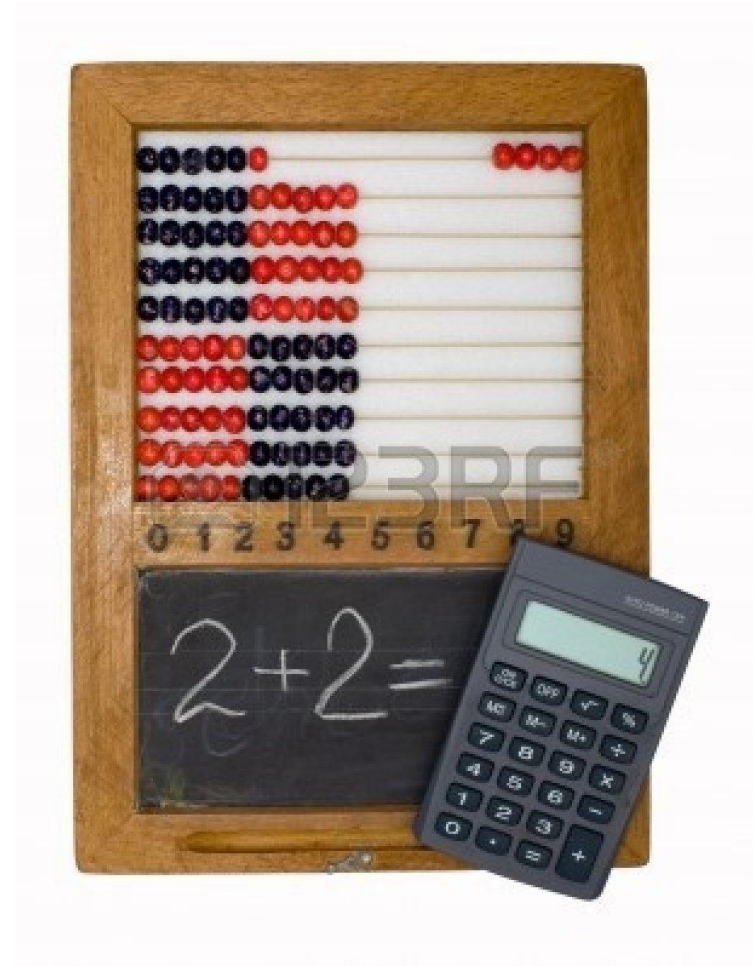




Elementos finitos

¿Qué es el FEM?

Método de cálculo
aproximado.



¿En qué se basa?

Dividir el problema



¿Cuándo empezó?



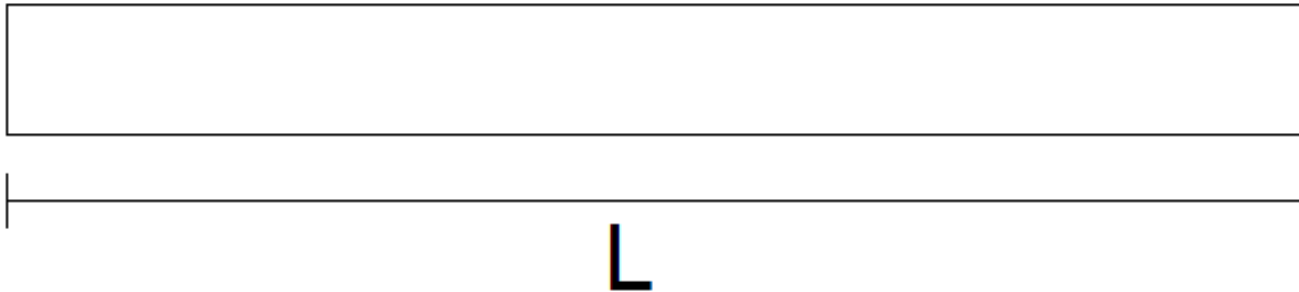
El problema






La solución

Una barra



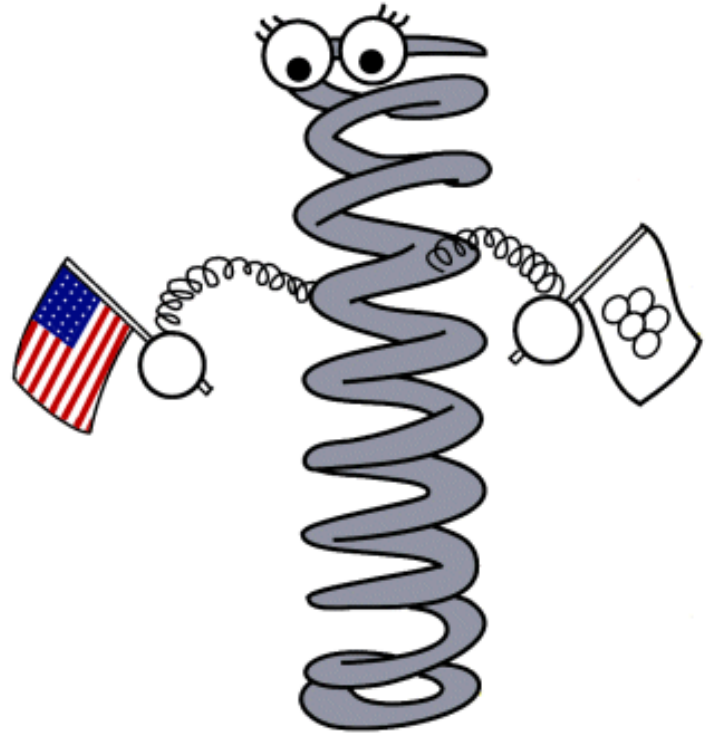
A young boy with short brown hair and a wide, toothy grin is the central focus. He is wearing a light blue t-shirt with a dark red collar. He is holding a thin wooden stick in his right hand. The background is a festive indoor setting, likely a birthday party, with a yellow chair, a grey sofa, and several wrapped gifts in pink, orange, and blue paper. The floor is wooden, and a pair of red and white sneakers is visible in the lower left.

