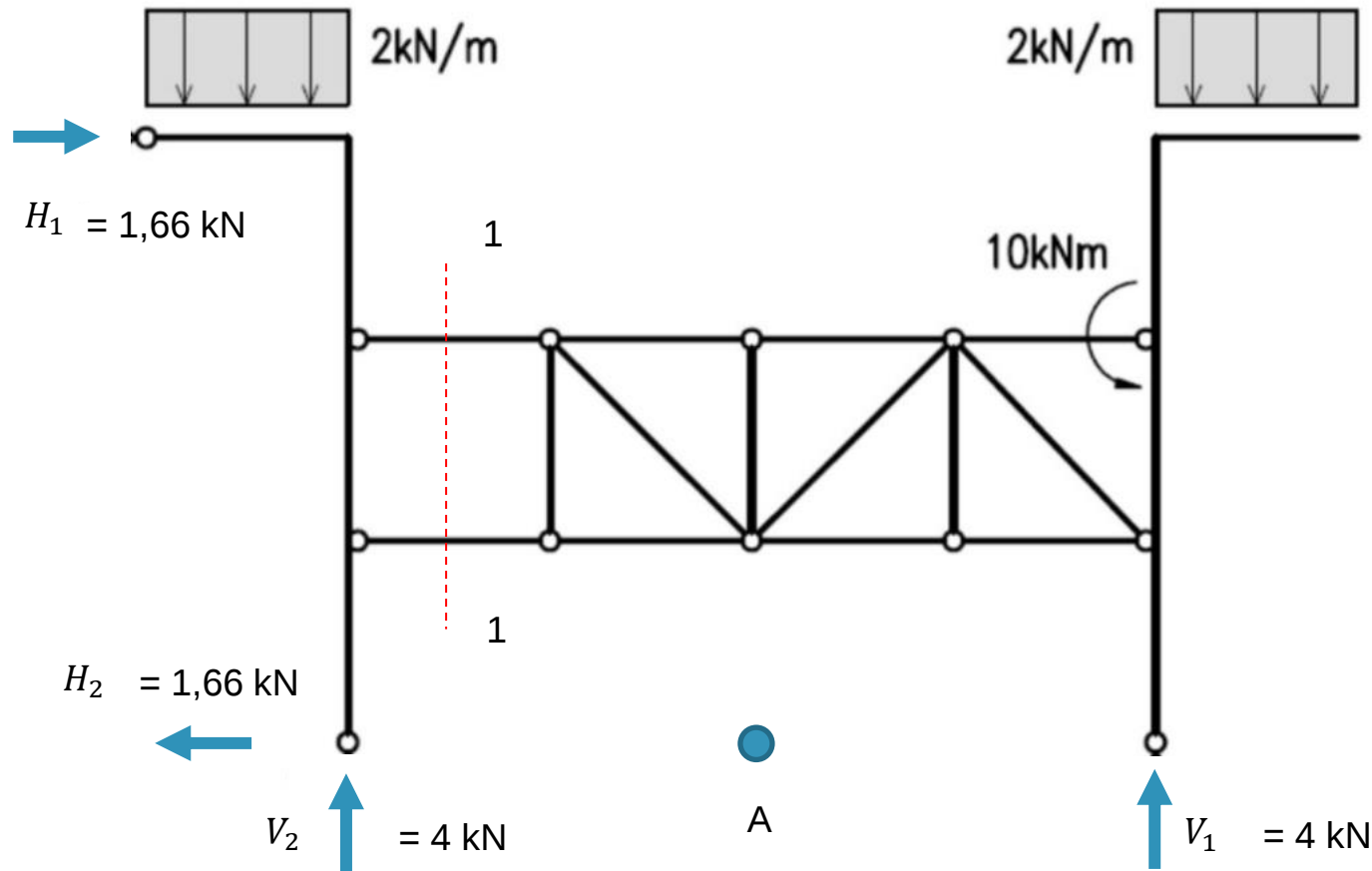


Análisis cinemático

GL = ? 4

CV = ? 4

Diagrama de características - Estructuras Mixtas



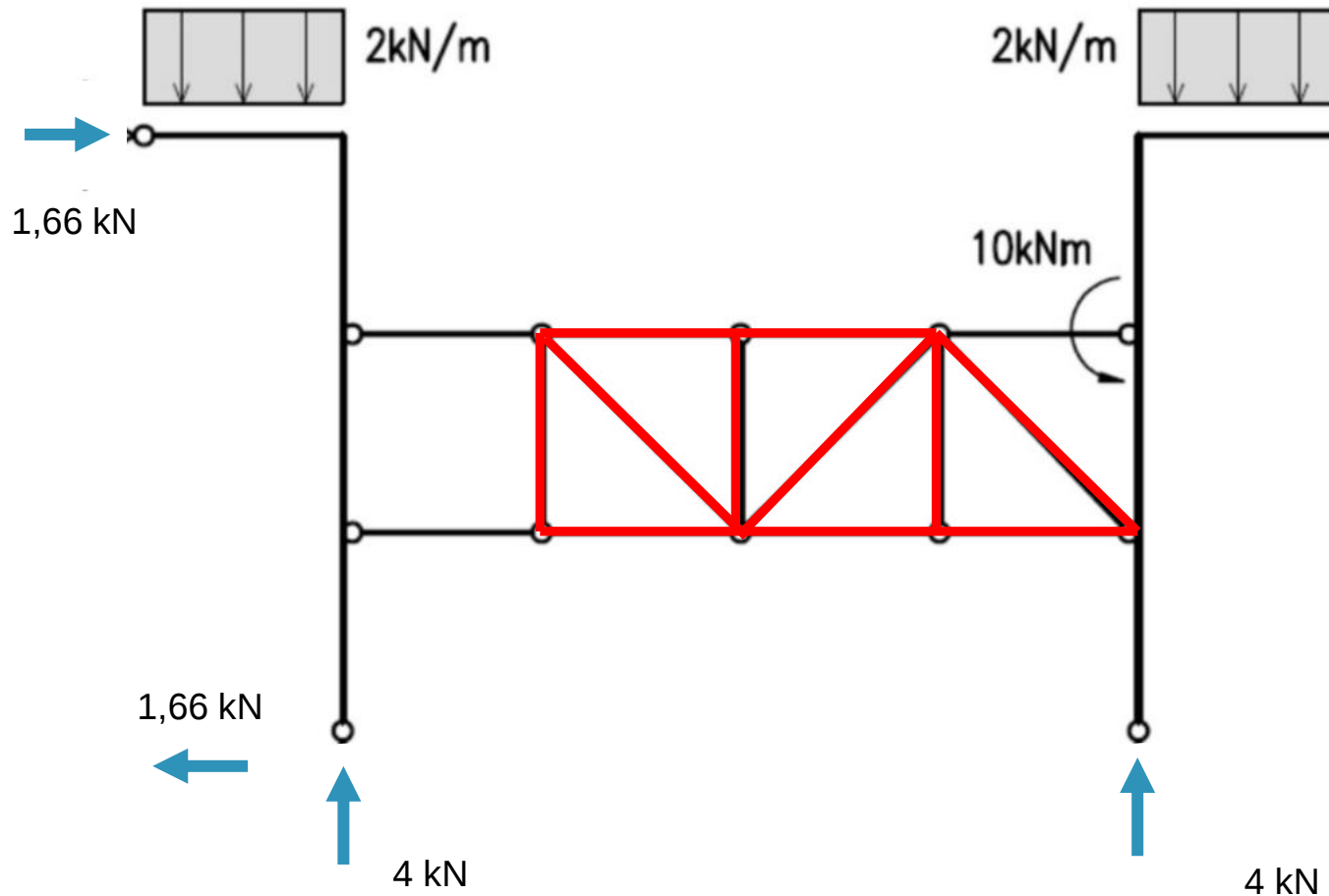
$$\sum F_v = 0 = -q * 2m - q * 2m + V_1 + V_2$$

