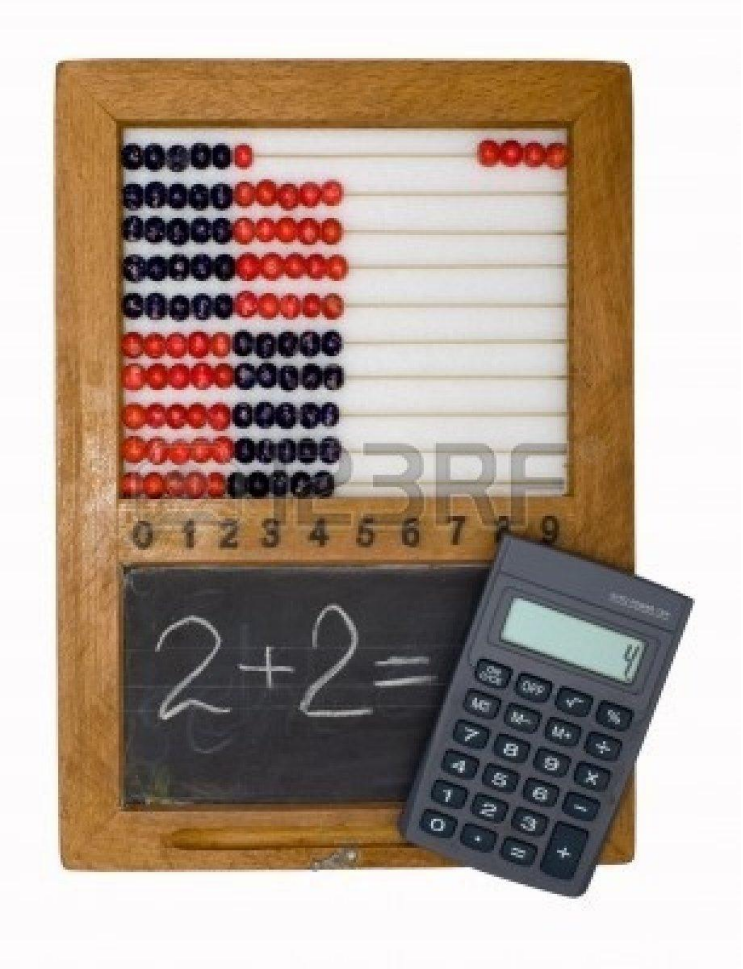

Elementos finitos

¿Qué es el FEM?

Método de cálculo aproximado.



¿En qué se basa?

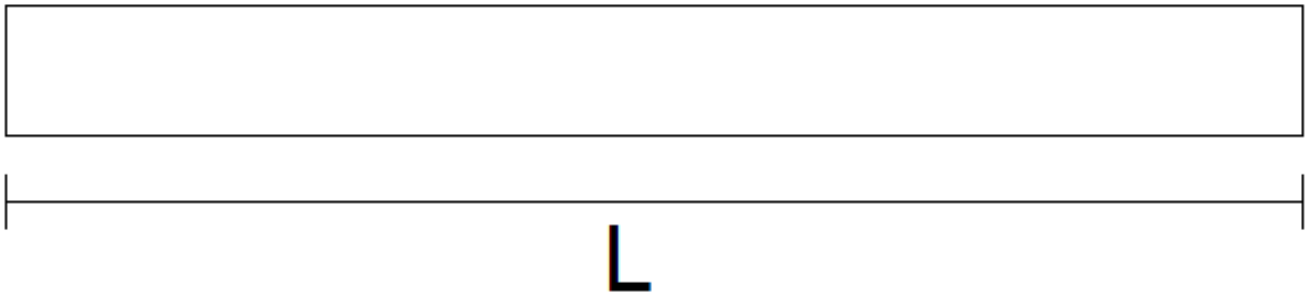
Dividir el problema

¿Cuándo empezó?

El problema


La solución

Una barra

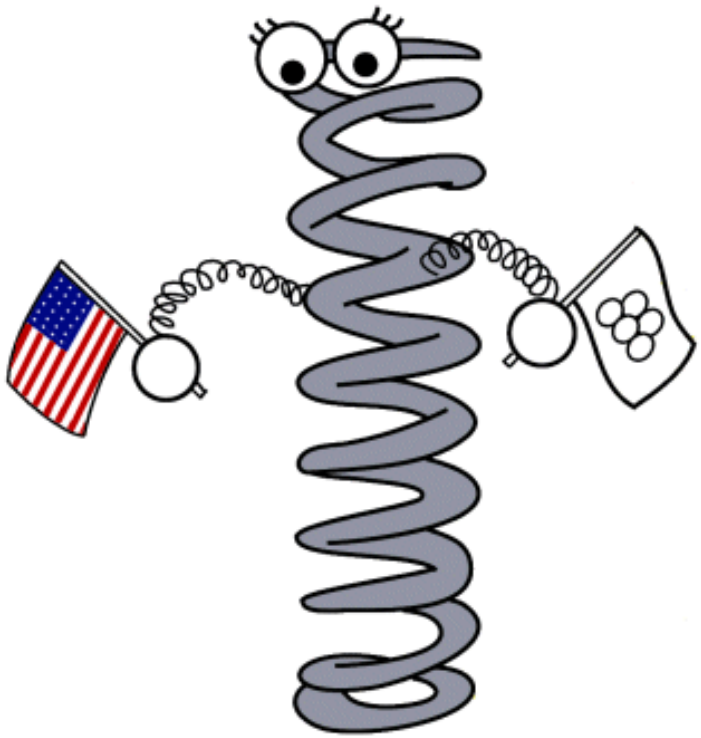



Es un
PALOOO!!!!

