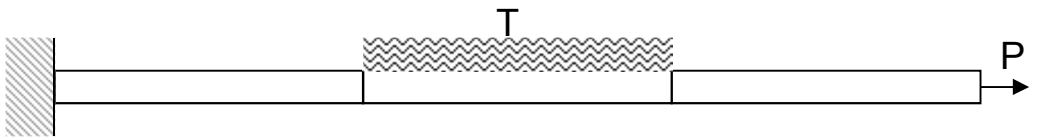
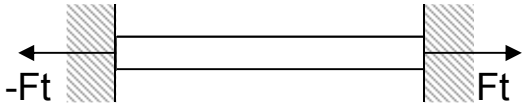
Carga Térmica

Análisis



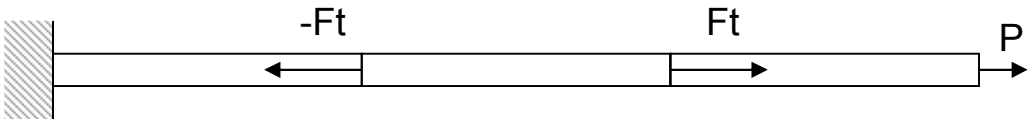
$\varepsilon = \alpha \Delta T \; ; \; \frac{F}{AE} = \varepsilon$

1) Elemento completamente restringido



$$F_t = \alpha A E \Delta T \qquad \sigma_0 = -\alpha E \Delta T$$

2) Armar estructura



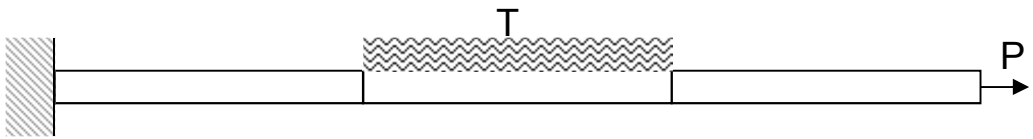
3) Resolver

$$\frac{AE}{L}\begin{bmatrix} 1 & -1 & 0 & 0 \\ -1 & 2 & -1 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & 1 \end{bmatrix}\begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix} = \begin{Bmatrix} F_1 \\ -F_t \\ F_t \\ P \end{Bmatrix} \quad ; \quad \{D\} = \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix} \qquad \sigma = E\,\varepsilon = E\,B\,D$$

4) Superponer tensiones $\sigma = E\,\varepsilon + \sigma_0$

Carga Térmica

Resolución



Planteo de sistema

$$\frac{AE}{L}\begin{bmatrix} 1 & -1 & 0 & 0 \\ -1 & 2 & -1 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & 1 \end{bmatrix}\begin{Bmatrix} 0 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix} = \begin{Bmatrix} R \\ -F_t \\ F_t \\ P \end{Bmatrix}$$

Aplicación Restricciones

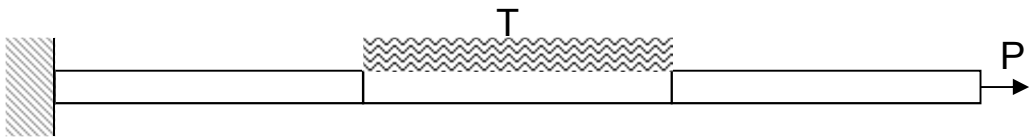
$$\frac{AE}{L}\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 1 \end{bmatrix}\begin{Bmatrix} u_2 \\ u_3 \\ u_4 \end{Bmatrix} = \begin{Bmatrix} -\alpha AE\Delta T \\ \alpha AE\Delta T \\ P \end{Bmatrix}$$

Resolución

$$\begin{Bmatrix} u_2 \\ u_3 \\ u_4 \end{Bmatrix} = \begin{Bmatrix} \dfrac{LP}{AE} \\ L\alpha\Delta T + \dfrac{2LP}{AE} \\ L\alpha\Delta T + \dfrac{3LP}{AE} \end{Bmatrix}$$

