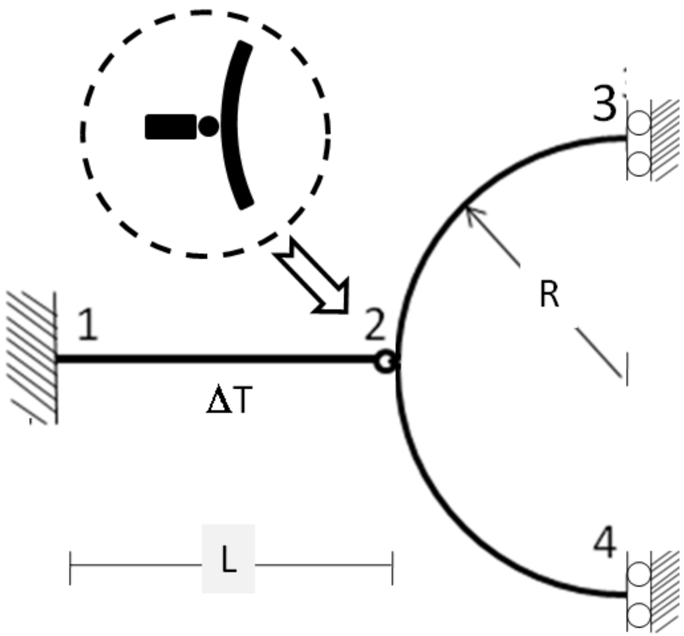
La estructura de la figura consta de una barra recta de longitud L=1 m, y rigidez **EA=10^5 kN,** unida a un arco de radio **R=1 m** y rigidez **EI=10^5 kN m2** a través de una articulación (véase detalle).

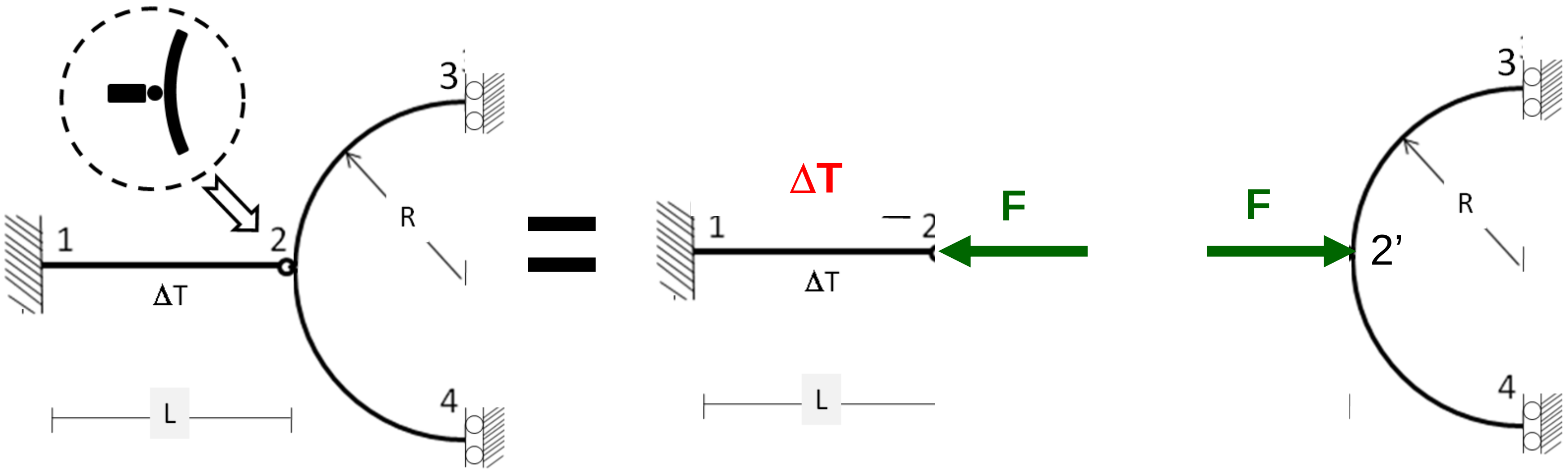
Si la barra recta sufre un incremento térmico uniforme de ΔT=30ºC, se pide determinar:

a) Esfuerzos en la barra recta.