Es un
PALOOO!!!!

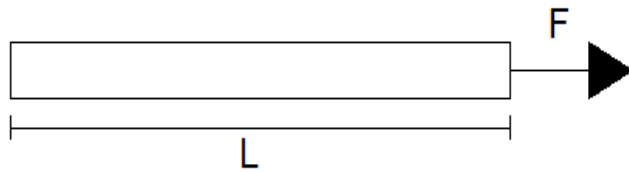
¿Cómo funciona?

Ley de Hooke

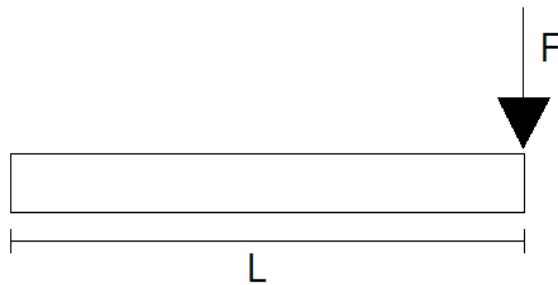
$$F = k * x$$



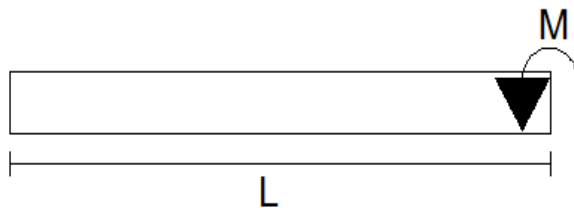
¿Cómo funciona?



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



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



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

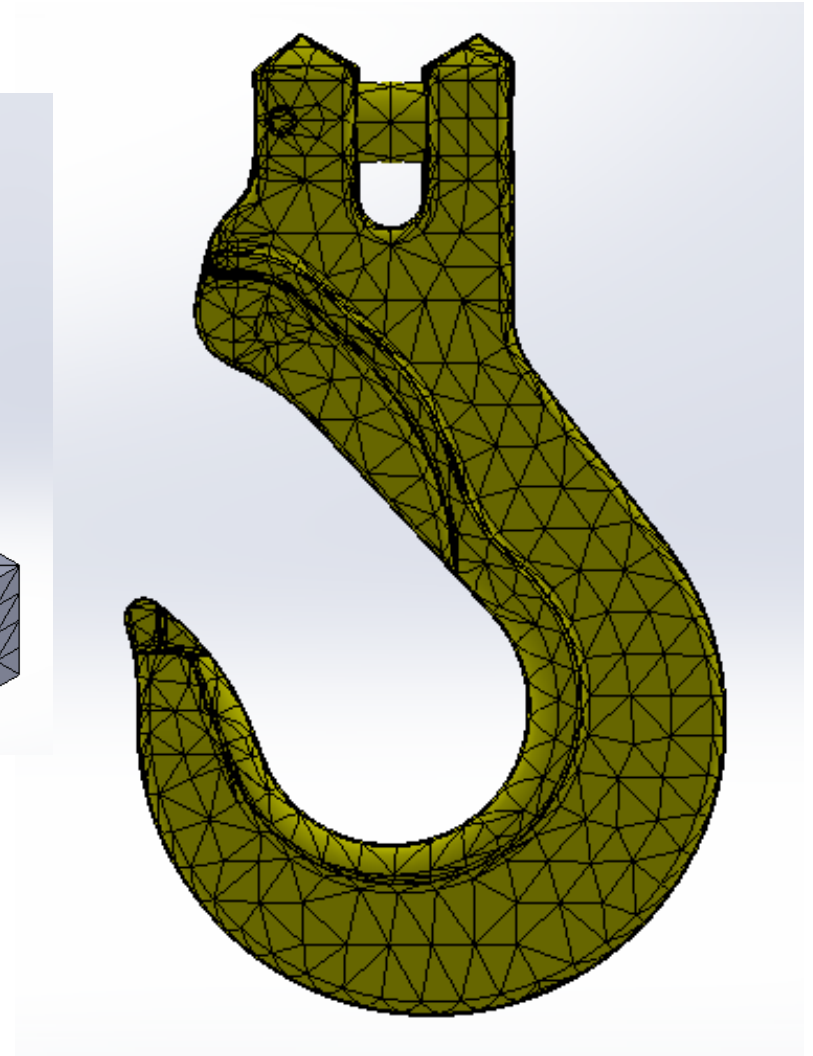
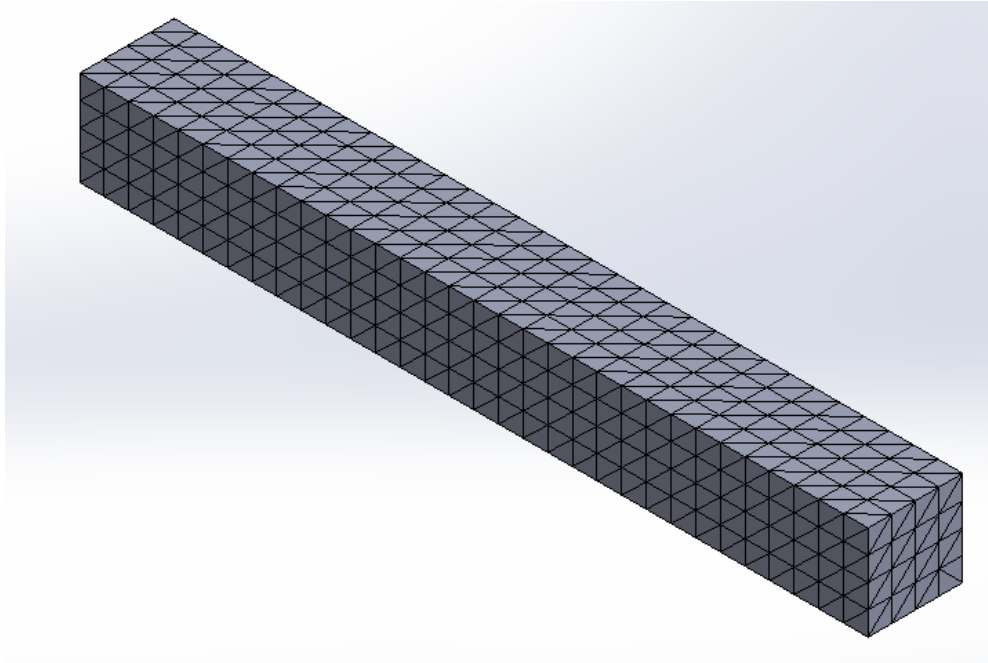
$$\begin{bmatrix} \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$