Carga Térmica

Resolución



Paso a Tensiones $\sigma = E\,BD + \sigma_0$ $B = \left[-\frac{1}{L} \quad \frac{1}{L} \right]$

$$\sigma_1 = E\left[-\frac{1}{L} \quad \frac{1}{L} \right]\left\{ 0 \quad \frac{LP}{AE} \right\} = \frac{P}{A}$$

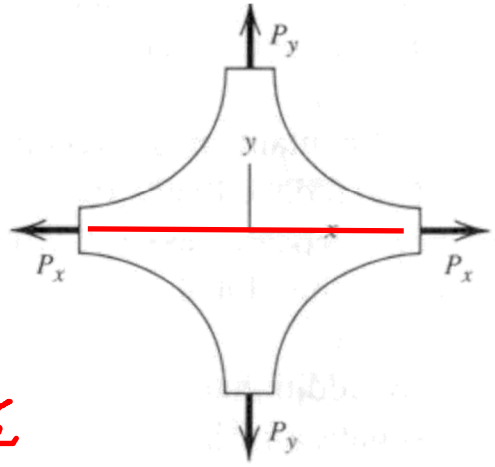
$$\sigma_2 = E\left[-\frac{1}{L} \quad \frac{1}{L} \right]\left\{ \frac{LP}{AE} \quad L\alpha\Delta T + \frac{2LP}{AE} \right\} = -\frac{P}{A} + E\alpha\Delta T + \frac{2P}{A} = E\alpha\Delta T + \frac{P}{A}$$

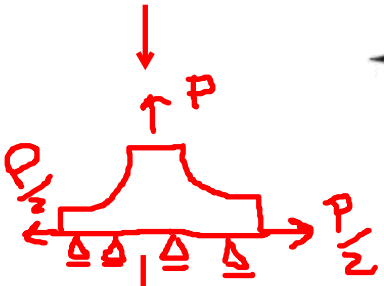
$$\sigma_3 = E\left[-\frac{1}{L} \quad \frac{1}{L} \right] = \left\{ L\alpha\Delta T + \frac{2LP}{AE} \quad L\alpha\Delta T + \frac{3LP}{AE} \right\} = \frac{P}{A}$$

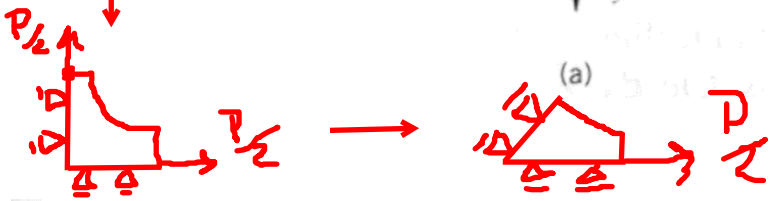
Resultado:
Compensación de tensión térmica con tensión estructura.

$$\sigma = \sigma_2 + \sigma_0 = \frac{P}{A}$$

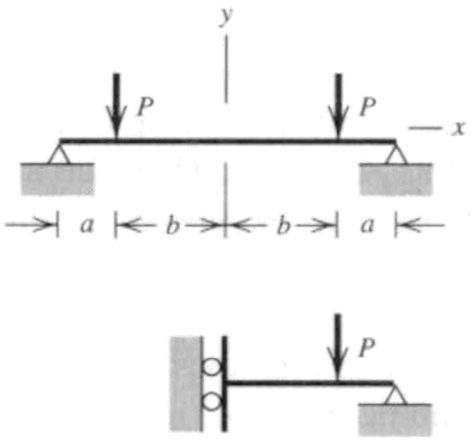
Simetrías







(a)