$$\sum F_h = 0 = H_1 = H_2$$

$$\sum M_A = 0 = -10kNm + H_1 * 6m \rightarrow H_1 = 10kNm/6m$$

$$\sum F_v^{1-1} = 0 = V_2 - q * 2m$$

Diagrama de características - Estructuras Mixtas



Diagramas de características
Despiece de estructura

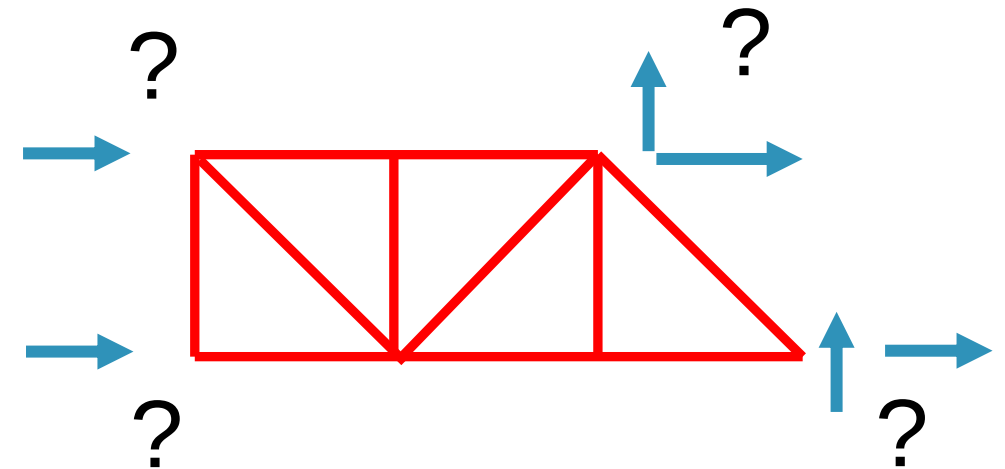


