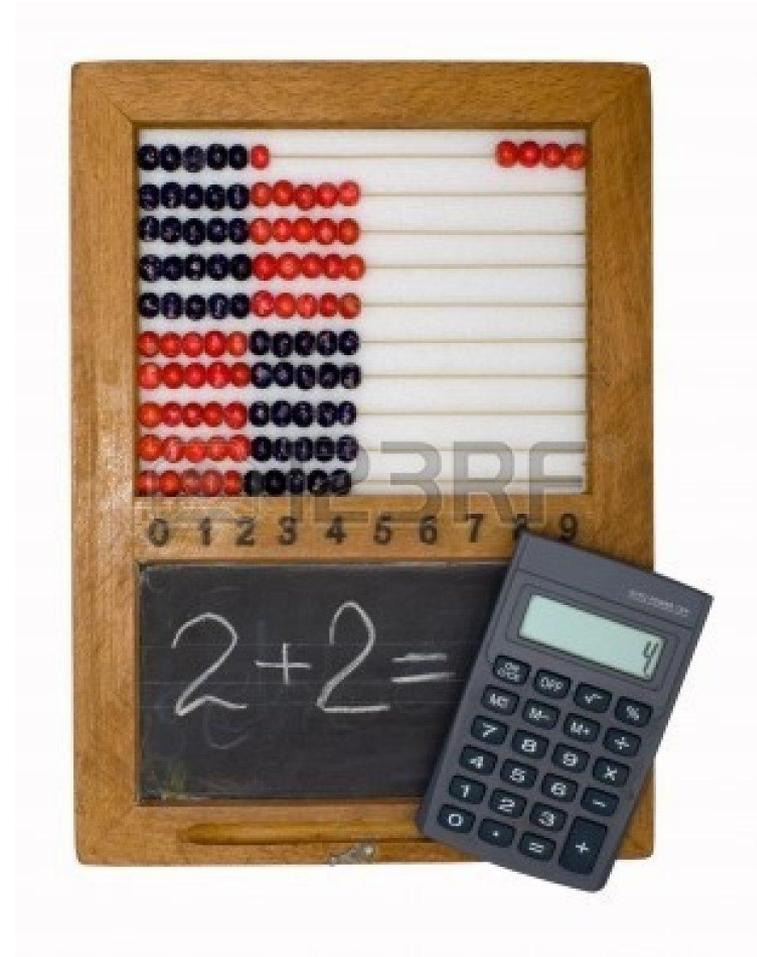




Elementos finitos

¿Qué es el FEM?

Método de cálculo
aproximado.



¿En qué se basa?

Dividir el problema



¿Cuándo empezó?



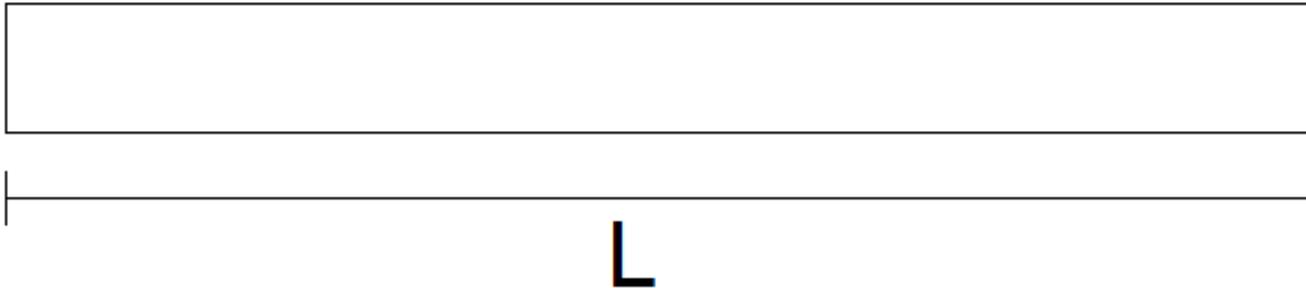
El problema





La solución

Una barra



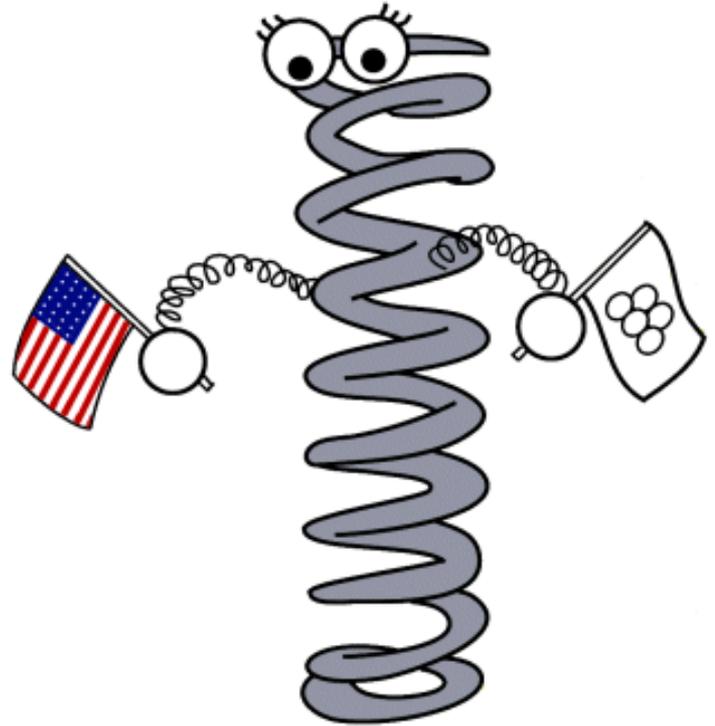
A young boy with brown hair and a light blue shirt with a red collar is sitting at a table. He has a wide, toothy grin and is holding a wooden stick. The table is covered with wrapped gifts in various colors (purple, orange, blue, red). In the background, there is a yellow chair and a grey sofa. The scene appears to be a birthday party or a gift-opening event.