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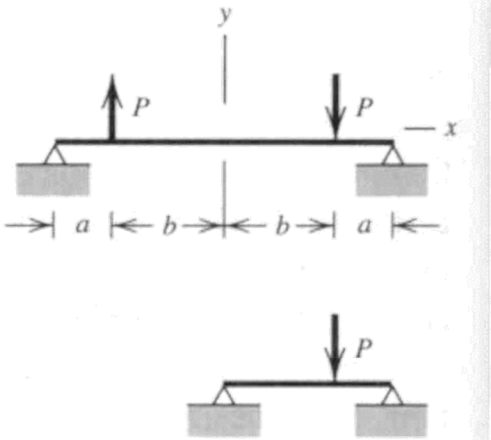
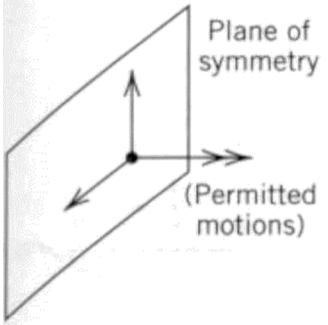
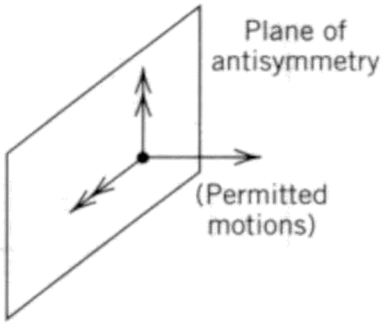
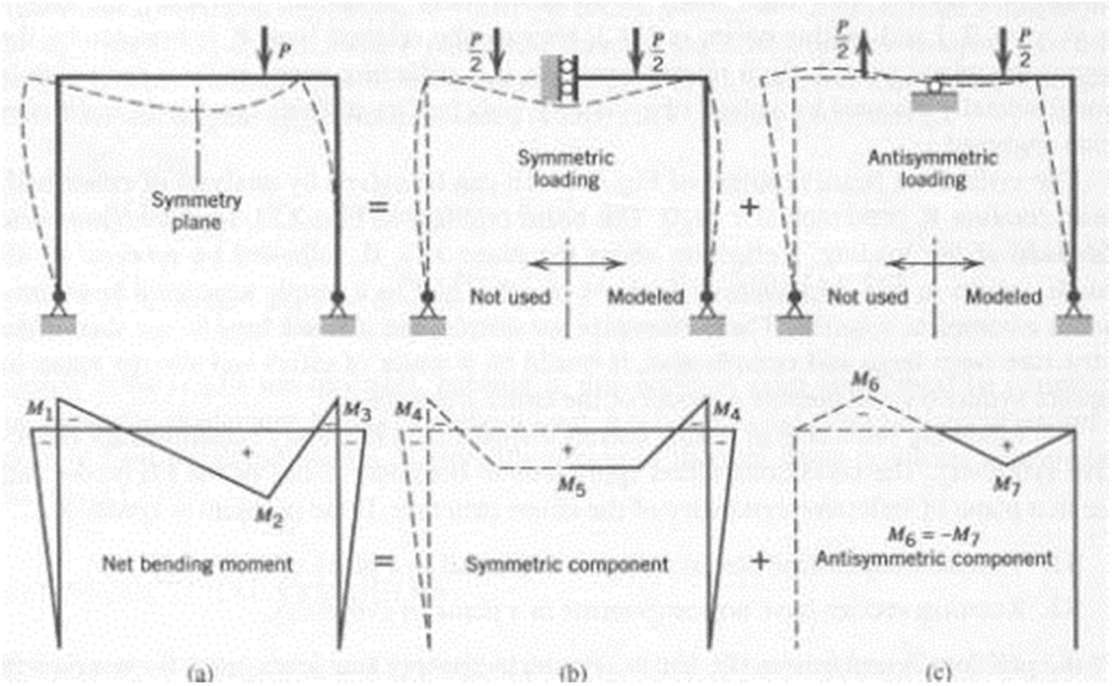


(c)