Diagrama de características - Estructuras Mixtas

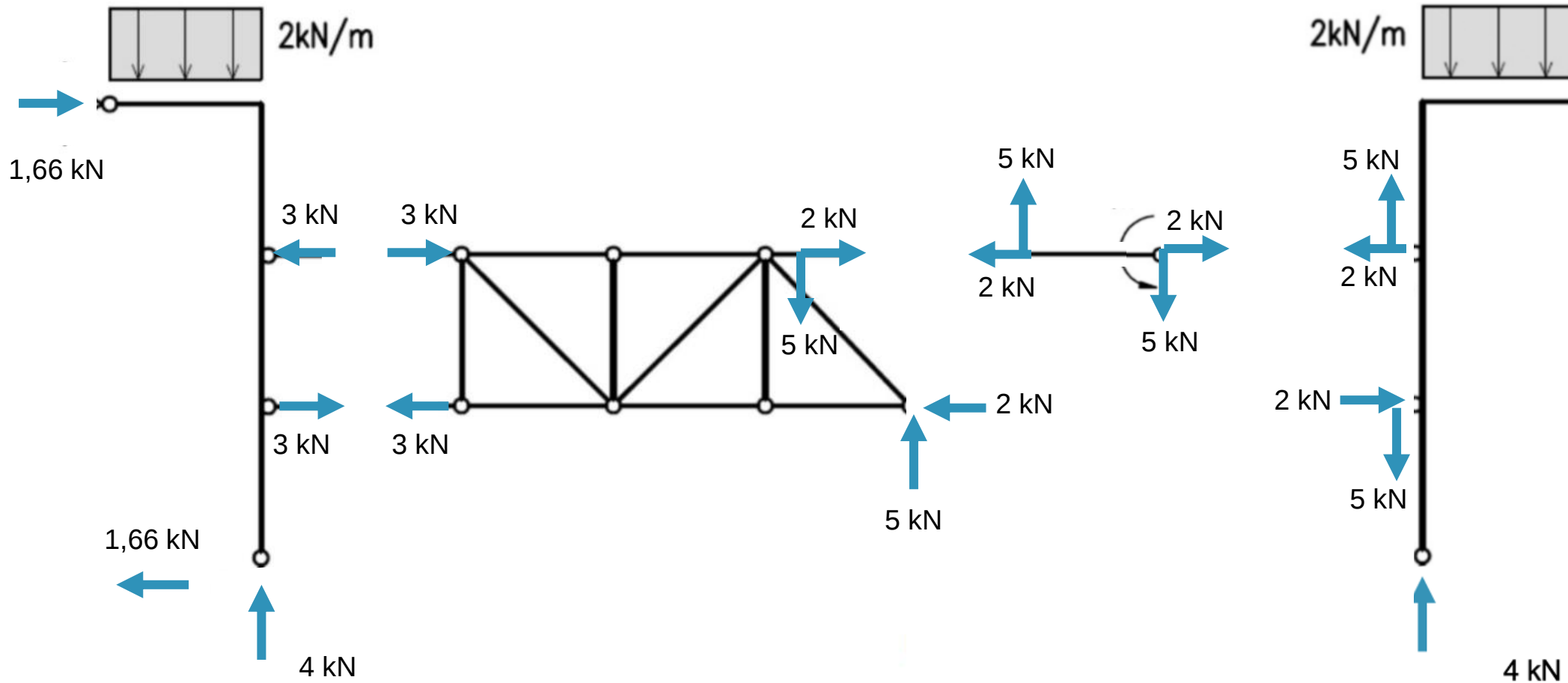


Diagrama de características - Estructuras Mixtas

- Barras inactivas

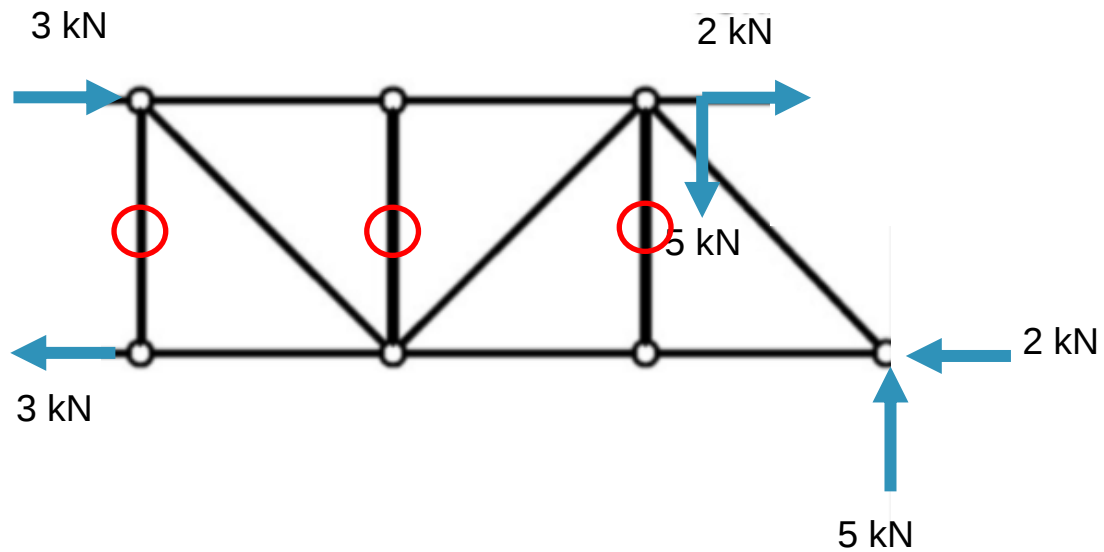
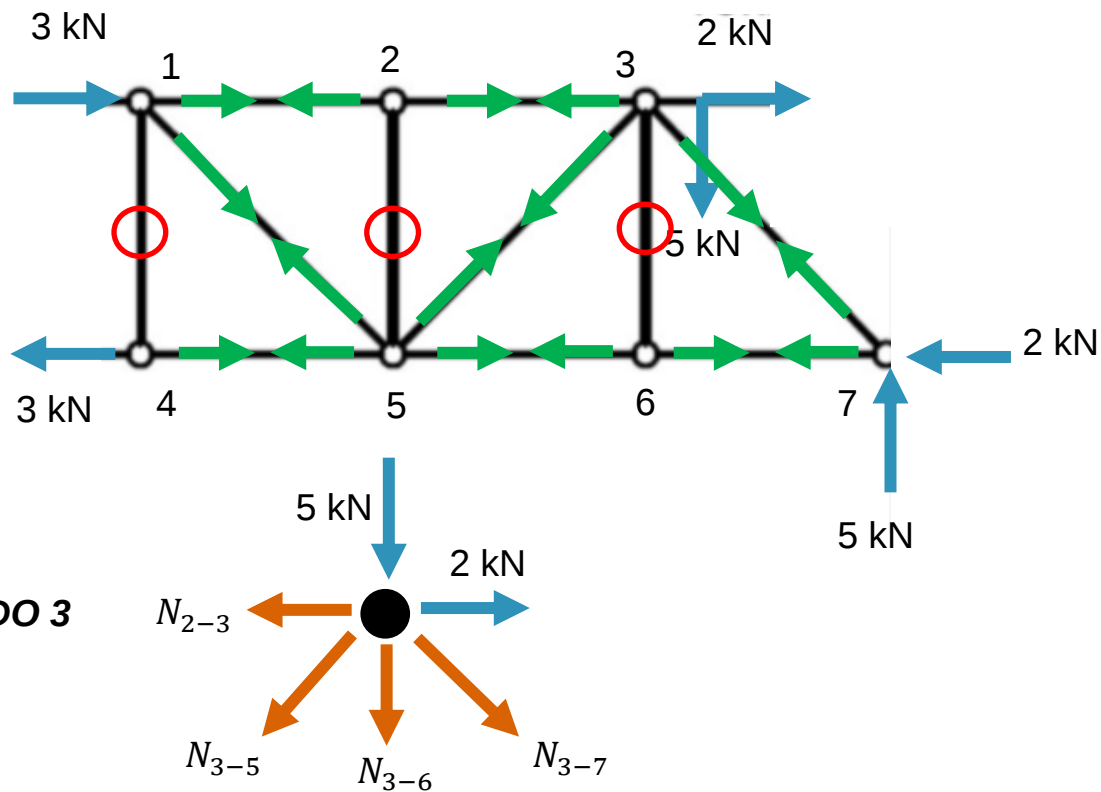


Diagrama de características - Estructuras Mixtas