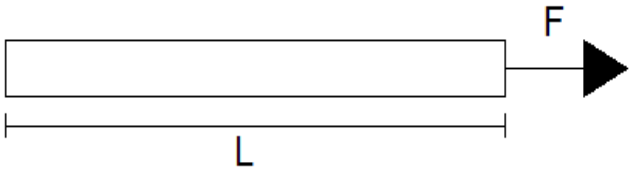
¿Cómo funciona?

Ley de Hooke

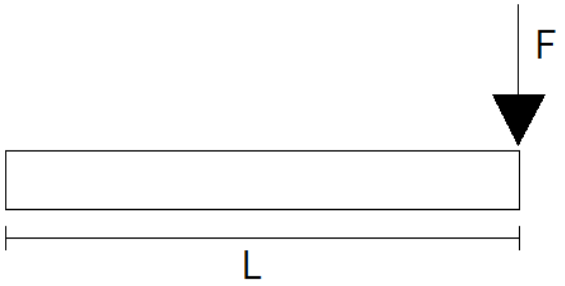
$$F = k * x$$



¿Cómo funciona?

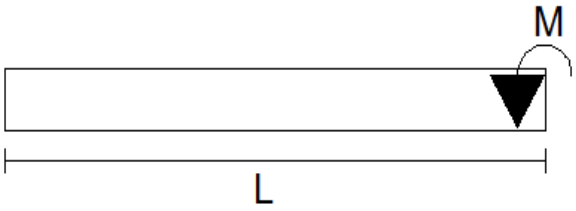


$$K = \frac{EA}{L}$$



$$K = \frac{12EI}{L^3}$$

$$\begin{bmatrix} \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$



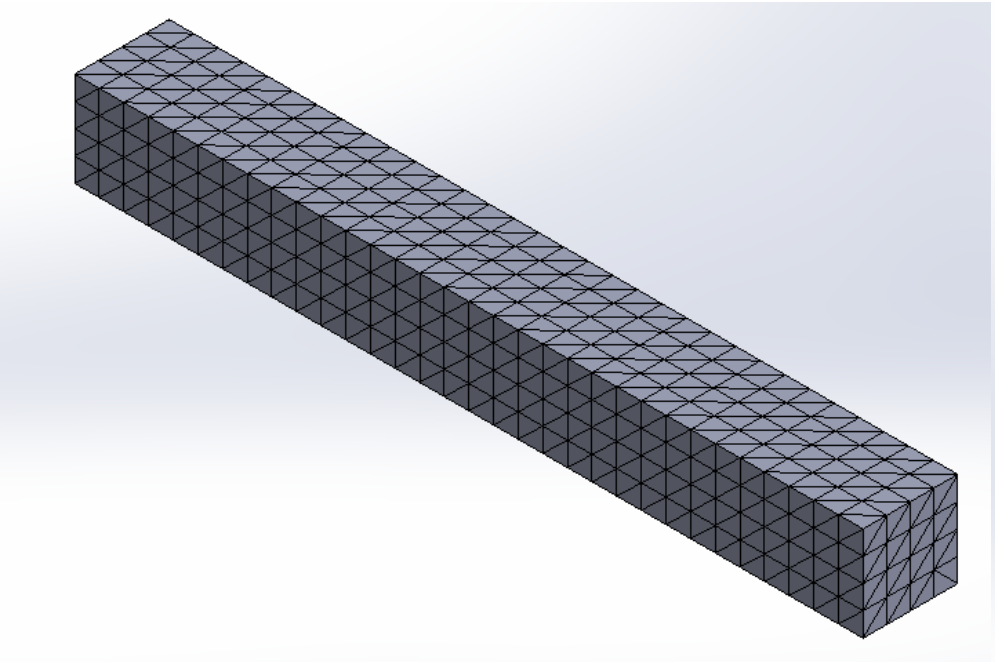
$$K = \frac{6EI}{L^2}$$

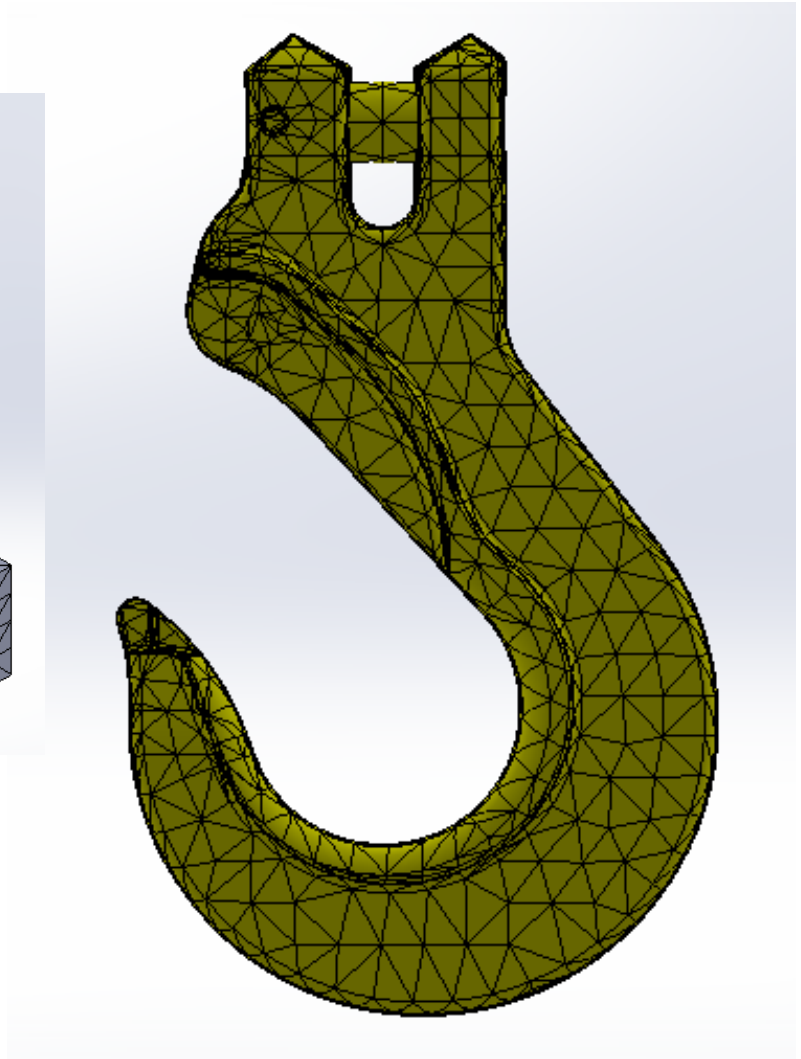
Forma matricial ley de Hooke

$$\{F\} = [K] * \{U\}$$

$$\begin{bmatrix} N_1 \\ V_2 \\ M_3 \\ N_4 \\ V_5 \\ M_6 \end{bmatrix} = \left[\begin{array}{ccc:ccc} \frac{EA}{L} & 0 & 0 & \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} & 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{4EI}{L} & 0 & \frac{6EI}{L^2} & \frac{2EI}{L} \\ \hdashline \frac{EA}{L} & 0 & 0 & \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} & 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{2EI}{L} & 0 & \frac{6EI}{L^2} & \frac{4EI}{L} \end{array}\right] * \begin{bmatrix} d_1 \\ d_2 \\ J_3 \\ d_4 \\ d_5 \\ J_6 \end{bmatrix}$$