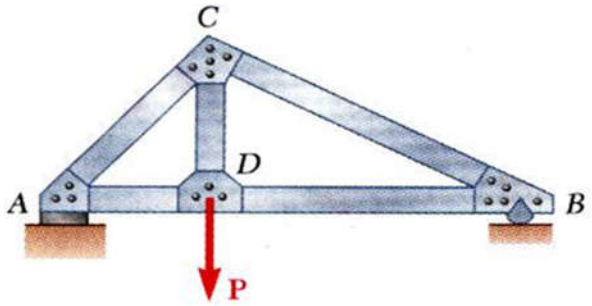


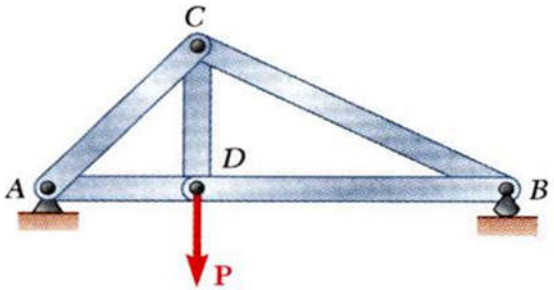




Casos de Estructuras

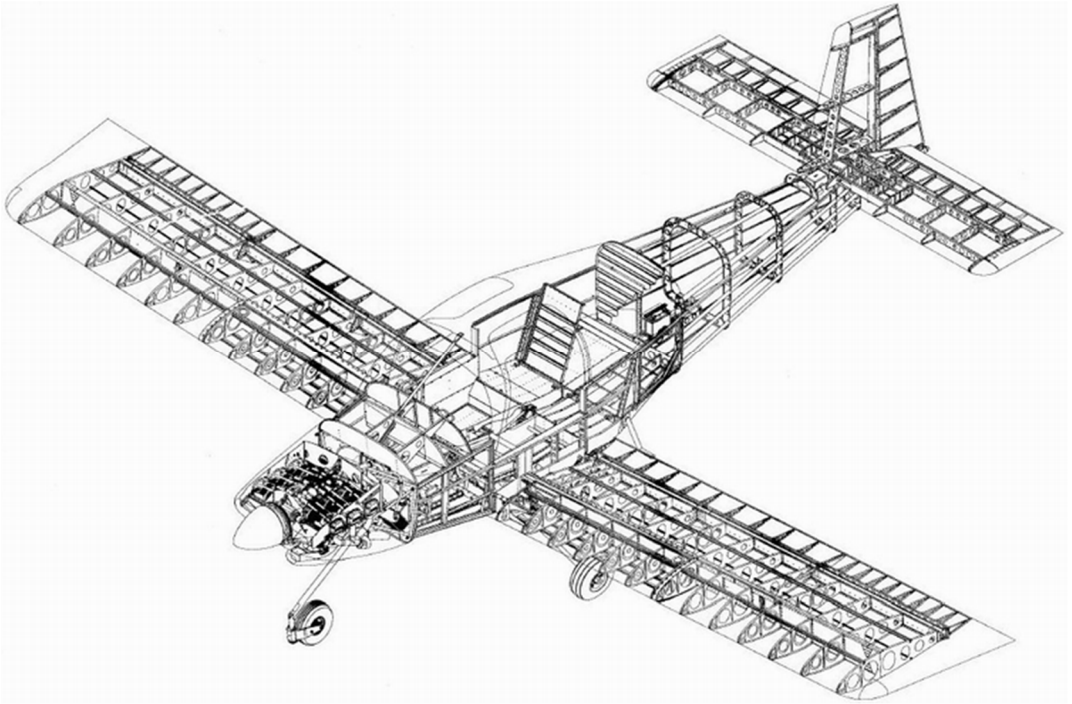
Casos de Estructuras



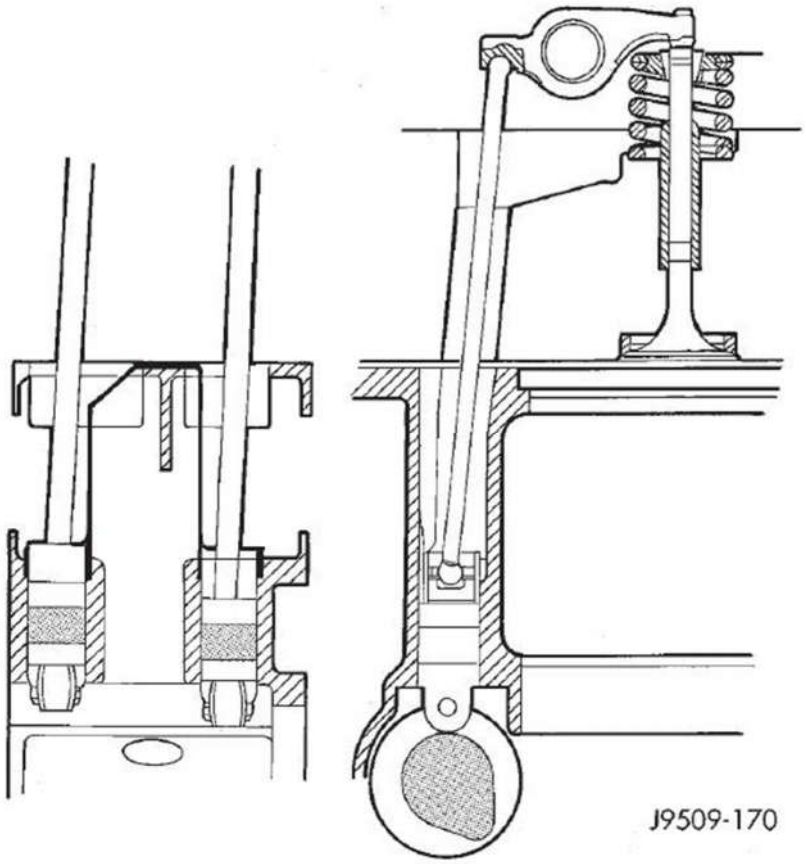


