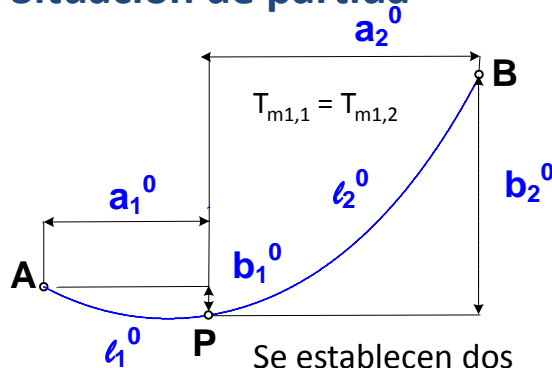


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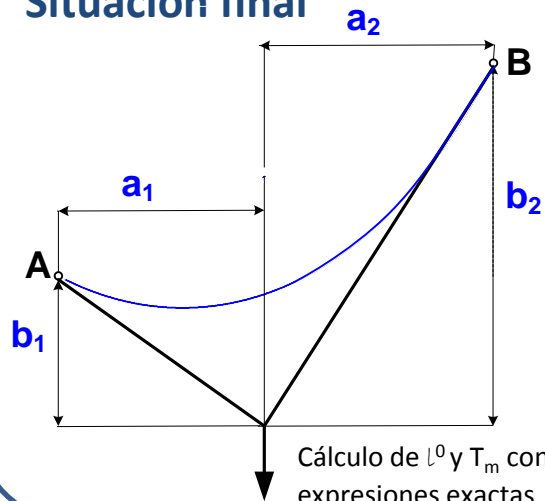
Equilibrio de hilos con cargas puntuales

Situación de partida



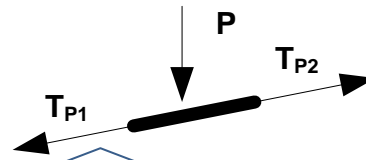
Se establecen dos catenarias (1 y 2) a ambos lados de la carga puntual

Situación final



Cálculo de l^0 y T_m con expresiones exactas

Para un elemento diferencial \rightarrow Equilibrio de fuerzas



Las fuerzas a la izquierda del cable se consideran con signo negativo

$$T_{p1x} + T_{p2x} = 0$$

$$T_{01} = T_{02} = T_0$$

$$-T_{01} + T_{02} = 0$$

$$h_1 = h_2 = h'$$

$$T_{p1y} + T_{p2y} - P - pds = 0$$

Recordando:
 $T_y = T_0 y' = p h' \sinh\left(\frac{x}{h'}\right)$

Se desprecian las fuerzas diferenciales

$$p h' \left(\sinh\left(\frac{x_{p2}}{h'}\right) - \sinh\left(\frac{x_{p1}}{h'}\right) \right) = P \quad (1)$$

$$a_1 + a_2 = a \quad (2)$$

$$b_1 + b_2 = b \quad (3)$$

$$x_{p1} = x_{A1} + a_1$$

$$x_{p2} = x_{B2} - a_2$$

$$y_{p1} - y_{A1} = b_1$$

$$h' \left(\cosh\left(\frac{x_{p1}}{h'}\right) - \cosh\left(\frac{x_{A1}}{h'}\right) \right) = b_1 \quad (4)$$

$$y_{B2} - y_{p2} = b_2$$

$$h' \left(\cosh\left(\frac{x_{B2}}{h'}\right) - \cosh\left(\frac{x_{p2}}{h'}\right) \right) = b_2 \quad (5)$$

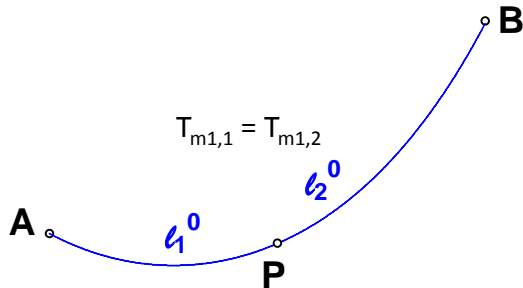
$$l_1^0 + l_1^0 \frac{T_{m2,1} - T_{m1,1}}{ES} = h' \left(\sinh\left(\frac{x_{p1}}{h'}\right) - \sinh\left(\frac{x_{A1}}{h'}\right) \right) \quad (6)$$

$$l_2^0 + l_2^0 \frac{T_{m2,2} - T_{m1,2}}{ES} = h' \left(\sinh\left(\frac{x_{B2}}{h'}\right) - \sinh\left(\frac{x_{p2}}{h'}\right) \right) \quad (7)$$

Incógnitas x_{A1} , x_{B2} , a_1 , a_2 , b_1 , b_2 , h'

2 Equilibrio de hilos con cargas distribuidas distintas

Situación de partida

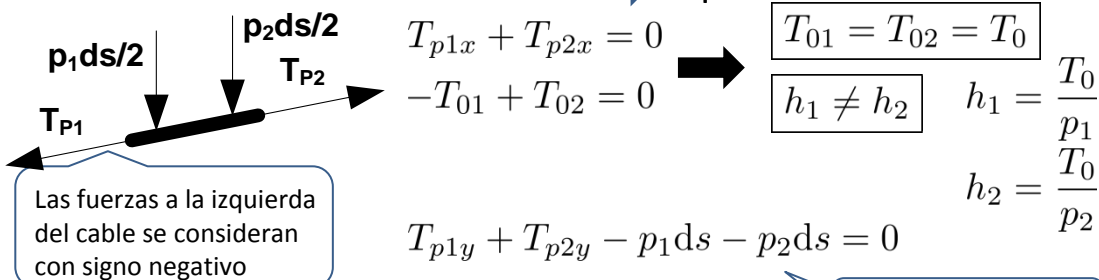


Situación final

Se establecen dos catenarias (1 y 2)

Cálculo de l^0 y T_m con expresiones exactas

Para un elemento diferencial \rightarrow Equilibrio de fuerzas



$$T_0 \left(\sinh \left(\frac{x_{p2}}{h_2} \right) - \sinh \left(\frac{x_{p1}}{h_1} \right) \right) = 0 \quad (1)$$

Se desprecian las fuerzas diferenciales

$$a_1 + a_2 = a \quad (2)$$

$$b_1 + b_2 = b \quad (3)$$

$$y_{p1} - y_{A1} = b_1$$

$$y_{B2} - y_{p2} = b_2$$

$$x_{p1} = x_{A1} + a_1$$

$$x_{p2} = x_{B2} - a_2$$

$$h_1 \left(\cosh \left(\frac{x_{p1}}{h_1} \right) - \cosh \left(\frac{x_{A1}}{h_1} \right) \right) = b_1 \quad (4)$$

$$h_2 \left(\cosh \left(\frac{x_{B2}}{h_2} \right) - \cosh \left(\frac{x_{p2}}{h_2} \right) \right) = b_2 \quad (5)$$

$$l_1^0 + l_1^0 \frac{T_{m2,1} - T_{m1,1}}{ES} = h_1 \left(\sinh \left(\frac{x_{p1}}{h_1} \right) - \sinh \left(\frac{x_{A1}}{h_1} \right) \right) \quad (6)$$

$$l_2^0 + l_2^0 \frac{T_{m2,2} - T_{m1,2}}{ES} = h_2 \left(\sinh \left(\frac{x_{B2}}{h_2} \right) - \sinh \left(\frac{x_{p2}}{h_2} \right) \right) \quad (7)$$

Incógnitas x_{A1} , x_{B2} , a_1 , a_2 , b_1 , b_2 , T_0