Trabajo de Métodos Numéricos.

Pieza #3

$a = 100$ cm $\quad b = 2a$

$L = 10$ m

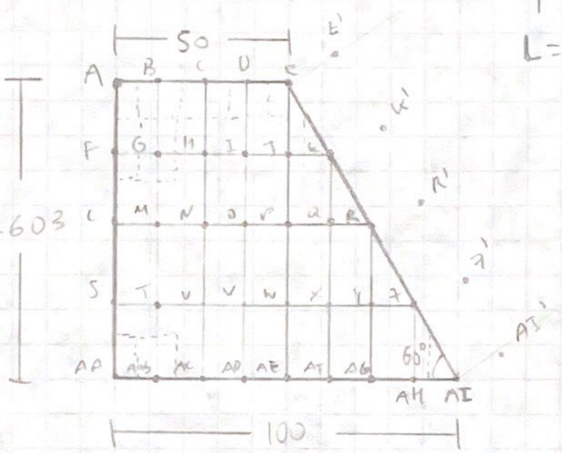
$h = 150 \ \frac{W}{m^2 K}$

$\Delta x = 12.5$ cm

$\Delta y = 21.65075$ cm

$L = 0.5$ m

$\alpha = \frac{k}{\rho C_p} \qquad \tau = \frac{\alpha \Delta t}{\Delta x^2}$



Nodo A

$$+ \frac{k \frac{\Delta y}{2} L (T_B - T_A)^i}{\Delta x} + h \frac{\Delta x}{2} L (T_\infty - T_A)^i = \rho \frac{\Delta x \Delta y}{4} L C_p \frac{(T_A^{i+1} - T_A^i)}{\Delta t}$$

$$\frac{k \frac{\Delta x}{2} L (T_F - T_A)^i}{\Delta y}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta y}{2} (T_B - T_A)^i + \frac{h}{k} \frac{\Delta x^2}{2} (T_\infty - T_A)^i + \frac{\Delta x^2}{2 \Delta y} (T_F - T_A) = \Delta y \rho \frac{\Delta x^2}{k} \frac{C_p}{4} \frac{(\ )}{\Delta t}$$

$$= \frac{\Delta y}{4} \frac{\Delta x^2}{\alpha} \frac{(T_A^{i+1} - T_A^i)}{\Delta t}$$

$$= \frac{\Delta y}{4 \tau} (T_A^{i+1} - T_A^i)$$

$$2\tau (T_B - T_A)^i + 2\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} (T_\infty - T_A)^i + 2\tau \frac{\Delta x^2}{\Delta y^2} (T_F - T_A)^i + T_A^i = T_A^{i+1}$$

$$T_A^i \left(1 - 2\tau - 2\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} - 2\tau \frac{\Delta x^2}{\Delta y^2}\right) + 2\tau \left(T_B^i + T_\infty \frac{h}{k} \frac{\Delta x^2}{\Delta y} + T_F^i \frac{\Delta x^2}{\Delta y^2}\right) = T_A^{i+1}$$

C.E Nodo A

$$1-2\tilde{\gamma}-2\tilde{\gamma}\frac{h}{k}\frac{\Delta x^2}{\Delta y}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}>0$$

Nodo B

$$k\frac{\Delta y}{2}\cancel{L}\frac{1}{\Delta x}(T_A-T_B)^i+k\frac{\Delta x\cancel{L}}{\Delta y}(T_G-T_B)^i+k\frac{\Delta y\cancel{L}}{2\Delta x}(T_C-T_B)^i$$

$$+h\Delta x\cancel{L}(T_\infty-T_B)^i=\rho\Delta x\frac{\Delta y}{2}\cancel{L}c_p\frac{(T_B^{i+1}-T_B^i)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right)\quad\frac{\Delta y}{2}(T_A-T_B)^i+\frac{\Delta x^2}{\Delta y}(T_G-T_B)^i+\frac{\Delta y}{2}(T_C-T_B)^i+\frac{h}{k}\Delta x^2(T_\infty-T_B)^i$$

$$=\rho\frac{\Delta x^2}{k}\frac{\Delta y}{2}c_p\frac{(T_B^{i+1}-T_B^i)}{\Delta t}$$

$$=\frac{\Delta x^2}{\alpha}\frac{\Delta y}{2}\frac{(T_B^{i+1}-T_B^i)}{\Delta t}$$

$$=\frac{\Delta y}{2\tilde{\gamma}}(T_B^{i+1}-T_B^i)$$

$$T_B^i+\tilde{\gamma}(T_A-T_B)^i+2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}(T_G-T_B)^i+\tilde{\gamma}(T_C-T_B)^i+2\tilde{\gamma}\frac{\Delta x^2}{\Delta y}\frac{h}{k}(T_\infty-T_B)^i$$

$$=T_B^{i+1}$$

$$T_B^i\left(1-2\tilde{\gamma}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)+\tilde{\gamma}\left(T_A^i+T_G^i2\frac{\Delta x^2}{\Delta y^2}+T_C^i+2T_\infty\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)$$

$$=T_B^{i+1}$$

C.E Nodo B, C, D

$$1-2\tilde{\gamma}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y}\frac{h}{k}>0$$