http://www.johnweeks.com/c-and-d-canal/pages/reedypoint.html

Casos de Estructuras



Mecanismos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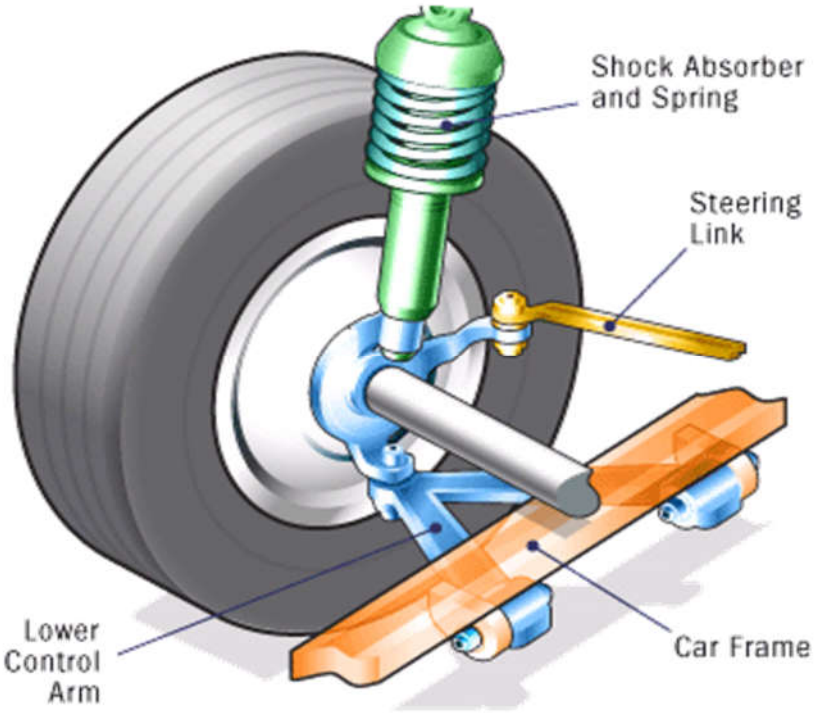
Shock Absorber and Spring
Steering Link
Lower Control Arm
Car Frame