Malla

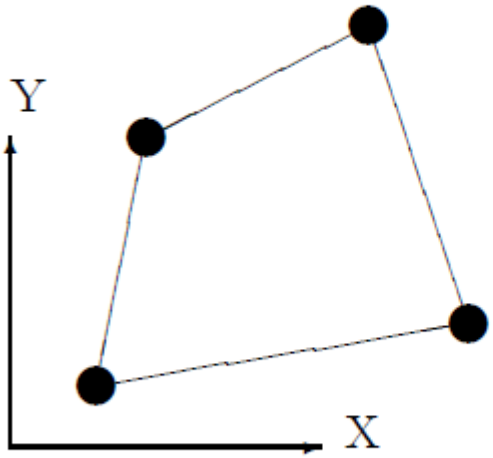




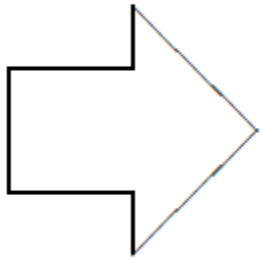
Transformación

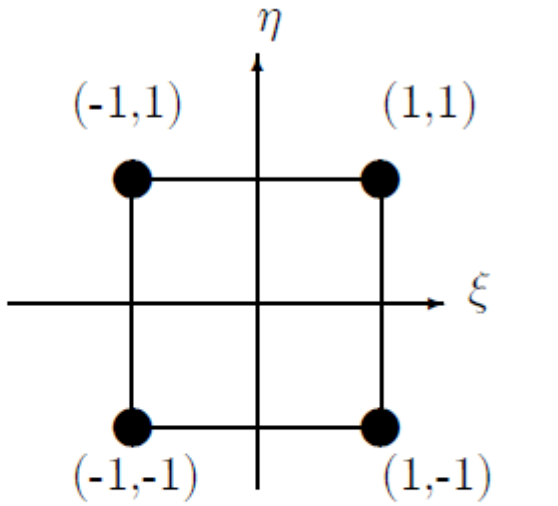
PROYECCIÓN

$x = x(\xi, \eta)$, $y = y(\xi, \eta)$



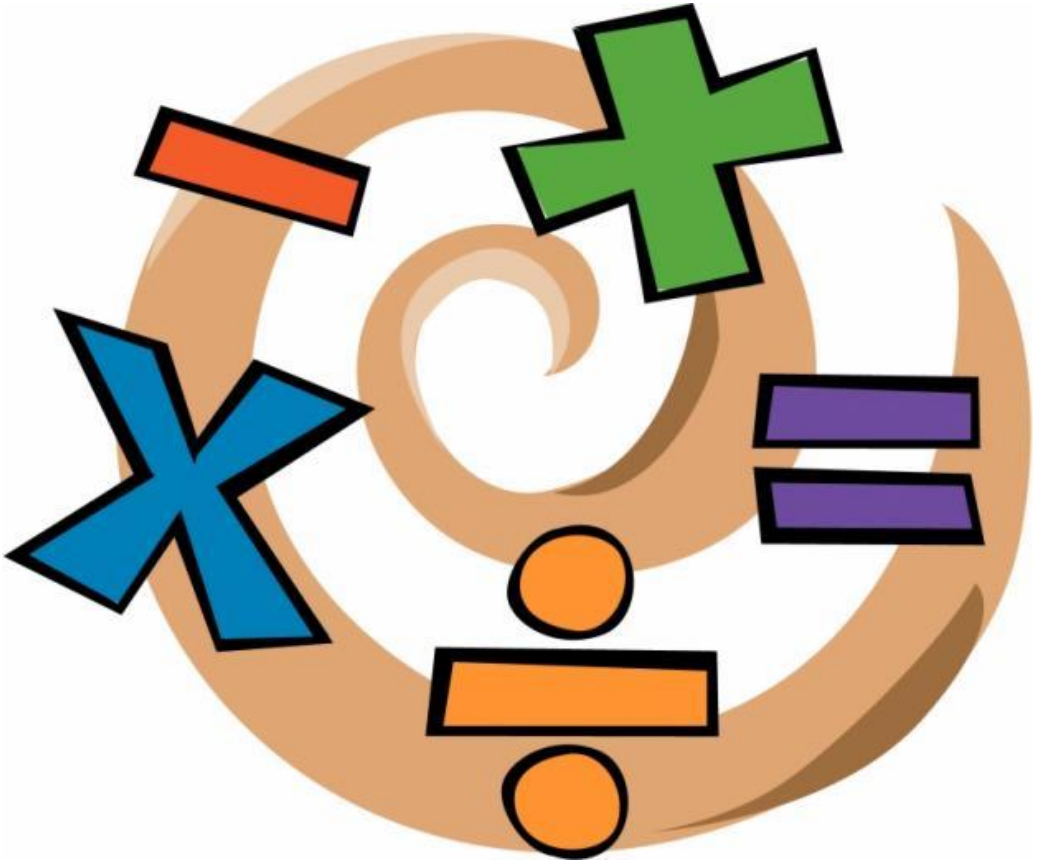
Coordenadas reales (x, y)





Coordenadas locales (ξ, η)