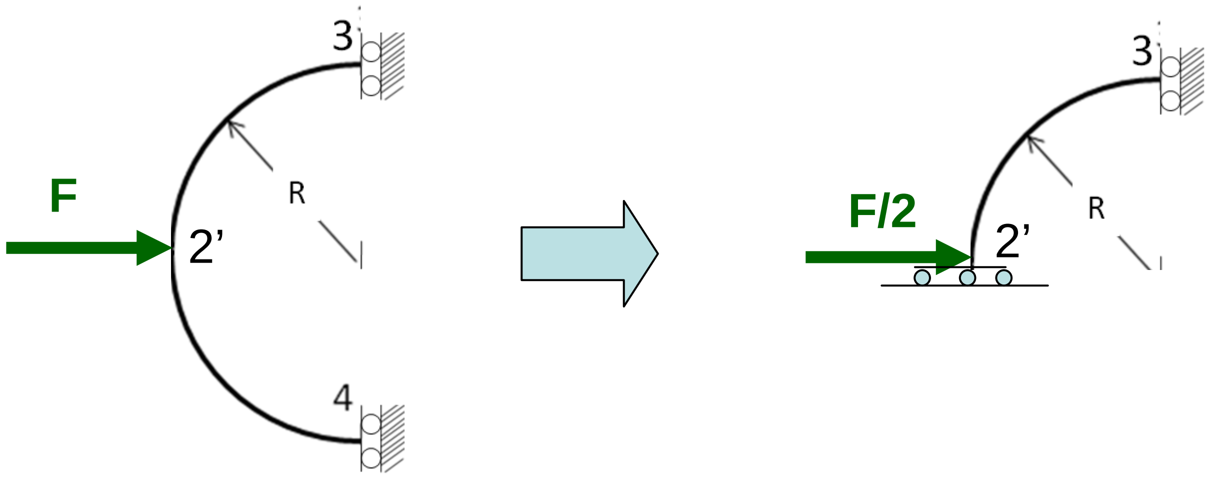
b) Desplazamiento horizontal experimentado por la sección 2.

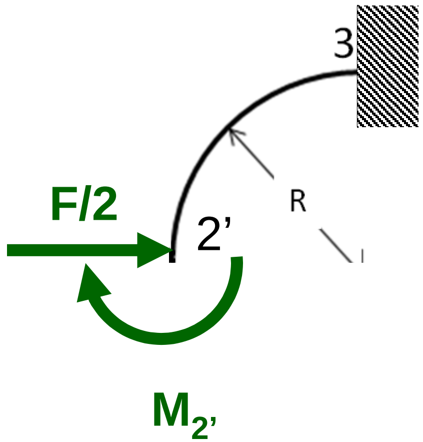
Nota: Supóngase un coeficiente de dilatación térmica de las barras α=10-5 ºC-1.