Forma matricial ley de Hooke

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

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

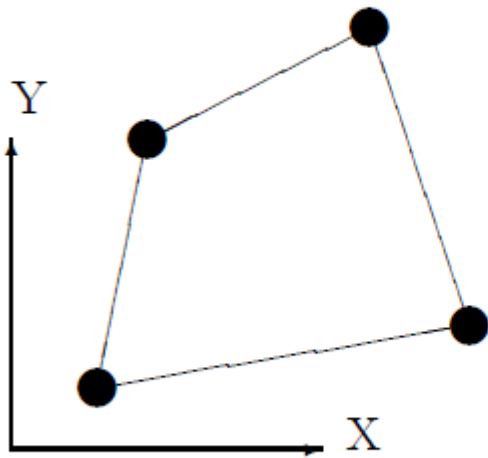
Malla



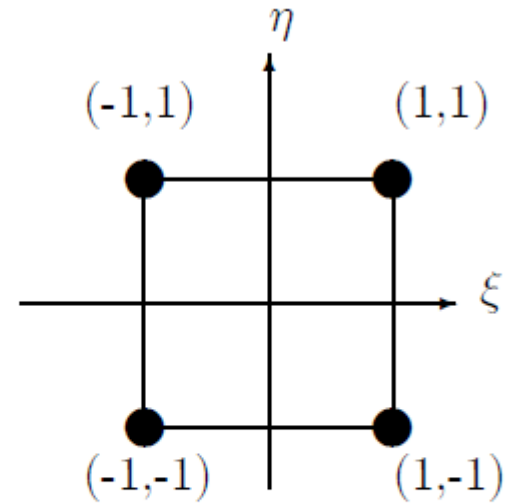
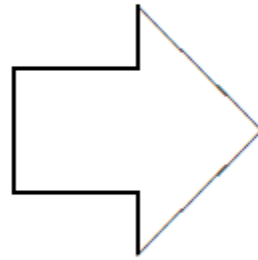
Transformación