- Barras inactivas

- Equilibrio de nudos



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

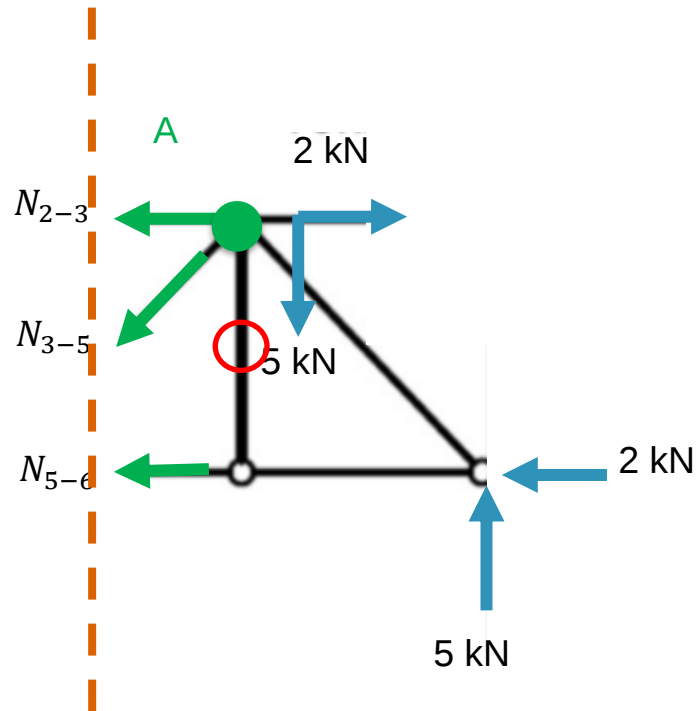
$$\boxed{1} \quad \sum F_x = 0 \quad N_{1-2} + 3kN + N_{1-5} * \cos(\alpha) = 0 \quad \rightarrow N_{1-2} = -3kN$$