Es un
PALOOO!!!!

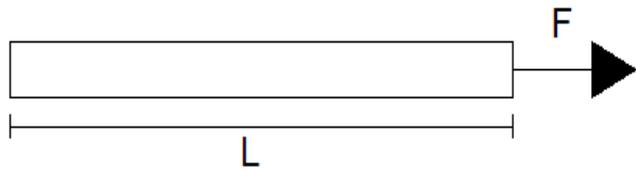
¿Cómo funciona?

Ley de Hooke

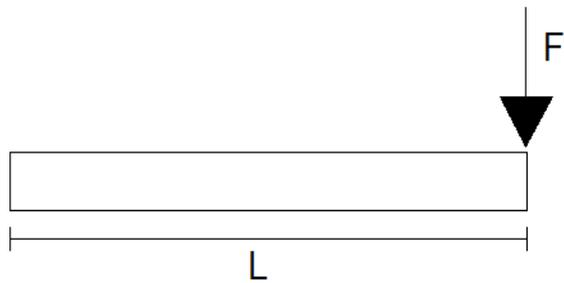
$$F = k * x$$



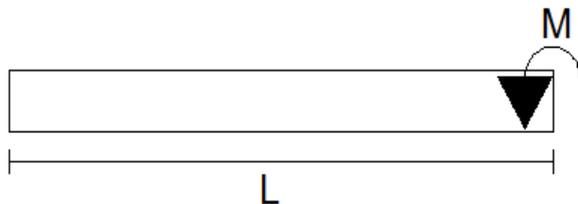
¿Cómo funciona?



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



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



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

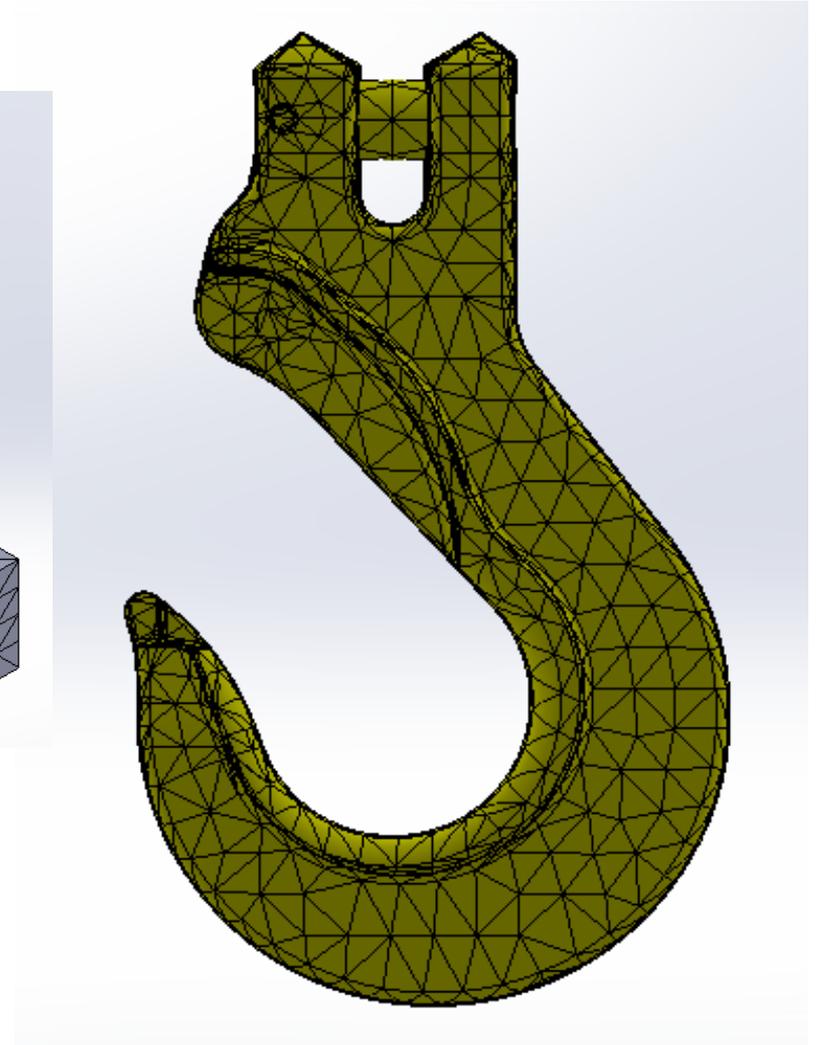
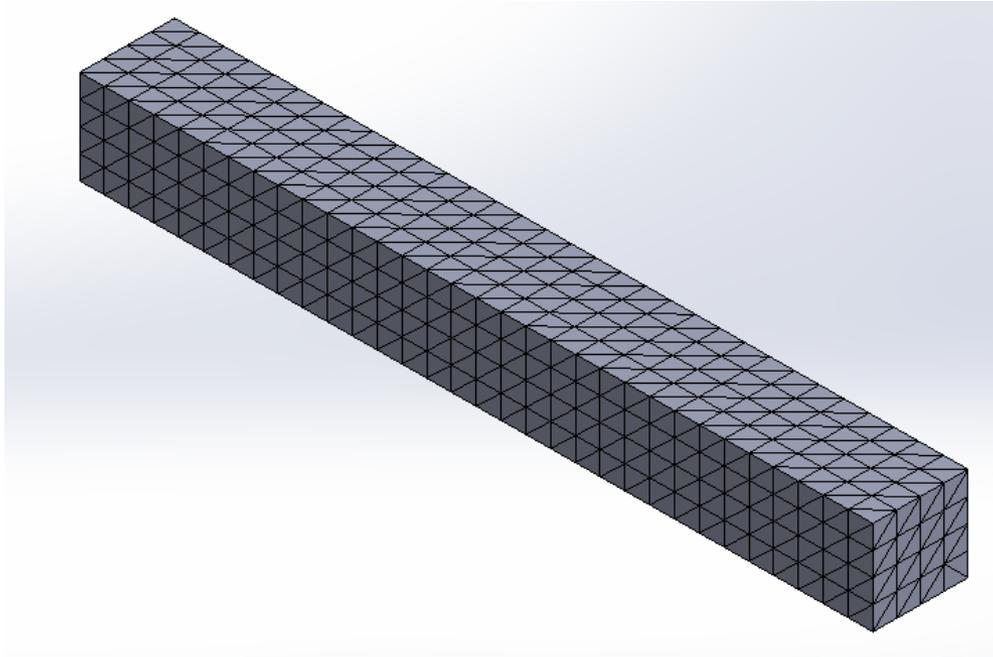
$$\begin{bmatrix} \frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$