PROYECCIÓN

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

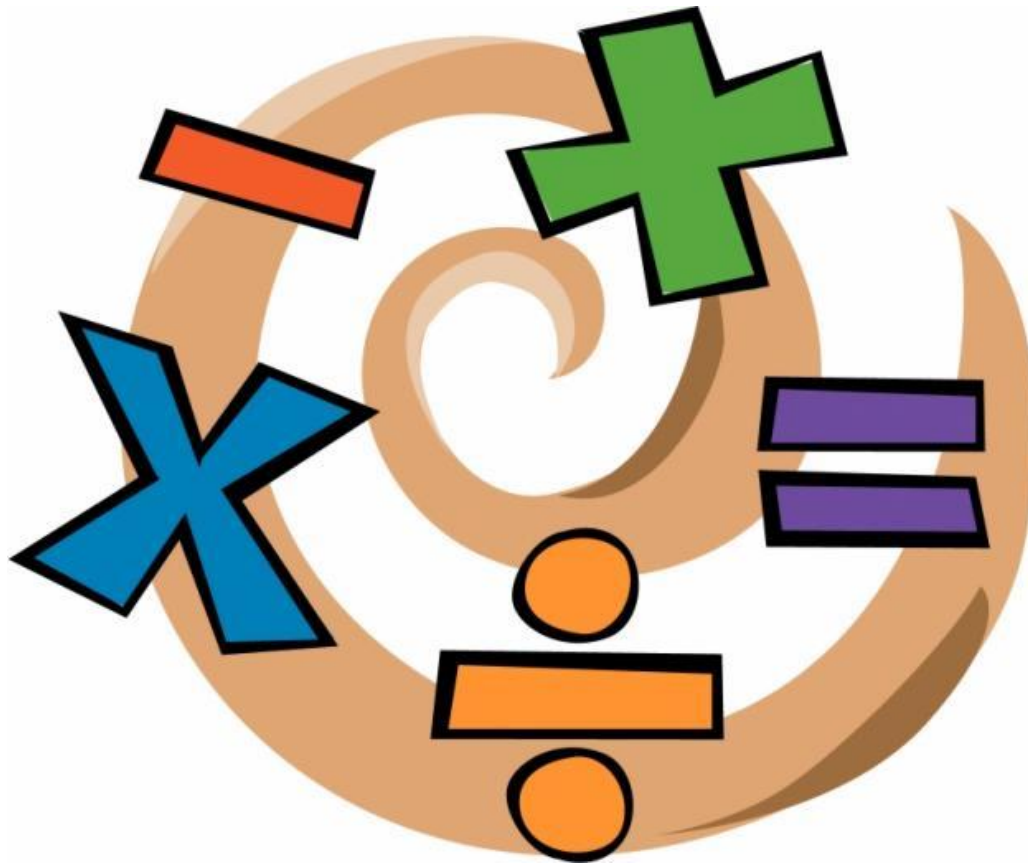


Coordenadas reales (x, y)



Coordenadas locales (ξ, η)

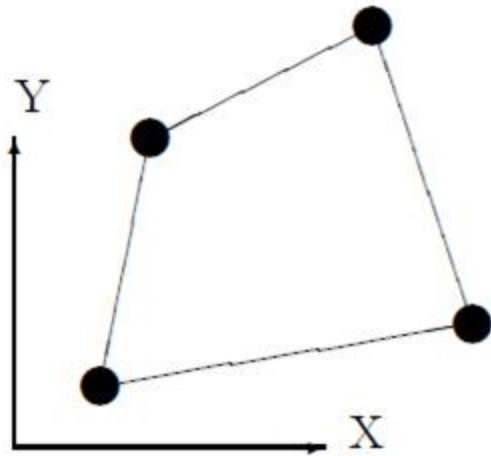
Cálculos



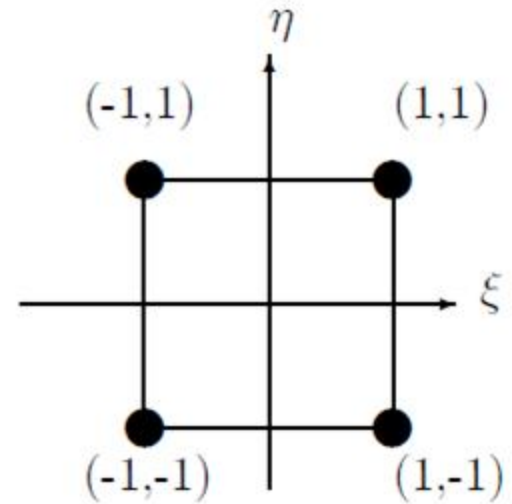
Revertir transformación

PROYECCIÓN

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



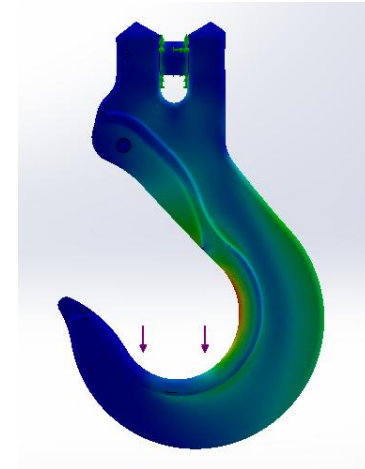
Coordenadas reales (x, y)



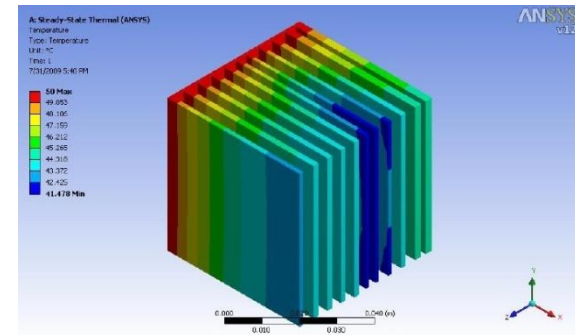
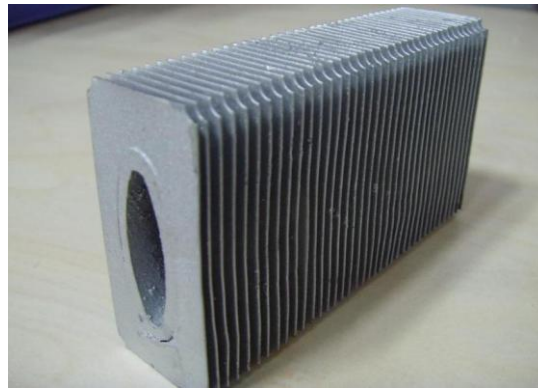
Coordenadas locales (ξ, η)