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

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

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

Diagrama de características - Estructuras Mixtas



- Barras inactivas

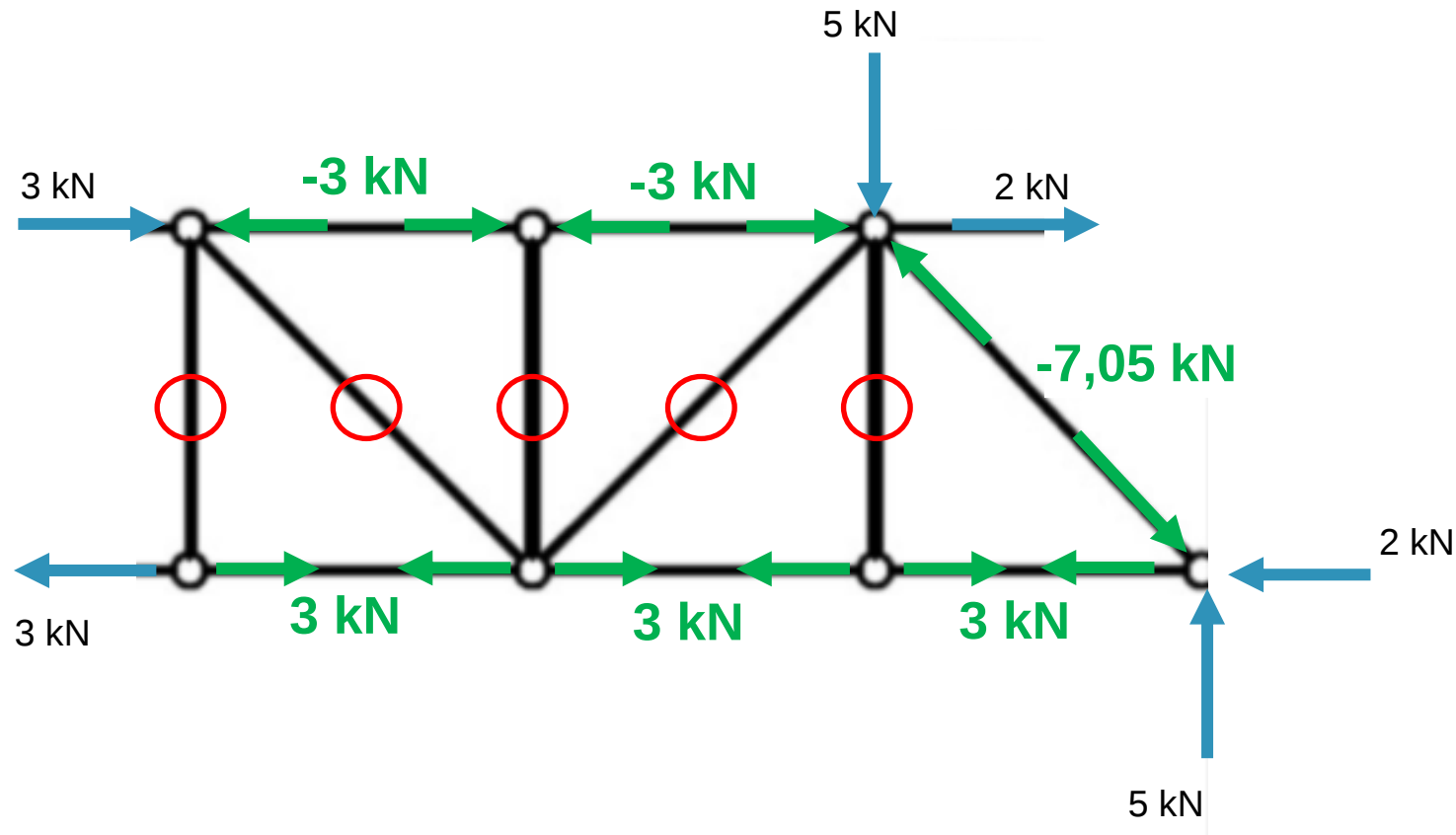
- Equilibrio de nudos