Forma matricial ley de Hooke

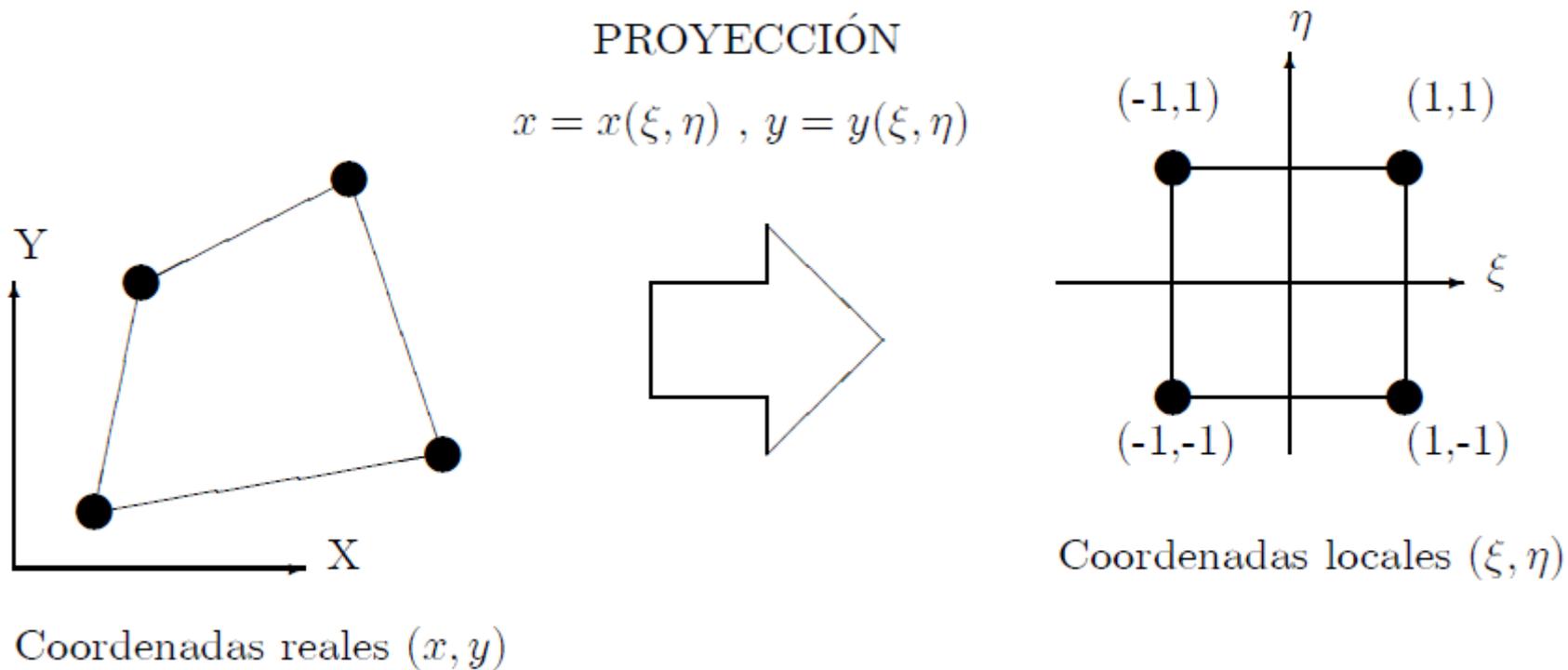
$$\{F\} = [K] * \{U\}$$

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

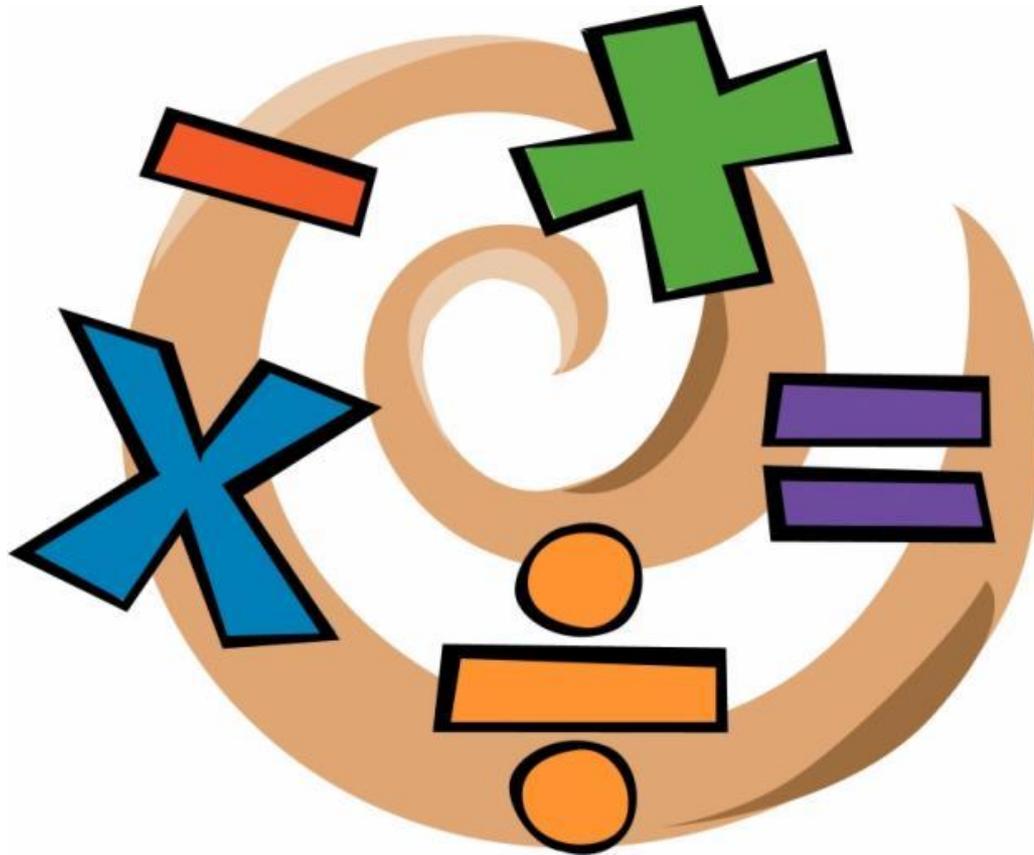
Malla



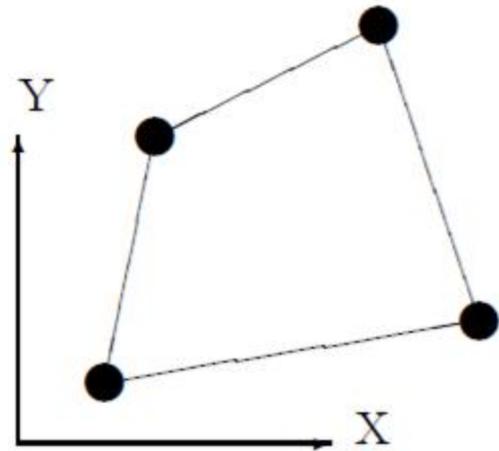
Transformación



Cálculos



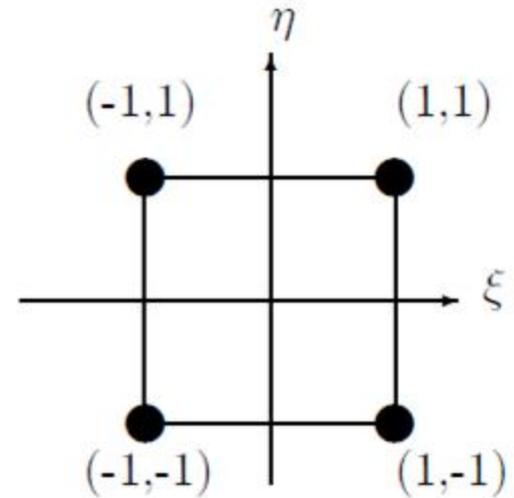
Revertir transformación



Coordenadas reales (x, y)