Aplicaciones

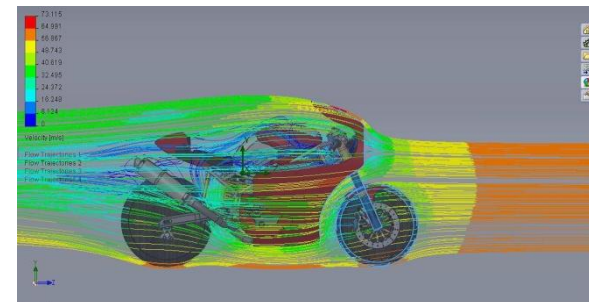
Ensayo estático



Ensayo de
transmisión
de calor

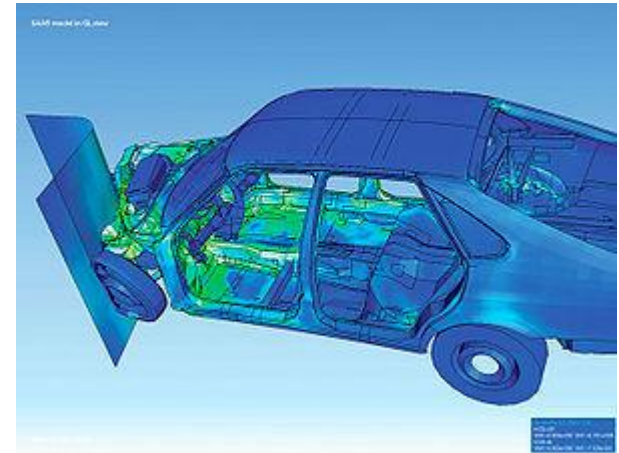


Ensayo
aerodinámico

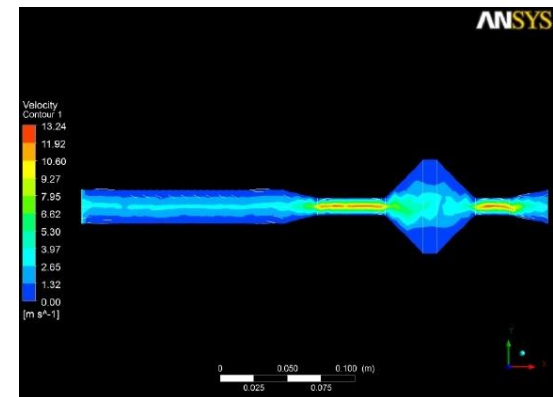