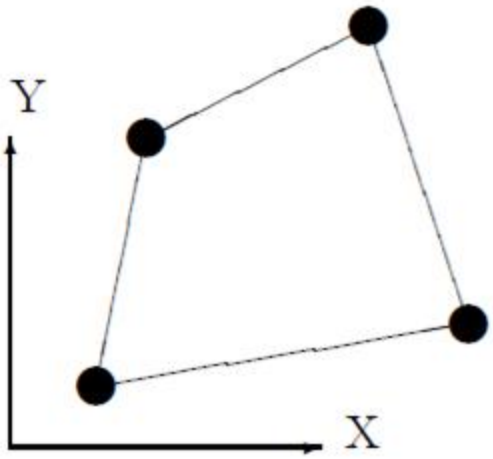
Cálculos



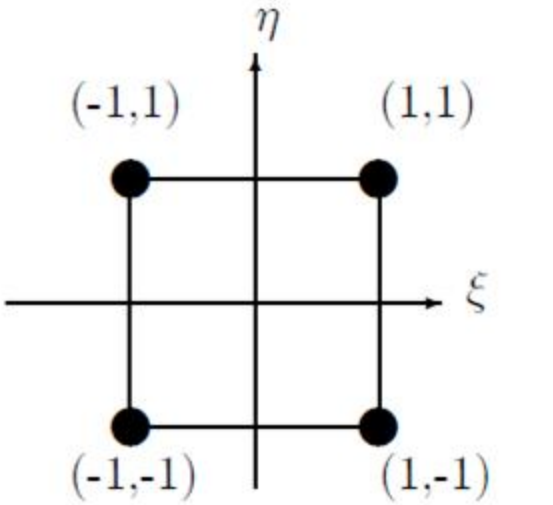
Revertir transformación

PROYECCIÓN

$x = x(\xi, \eta)$, $y = y(\xi, \eta)$



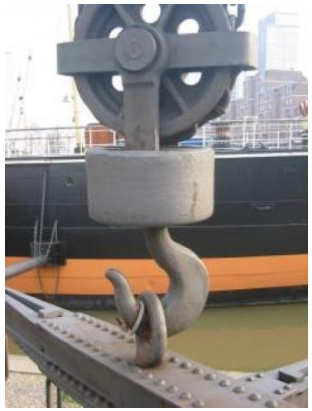
Coordenadas reales (x, y)

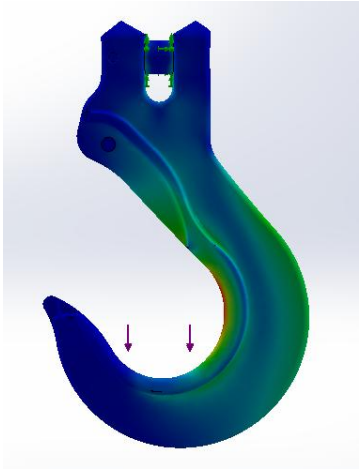


Coordenadas locales (ξ, η)