PROYECCIÓN

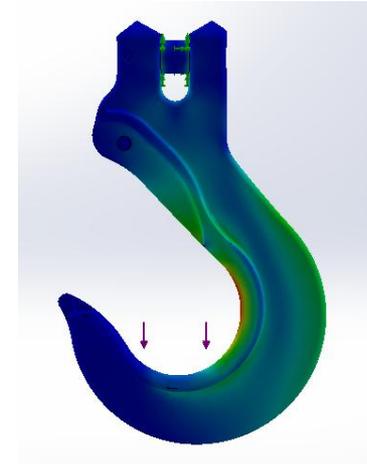
$$x = x(\xi, \eta) , y = y(\xi, \eta)$$



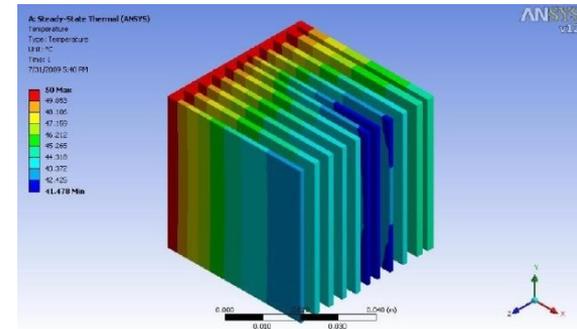
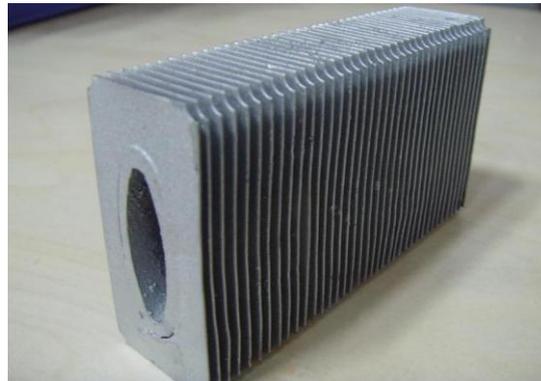
Coordenadas locales (ξ, η)