Aplicaciones

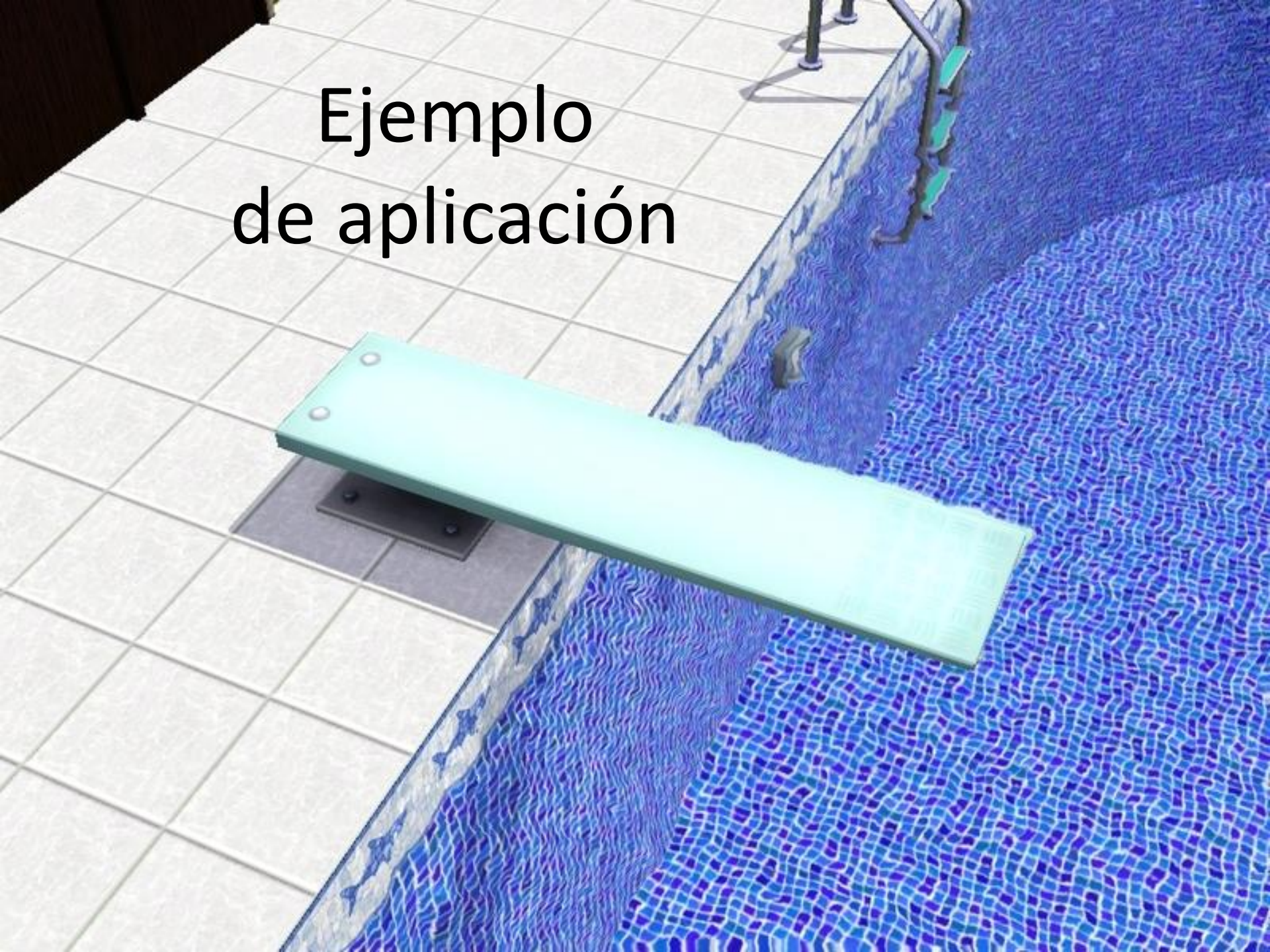
Ensayo de choque



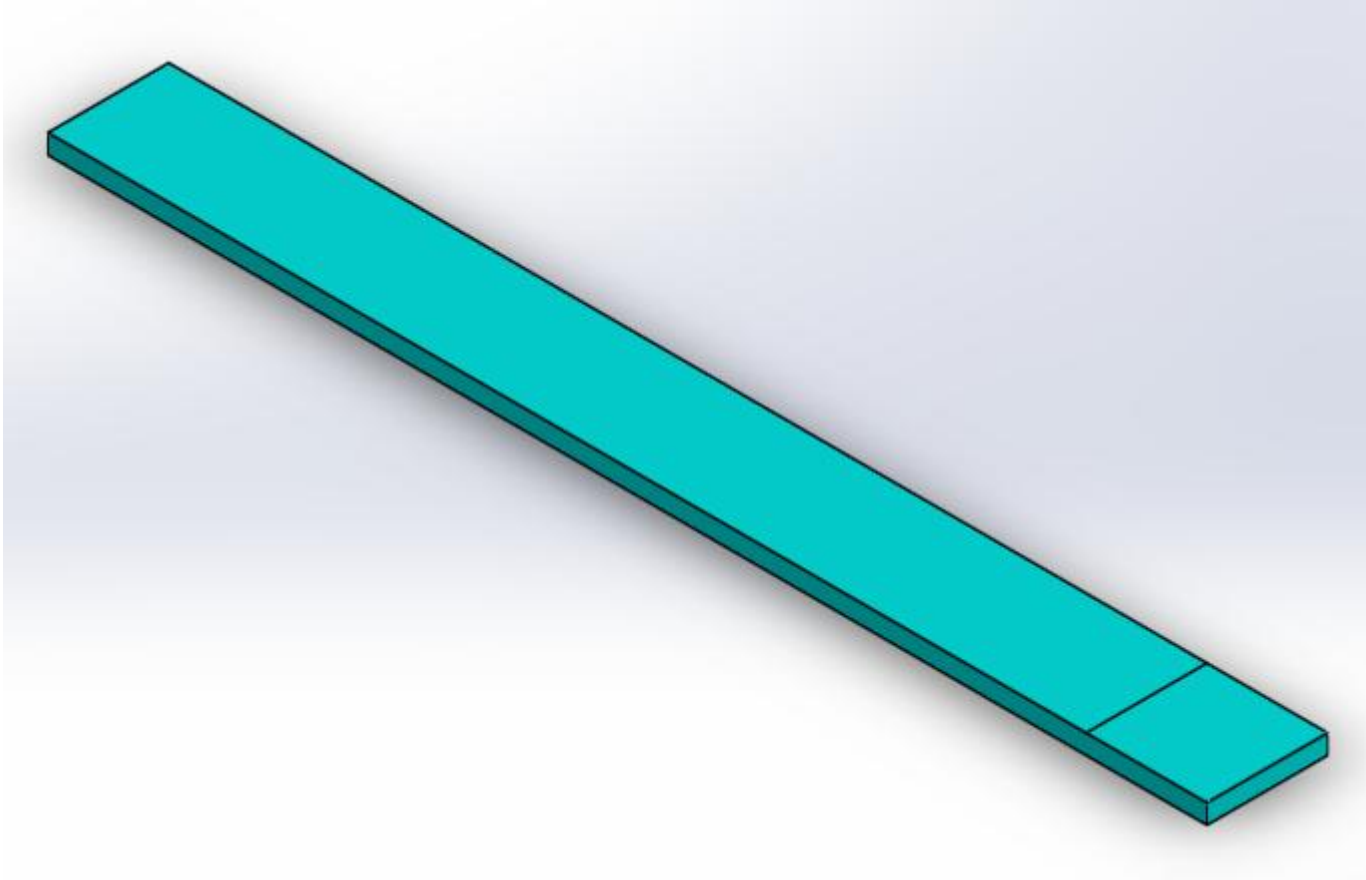
Ensayo fluidodinámico



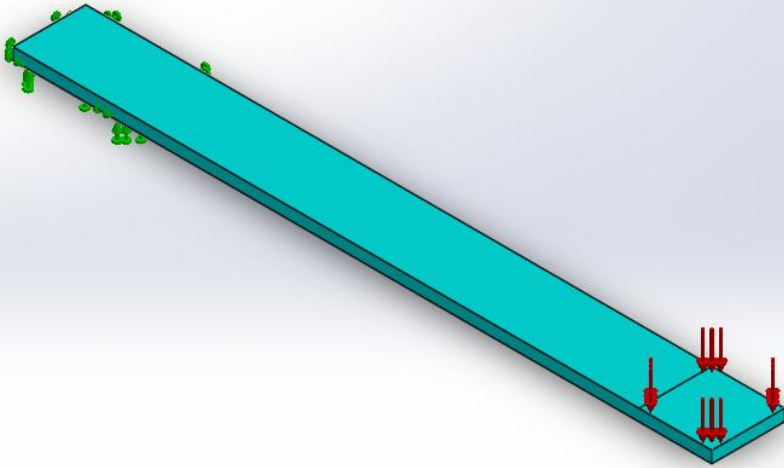