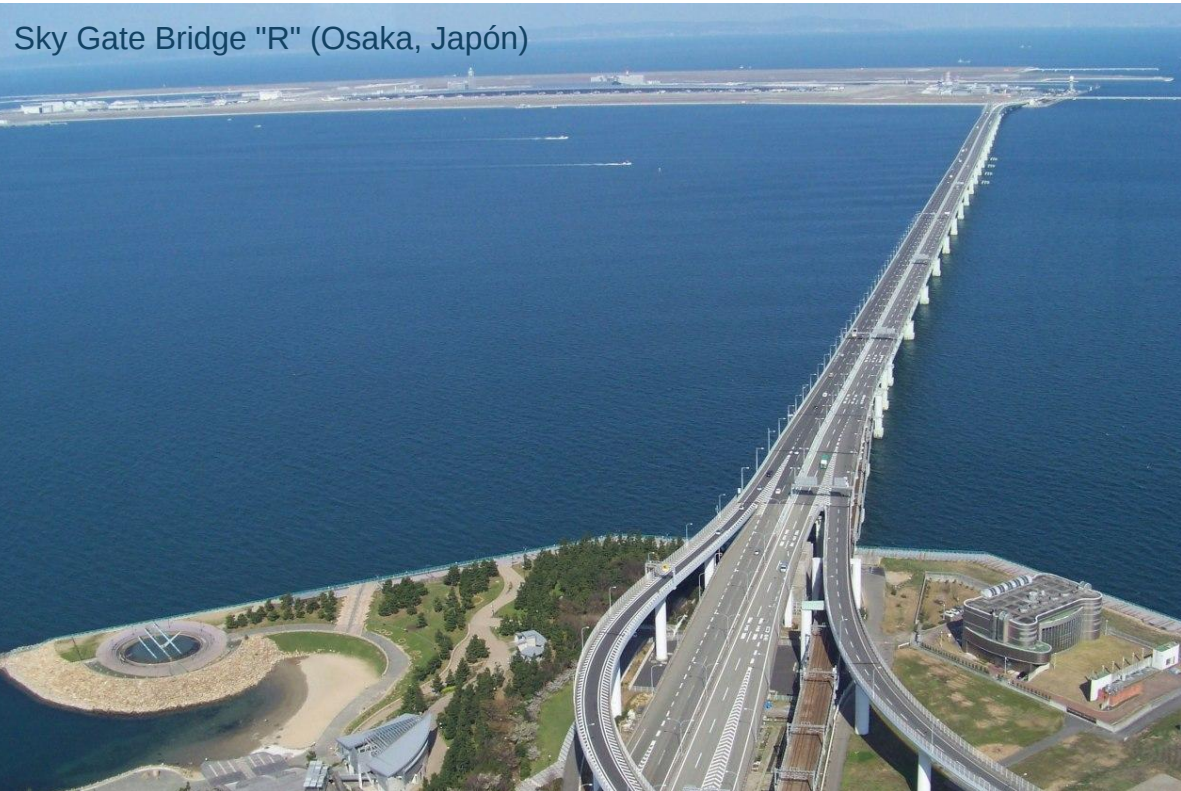
- Método de Ritter

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

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

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

Diagrama de características - Estructuras Mixtas



GRACIAS POR SU ATENCIÓN!