Aplicaciones

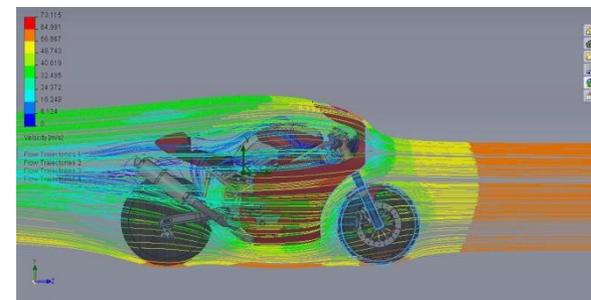
Ensayo estático



Ensayo de
transmisión
de calor

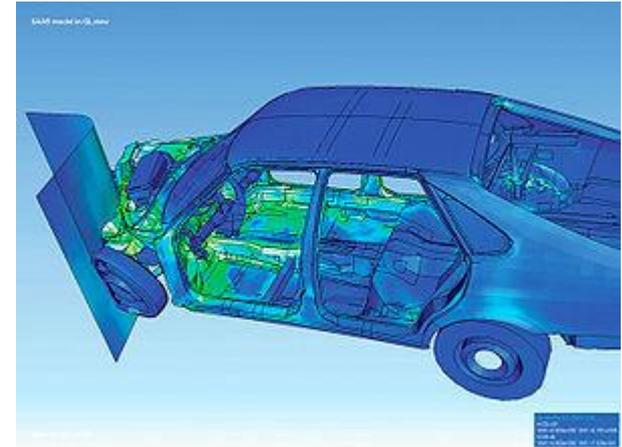


Ensayo
aerodinámico

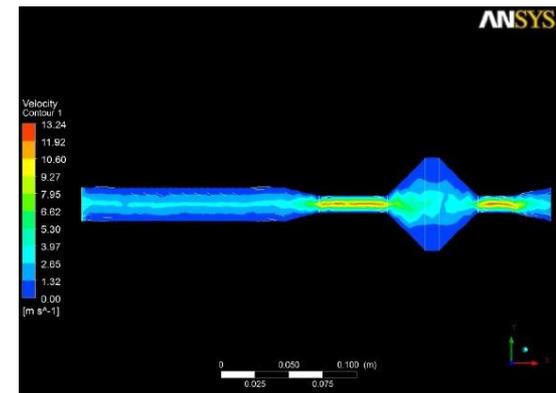