Ejemplo de aplicación



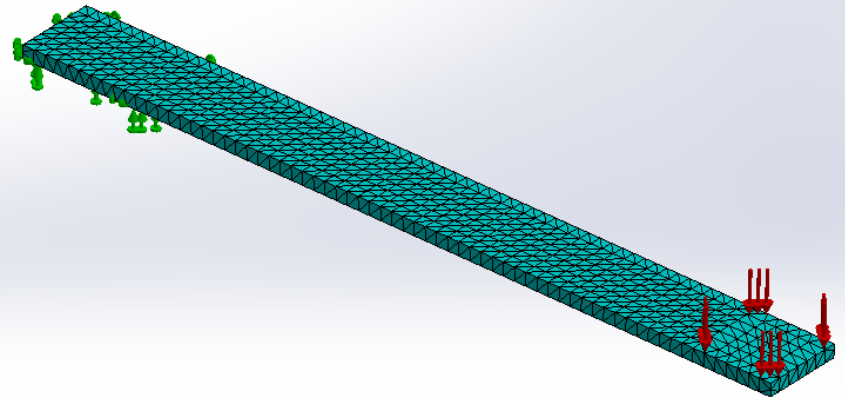
1º Modelado en software



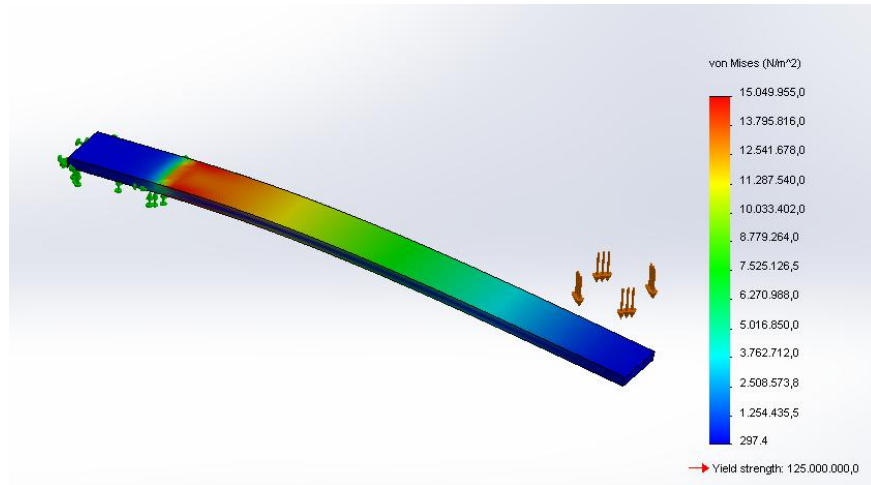
2º Determinar condiciones contorno y esfuerzos.



3º Mallado.