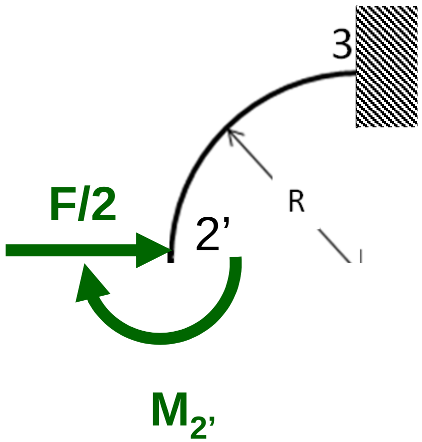


$$\vec{u}_2 = \alpha \Delta T \cdot L - \frac{FL}{EA} = \vec{u}_{2'}$$



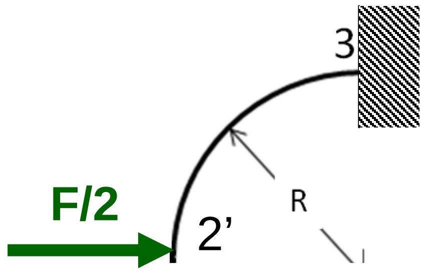


Siendo $\theta_{2'}$=0



Siendo $\theta_{2'}$=0

=



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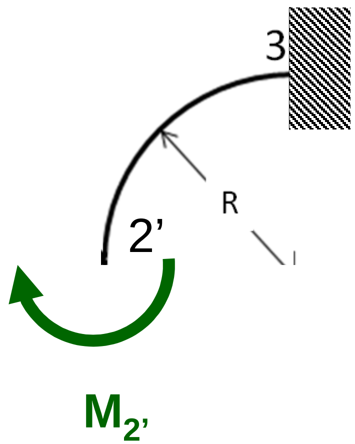
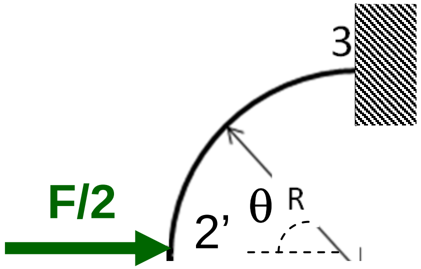
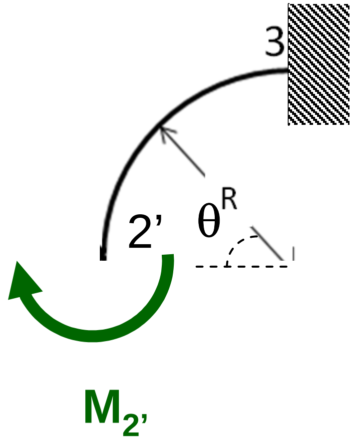




$$M(\theta)=\frac{F}{2}Rsen\theta$$

+



$$M(\theta)=M_{2'}$$

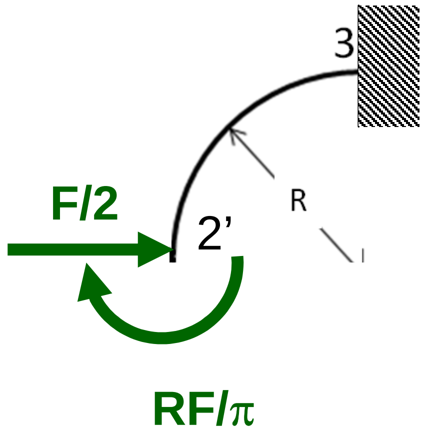
$$M(\theta)=\frac{F}{2}Rsen\theta-M_{2'}$$

$$\theta_{2'} = \frac{1}{EI}\int_0^{\pi} M(\theta)\cdot ds = 0 = \frac{1}{EI}\int_0^{\pi}\left[\frac{F}{2}Rsen\theta - M_{2'}\right]Rd\theta = 0$$

$$\Downarrow$$

$$M_{2'} = \frac{RF}{\pi}$$

Ahora ya podemos calcular $\vec{u}_{2'}$



$$\vec{u}_{2'} = \vec{u}_3 + \theta_3 R + \frac{1}{EI}\int_0^{\pi/2} \left[\frac{F}{2} R sen\theta \cdot R sen\theta \cdot R d\theta \right] -$$

$$- \frac{1}{EI}\int_0^{\pi/2} \frac{RF}{\pi} sen\theta \cdot R d\theta = \frac{1}{EI}\left[\frac{\pi R^3 F}{8} - \frac{R^3 F}{\pi} \right]$$

Para R=L=1 m:

$$\vec{u}_2 = \alpha \Delta T - \frac{F}{EA} = \vec{u}_{2'}$$

$$\vec{u}_{2'} = \frac{1}{EI}\left[\frac{\pi F}{8} - \frac{F}{\pi}\right] = 7{,}44 \cdot 10^{-7} \cdot F$$

$$F = 27{,}93 kN$$

Por tanto, la barra está sometida a un esfuerzo de compresión de 27,93 kN y:

$$\vec{u}_{2'} = 7{,}44 \cdot 10^{-7} \cdot F = 2{,}077 \cdot 10^{-5} m \quad (\text{hacia la derecha})$$