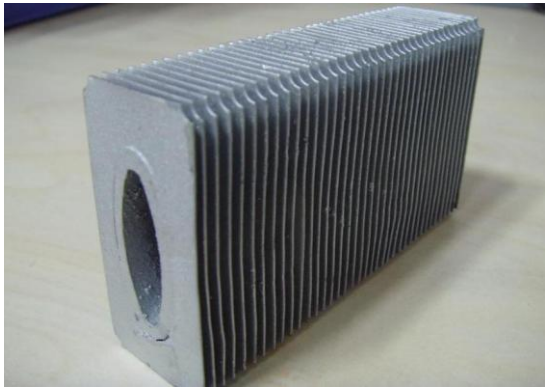
Aplicaciones

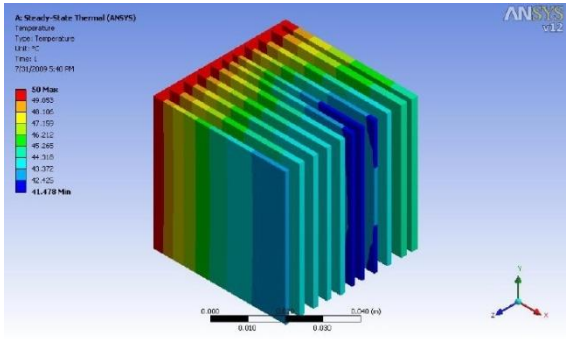
Ensayo estático



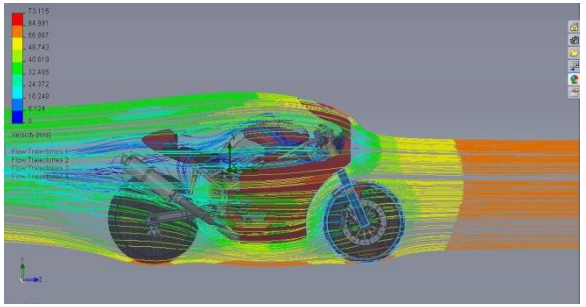


Ensayo de transmisión de calor



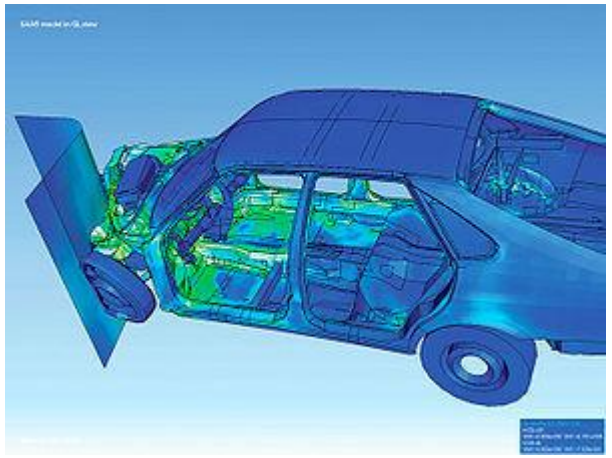