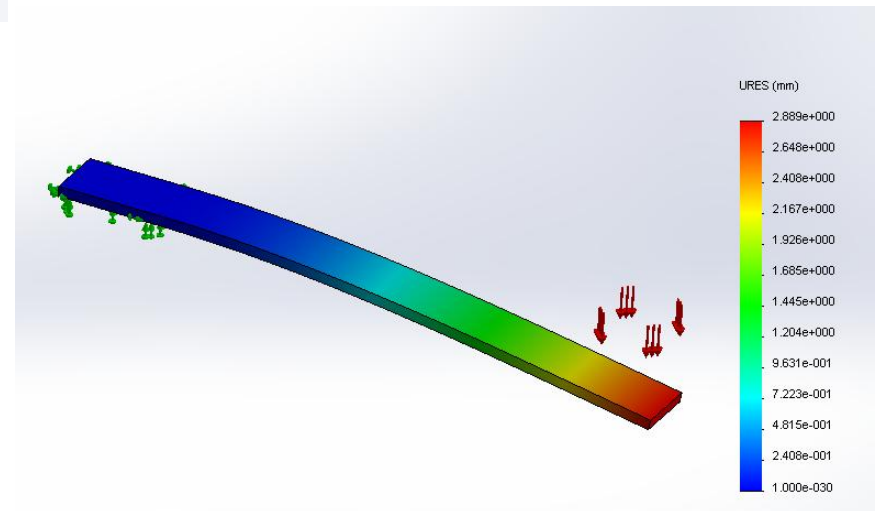


RESULTADOS



Tensiones

Desplazamientos

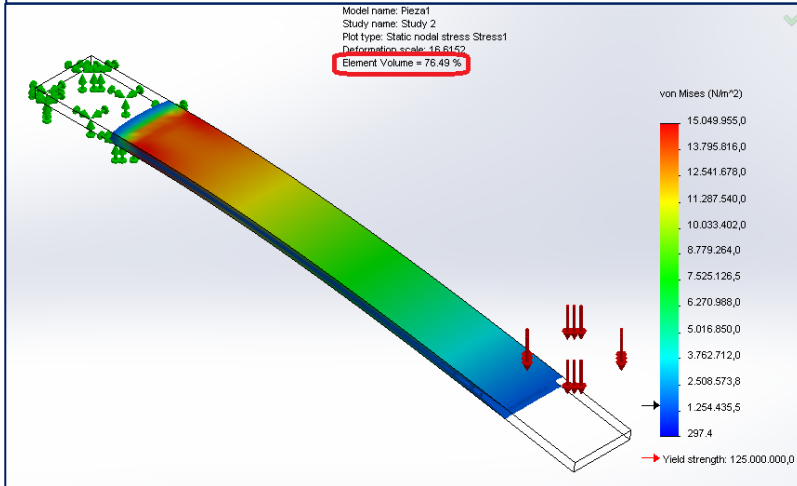




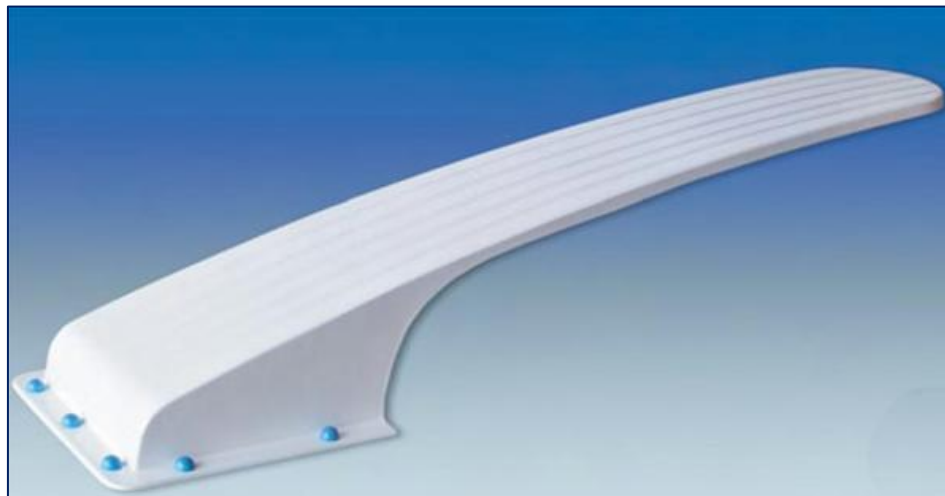
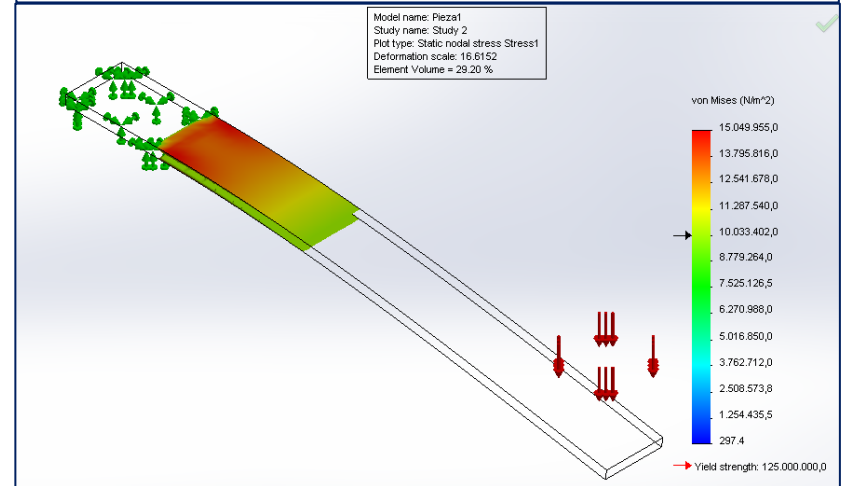
D
E
S
P
I
L
F
A
R
R
O

Localizar esfuerzos

Tensión = 1,5 MPa



Tensión = 10MPa

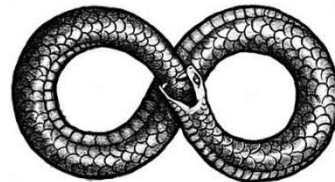


Conclusiones

- Ahorro de tiempo y dinero.



- Posibilidad ilimitada de modificar la pieza.



En definitiva, un gran avance para la ingeniería

Divide
y
Vencerás

