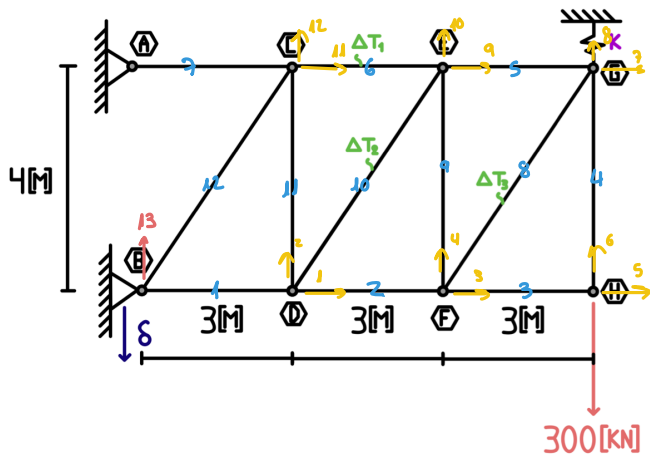


Problema 1



Grados de Hiper-Estática

$$GHE = (n+r) - 2j$$

$$n = \text{nº de barras} \rightarrow n = 12$$

$$r = \text{reacciones} \rightarrow r = 5$$

$$j = \text{nº de nodos} \rightarrow j = 8$$

$$\therefore GHE = 1$$

$$\rightarrow 0,01 \text{ MPa} \cdot \text{mm}^2 = \text{N}$$

Elemento Horizontal:

$$[K_H] = \frac{EA}{L} \begin{bmatrix} 1 & & & \\ 0 & 0 & S & \\ -1 & 0 & 1 & \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\therefore [K_H] = 2199,05 \text{ [N/m]}$$

$$\rightarrow \therefore K_1 = 2199,05 \text{ [kN-m]}$$

$$\hookrightarrow \frac{EA}{L} = 2199,05 \text{ [N/m]}$$

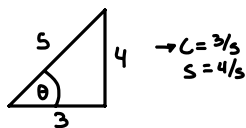
Rigidez vertical:

$$[K_V] = \frac{EA}{L} \begin{bmatrix} 0 & & & \\ 0 & 1 & & \\ 0 & 0 & 0 & \\ 0 & -1 & 0 & 1 \end{bmatrix}$$

$$\therefore [K_V] = 1649,29 \text{ [kN/m]}$$

$$\hookrightarrow \frac{EA}{L} = 1649,29 \text{ [kN/m]}$$

Rigidez diagonal



$$[K_d] = \frac{EA}{L} \begin{bmatrix} \frac{9}{25} & & & \\ \frac{12}{25} & \frac{16}{25} & & \\ -\frac{9}{25} & -\frac{12}{25} & \frac{9}{25} & \\ -\frac{12}{25} & -\frac{16}{25} & \frac{12}{25} & \frac{16}{25} \end{bmatrix}$$

$$\therefore [K_d] = 1319,43 \text{ [kN/m]}$$

$$\hookrightarrow \frac{EA}{L} = 1319,43 \text{ [kN/m]}$$

$$F_{DT1} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 138,54 \\ 0 \\ 138,54 \\ 0 \end{Bmatrix} \text{ [kN]}$$

$$F_{DT2} = \begin{Bmatrix} -35,62 \\ -47,50 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 35,62 \\ 47,50 \\ 0 \\ 0 \end{Bmatrix} \text{ [kN]}$$

$$F_{DT3} = \begin{Bmatrix} 0 \\ 0 \\ 75,21 \\ 100,28 \\ 0 \\ 0 \\ 0 \\ -75,21 \\ -100,28 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix} \text{ [kN]}$$

$$F_{ext} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix} \text{ [kN]}$$

$$\therefore F = \begin{Bmatrix} -35,62 \\ -47,5 \\ 75,21 \\ 100,28 \\ 0 \\ -300 \\ -75,21 \\ -100,28 \\ -100,92 \\ 47,5 \\ 106,88 \\ -47,51 \end{Bmatrix}$$

Así, los desplazamientos nodales nos quedan:

$$u = \begin{Bmatrix} -0.0080 \\ -0.0080 \\ -0.0120 \\ -0.0186 \\ -0.0120 \\ -0.3130 \\ -0.0390 \\ -0.1311 \\ -0.0430 \\ -0.0115 \\ 0.0120 \\ -0.0729 \end{Bmatrix} \text{ [m]}$$

→ ∴ las reacciones serán de

$$A_x = -26,39 \text{ [kN]} \quad B_x = 58,06 \text{ [kN]}$$

$$A_y = 0 \quad B_y = 53,96 \text{ [kN]}$$

→ La fuerza de reacción en el resorte es de 280,295 [kN].