Ensayo aerodinámico

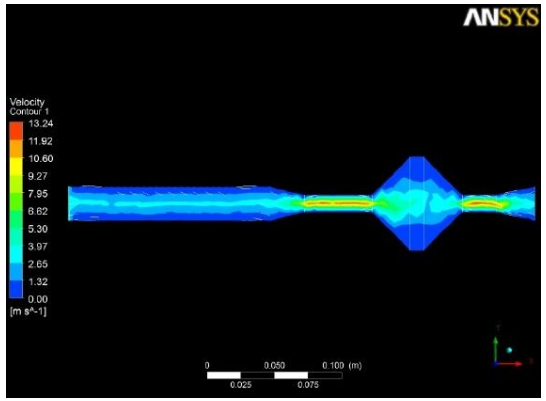


Aplicaciones

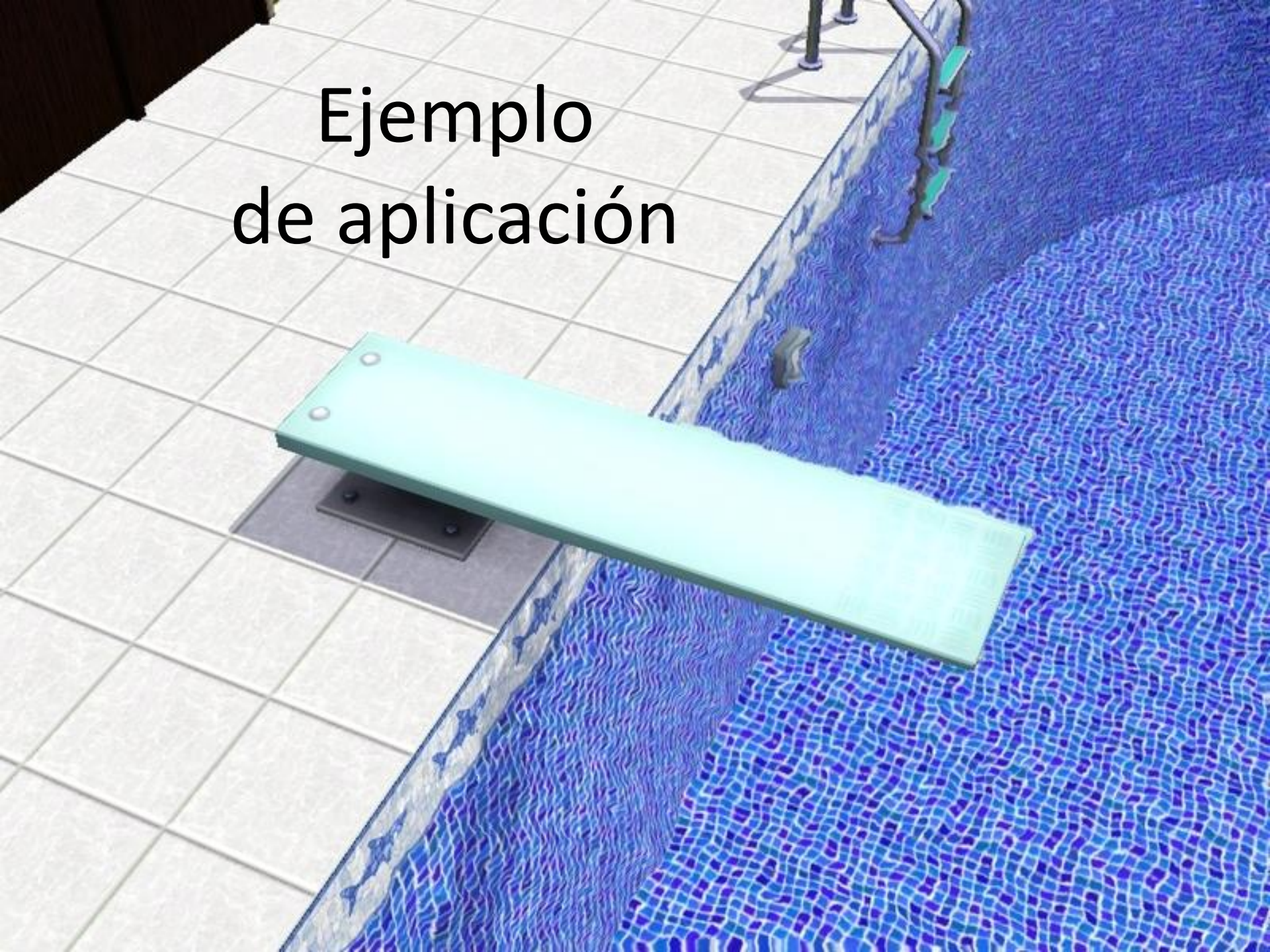
Ensayo de choque



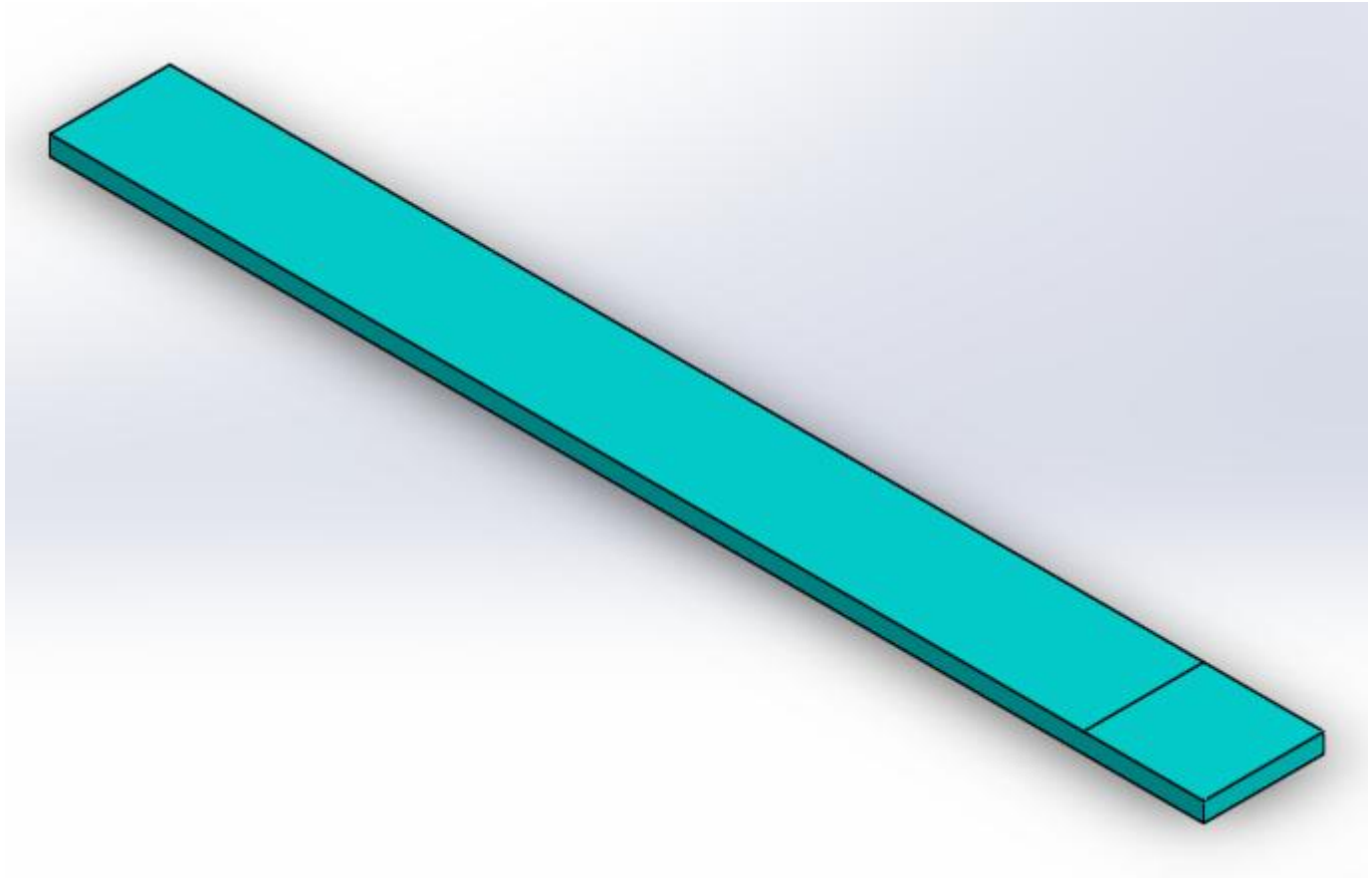
Ensayo fluidodinámico