Aplicaciones

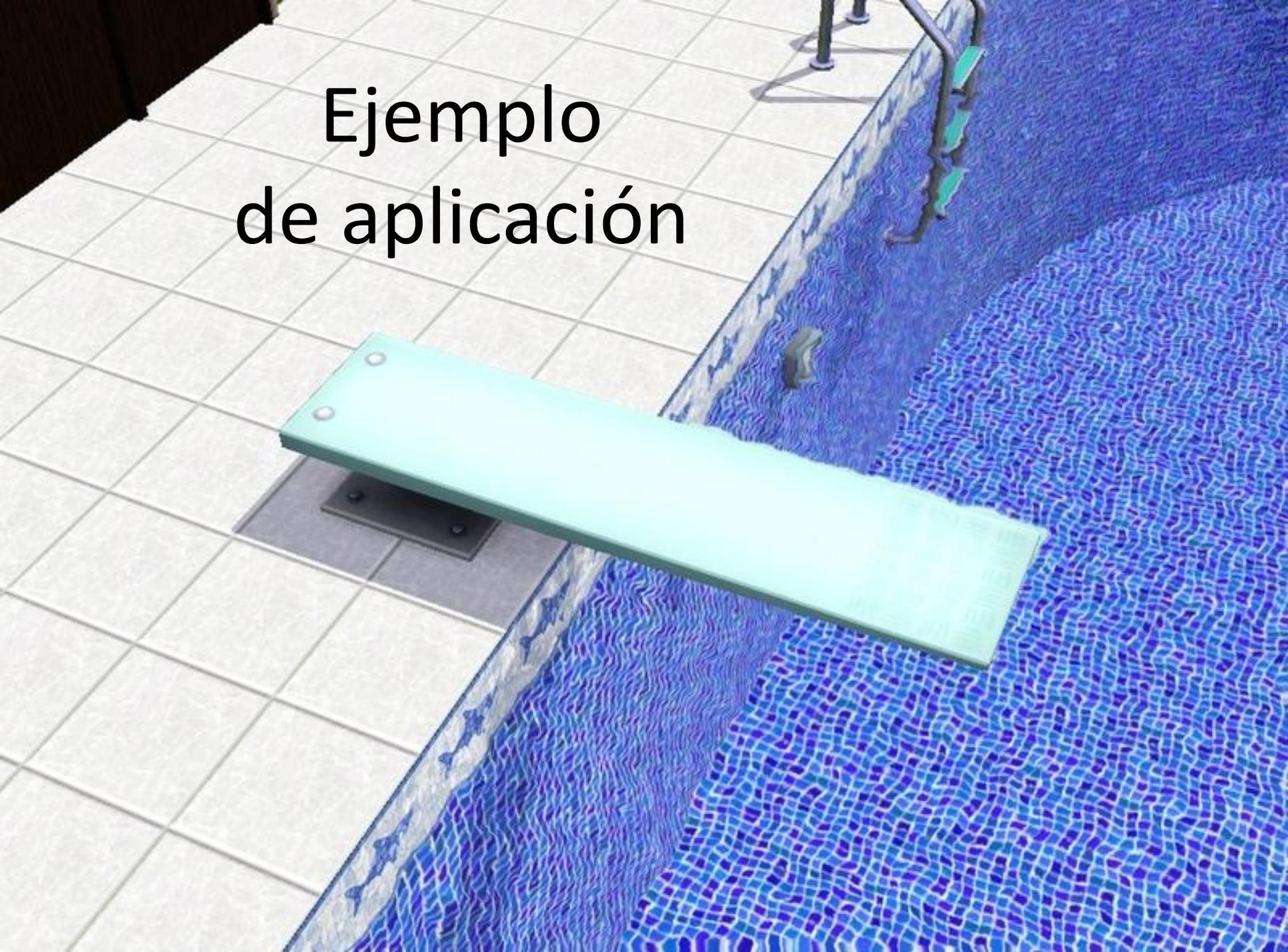
Ensayo de choque



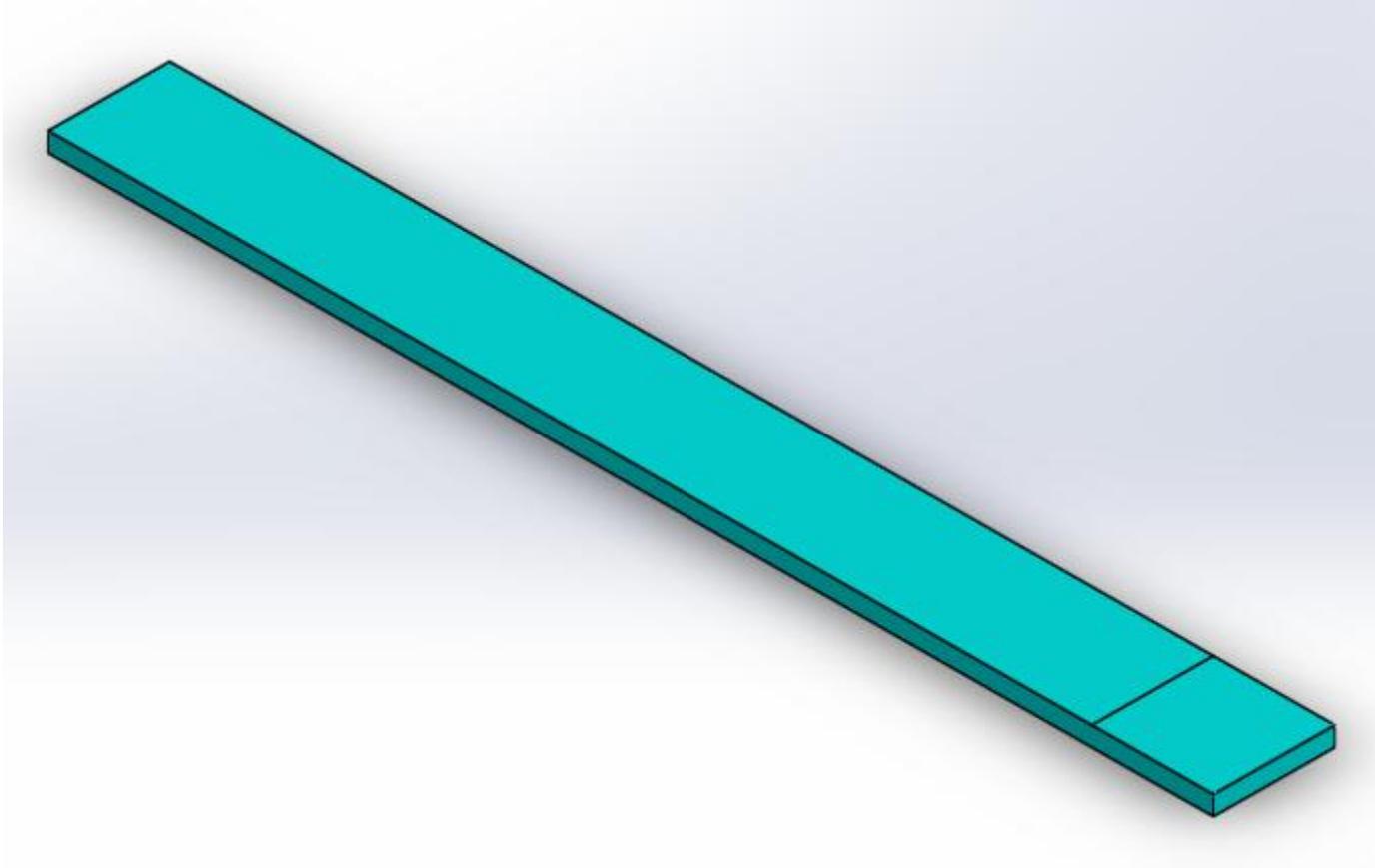
Ensayo fluidodinámico



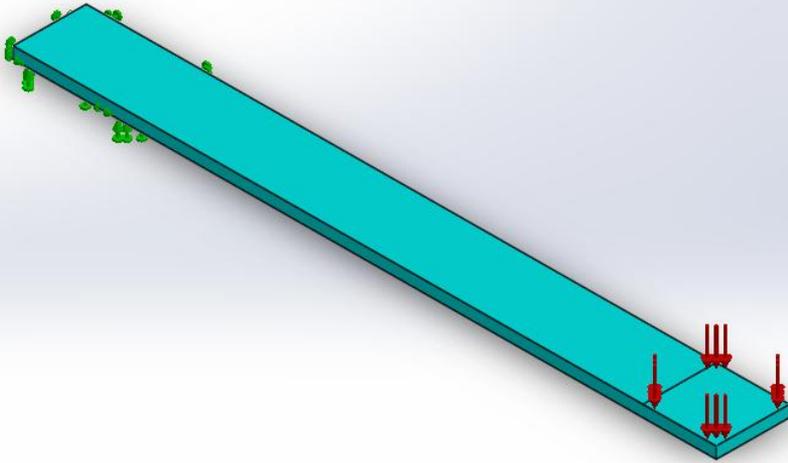
