Ex1 19/10/22 V02

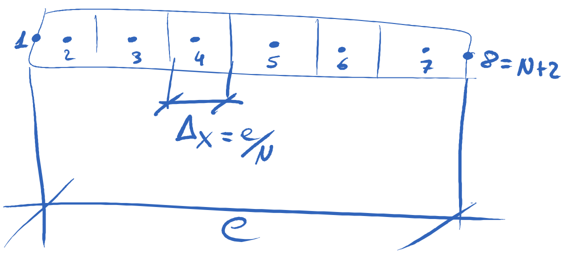
miércoles, 19 de octubre de 2022 20:19

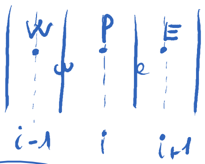
Input data

Physical : $e, H, W, \lambda(T), T_A, T_B, \alpha_A, \alpha_B, \dot{q}_v(T)$

Numerical : $N, \delta, T_{initial}$

And initial T mapping





N+2 Nodos
N+1 Faces

$$\boxed{\begin{gathered} X_w[i] = (i-1)\cdot \Delta x \\ \text{From } i=1 \text{ to } i=N+1 \end{gathered}}$$

$X_P[1] = 0$

$X_P[N+2] = e$

$X_P[i] = \dfrac{X_w[i] + X_w[i-1]}{2}$

From $i=2$ to $= N+1$

Previous Calculations $\xrightarrow{\text{Also}}$ $V_P[i]\ldots$

$$a_{P[i]}T_{[i]} = a_{w[i]}T_{[i-1]} + a_{E[i]}T_{[i+1]} + b_{P[i]}$$

$$\left(\frac{\lambda_w S_w}{d_{Pw}} + \frac{\lambda_e S_e}{d_{PE}}\right)T_P = \frac{\lambda_w S_w}{d_{Pw}}T_w + \frac{\lambda_e S_e}{d_{PE}}T_E + \dot{q}_v \rho V_P$$

$[W/m^3]$

First code we asume $\lambda = \text{Constant}$

$\dot{q}_{conv} = \dot{q}_{cond}$

$$\alpha_A(T_A - T_P) = -\lambda \left.\frac{dT}{dx}\right|_e \approx -\lambda_e \frac{T_E - T_P}{d_{PE}}$$

here we don't need Surface Area

$$\underbrace{\left(\frac{\lambda_e}{d_{PE}} + \alpha_A\right)}_{a_P} T_P = \underbrace{\frac{\lambda_e}{d_{PE}}}_{a_E} T_E + \underbrace{\alpha_A T_P}_{b_P}$$

$a_P T_P = a_E T_E + b_P$

$a_{P[i]} T_{[i]} = a_{E[i]} T_{[i+1]} + b_{P[i]}$

$a_{P[1]} T_{[1]} = a_{E[1]} T_{[2]} + b_{P[1]}$

Gauss – Seidel

$\lambda[i] = \lambda(T[i])$

$\dot{q}_v[i] = \dot{q}_v(T[i])$

→ Now the heat flux and the conduction heat transfer coefficient are dependent from the temperature.

Esto lo haré más tarde ...

$$\max\left|T^*[i] - T[i]\right| < \delta \,? \xrightarrow{\text{No?}} \text{recalculate Discretization Coefficients and Temp.}$$

↓ Yes

Final Calculations

Water

$$\lambda\left(\frac{W}{mK}\right) = -1{,}176 + 7{,}915 \cdot 10^{-3}\, T + 1{,}486 \cdot 10^{-5} \cdot T^2 - 1{,}317 \cdot 10^{-7} \cdot T^3 + 2{,}476 \cdot 10^{-10} \cdot T^4 - 1{,}556 \cdot 10^{-13} \cdot T^5$$

Saturation Conditions