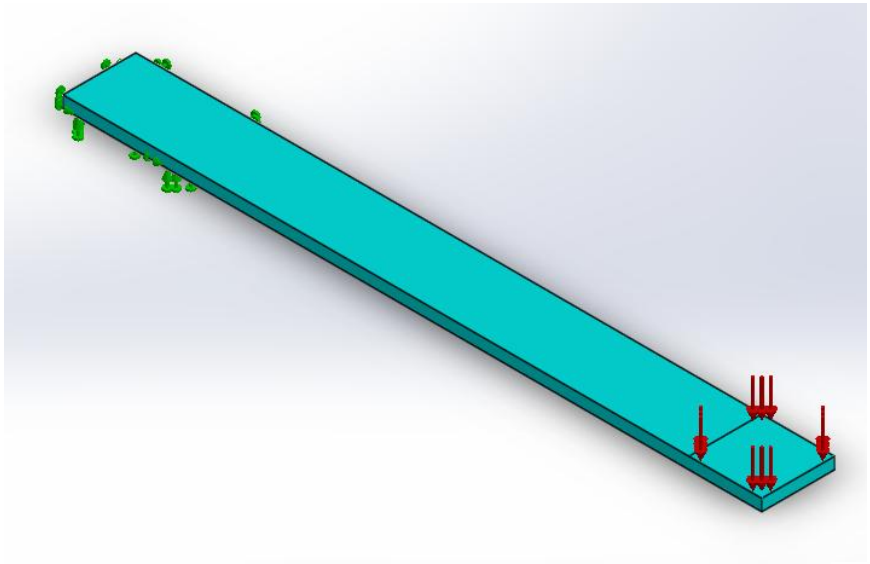


Ejemplo de aplicación



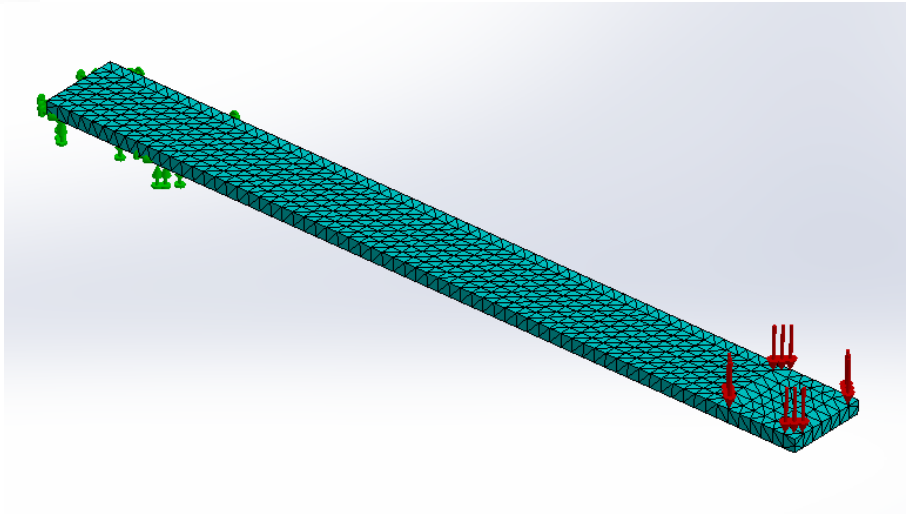
1º Modelado en software



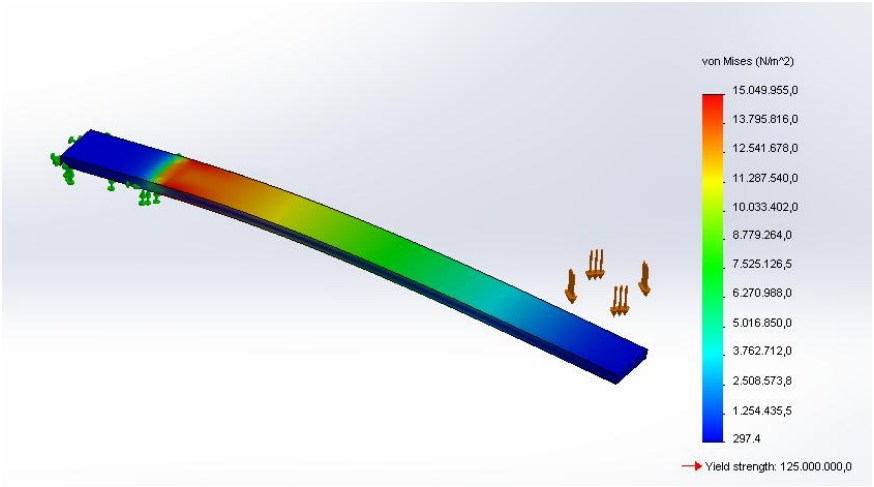


2º Determinar condiciones contorno y esfuerzos.

3º Mallado.