Ejemplo de aplicación



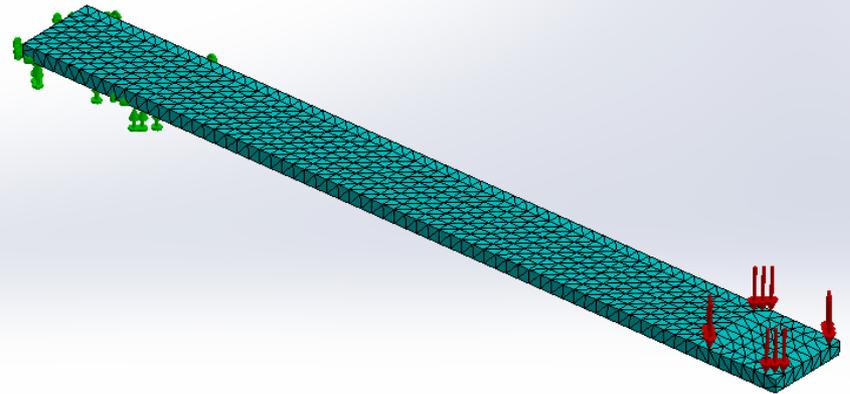
1º Modelado en software



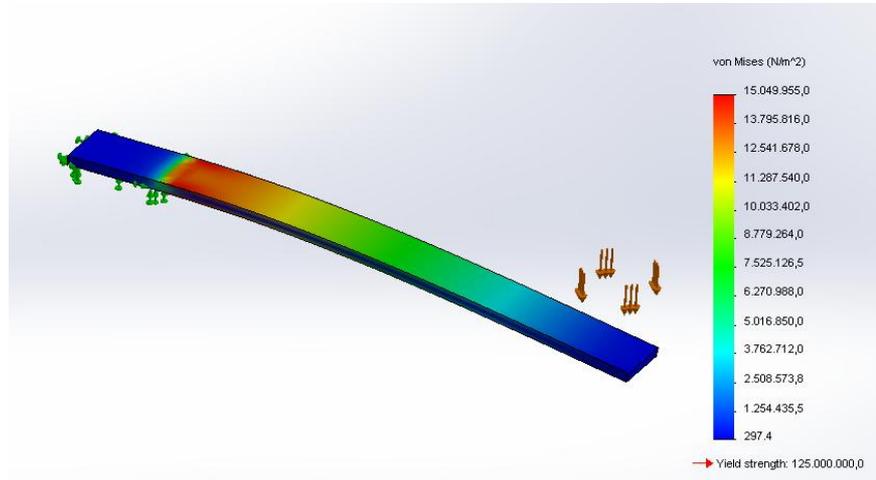
2º Determinar condiciones contorno y esfuerzos.



3º Mallado.