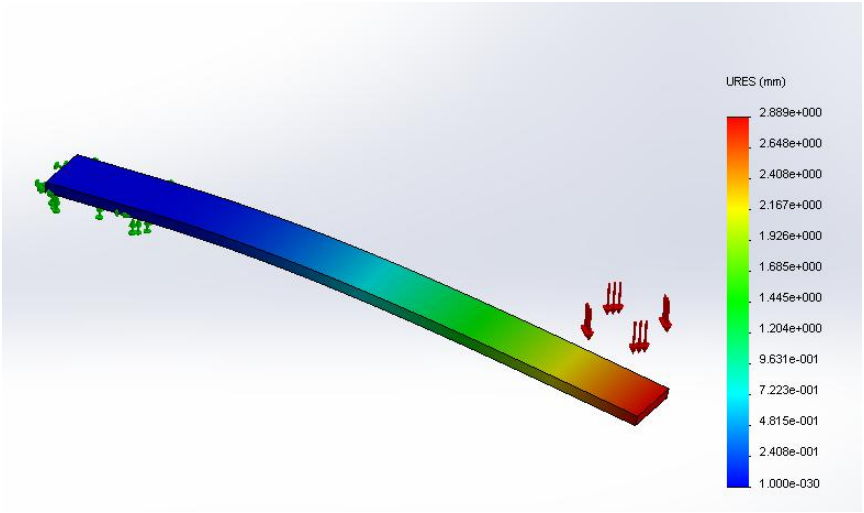


RESULTADOS



Tensiones

Desplazamientos



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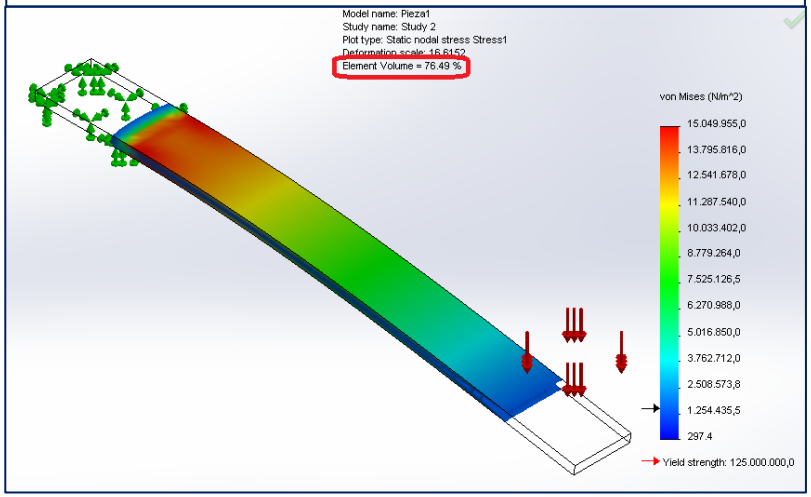
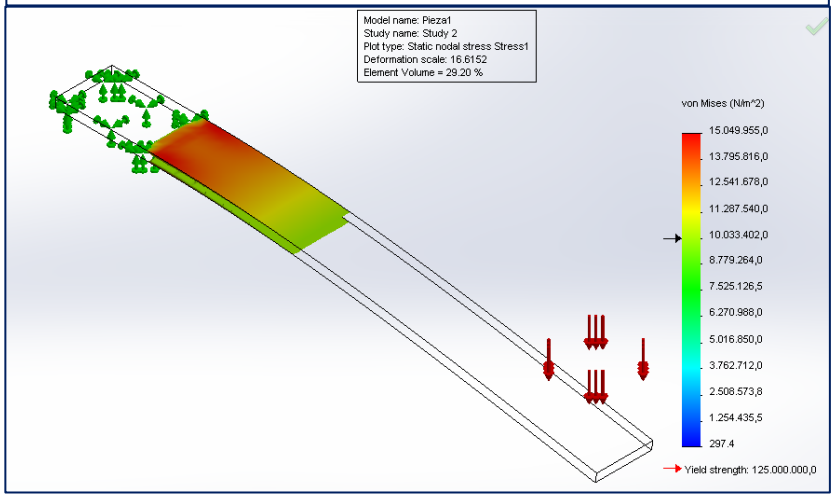
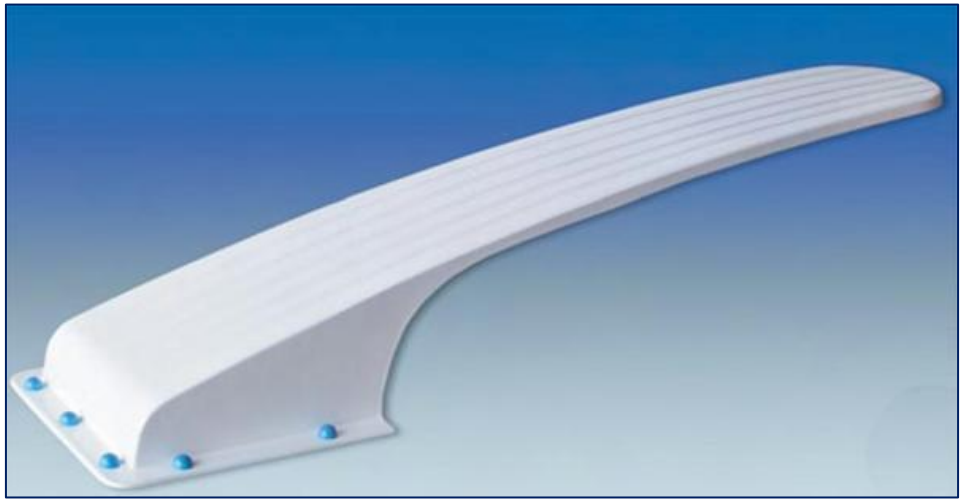
Localizar esfuerzos

Tensión = 1,5 MPa



Tensión = 10MPa

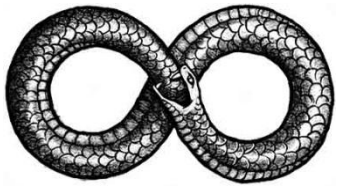




Conclusiones

- Ahorro de tiempo y dinero.

- Posibilidad ilimitada de modificar la pieza.



En definitiva, un gran avance para la ingeniería

Divide y Vencerás