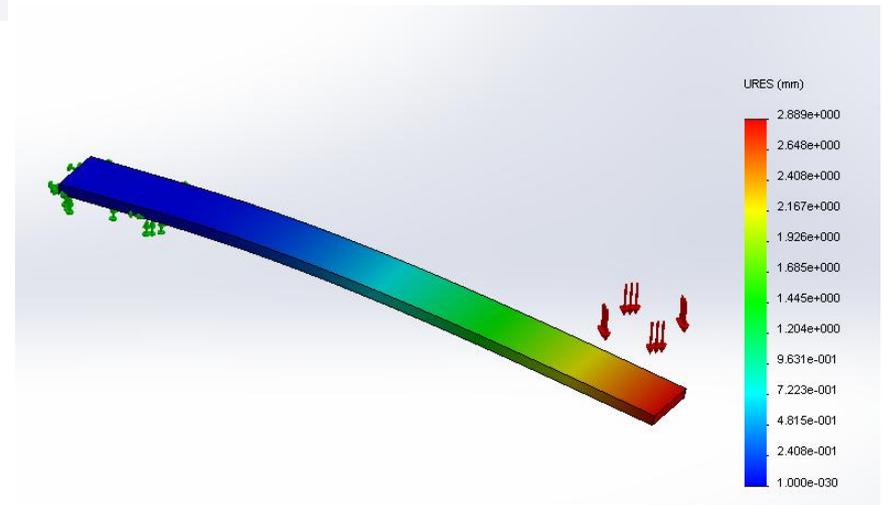


RESULTADOS



Tensiones

Desplazamientos

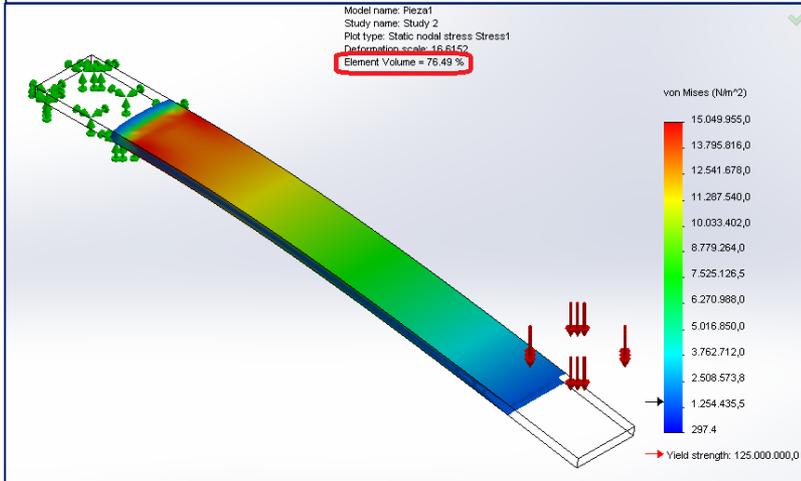




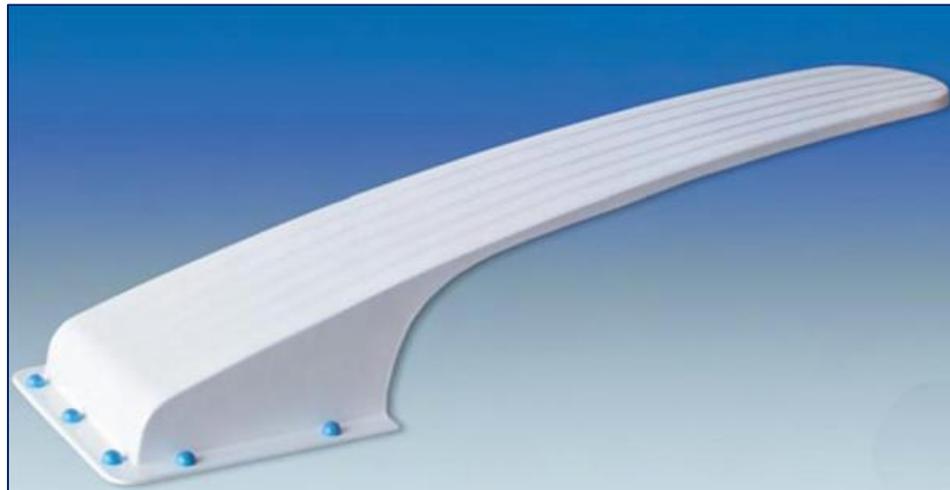
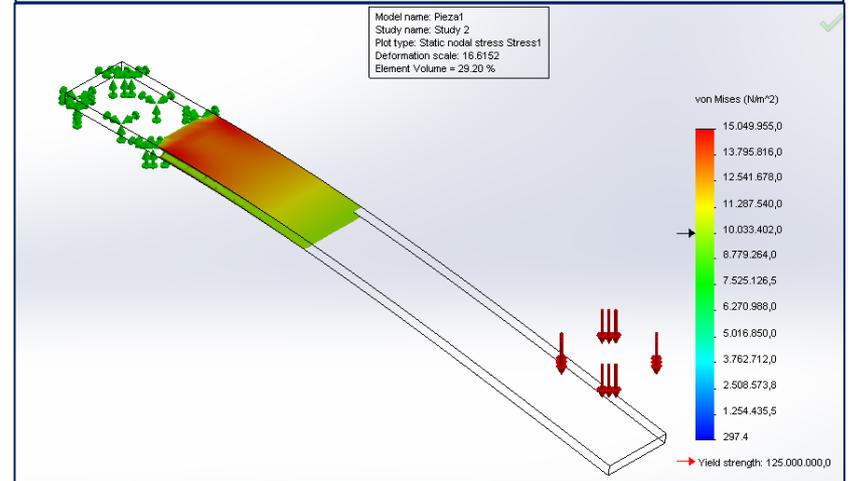
D
E
S
P
I
L
F
A
R
R
O

Localizar esfuerzos

Tensión = 1,5 MPa



Tensión = 10MPa

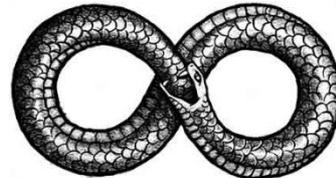


Conclusiones

- Ahorro de tiempo y dinero.



- Posibilidad ilimitada de modificar la pieza.



En definitiva, un gran avance para la ingeniería

Divide y Vencerás