$$T_C^i\left(1-2\tilde{\gamma}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)+\tilde{\gamma}\left(T_B^i+2T_H^i\frac{\Delta x^2}{\Delta y^2}+T_D^i+2T_\infty\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)$$

$$=T_C^{i+1}$$

$$T_D^i\left(1-2\tilde{\gamma}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\gamma}\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)+\tilde{\gamma}\left(T_C^i+2T_I^i\frac{\Delta x^2}{\Delta y^2}+T_E^i+2T_\infty\frac{\Delta x^2}{\Delta y}\frac{h}{k}\right)$$

$$=T_D^{i+1}$$

Nodo E

$$k \frac{\Delta y}{2} \frac{\cancel{L}}{\Delta x}\left(T_D - T_E\right)^i + k \frac{\Delta x}{\Delta y} \cancel{L}\left(T_J - T_E\right)^i + h \frac{\Delta x}{2} \cancel{L}\left(T_\infty - T_E\right)^i$$

$$= \rho \frac{3}{8} \Delta x \Delta y \cancel{L}\, C_p \frac{\left(T_E^{i+1} - T_E^i\right)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta y}{2}\left(T_D - T_E\right)^i + \frac{\Delta x^2}{\Delta y}\left(T_J - T_E\right)^i + \frac{h}{k}\frac{\Delta x^2}{2}\left(T_\infty - T_E\right)^i = \frac{\rho C_p}{k} \Delta x^2 \Delta y \frac{3}{8} \frac{\left(T_E^{i+1} - T_E^i\right)}{\Delta t}$$

$$= \frac{3}{8} \frac{\Delta x^2 \Delta y}{\alpha} \frac{\left(T_E^{i+1} - T_E^i\right)}{\Delta t}$$

$$= \frac{3}{8} \frac{\Delta y}{\tau}\left(T_E^{i+1} - T_E^i\right)$$

$$\frac{4}{3}\tau\left(T_D - T_E\right)^i + \frac{8}{3}\tau \frac{\Delta x^2}{\Delta y^2}\left(T_J - T_E\right)^i + \frac{4}{3}\tau \frac{h}{k}\Delta x^2\left(T_\infty - T_E\right)^i + T_E^i = T_E^{i+1}$$

$$T_E^i\left(1 - \frac{4}{3}\tau - \frac{8}{3}\tau\frac{\Delta x^2}{\Delta y^2} - \frac{4}{3}\tau\frac{h}{k}\Delta x^2\right) + \frac{4}{3}\tau\left(T_D^i + 2\frac{\Delta x^2}{\Delta y^2}T_J^i + \frac{h}{k}\Delta x^2 T_\infty\right)$$

$$= T_E^{i+1}$$

C.E Nodo E

$$1 - \frac{4}{3}\tau - \frac{8}{3}\tau\frac{\Delta x^2}{\Delta y^2} - \frac{4}{3}\tau\frac{h}{k}\Delta x^2 > 0$$

$$\frac{1}{\left(\frac{4}{3} + \frac{8}{3}\frac{\Delta x^2}{\Delta y^2} + \frac{4}{3}\frac{h}{k}\Delta x^2\right)} > \tau$$

Nodo F

$$k\frac{\Delta x \cancel{L}}{2\Delta y}(T_A-T_F)^i + k\frac{\Delta x}{2\Delta y}\cancel{L}(T_L-T_F)^i + k\frac{\Delta y \cancel{L}}{\Delta x}(T_G-T_F)^i$$

$$= \rho\frac{\Delta x}{2}\Delta y \cancel{L}\, c_p \frac{(T_F^{i+1}-T_F^i)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta x^2}{2\Delta y}(T_A-T_F)^i + \frac{\Delta x^2}{2\Delta y}(T_L-T_F)^i + \Delta y\,(T_G-T_F)^i$$

$$= c_p\frac{\rho}{k}\Delta x^2\Delta y \frac{(T_F^{i+1}-T_F^i)}{\Delta t}$$

$$= \frac{\Delta x^2}{\alpha}\Delta y \frac{(T_F^{i+1}-T_F)^i}{\Delta t}$$

$$= \frac{\Delta y}{\tau}(T_F^{i+1}-T_F^i)$$

$$\tau\frac{\Delta x^2}{2\Delta y^2}(T_A-T_F)^i + \tau\frac{\Delta x^2}{2\Delta y^2}(T_L-T_F)^i + \tau(T_G-T_F)^i + T_F^i = T_F^{i+1}$$

$$T_F^i\left(1-\tau\frac{\Delta x^2}{\Delta y^2}-\tau\right) + \tau\left(T_A^i\frac{\Delta x^2}{2\Delta y^2} + T_L^i\frac{\Delta x^2}{2\Delta y^2} + T_G^i\right) = T_F^{i+1}$$

C.E Nodo F, L, S

$$1-\tau\frac{\Delta x^2}{\Delta y^2}-\tau > 0$$

$$T_L^i\left(1-\tau\frac{\Delta y^2}{\Delta y^2}-\tau\right) + \tau\left(T_F^i\frac{\Delta x^2}{2\Delta y^2} + T_S^i\frac{\Delta x^2}{2\Delta y^2} + T_M^i\right) = T_L^{i+1}$$

$$T_S^i\left(1-\tau\frac{\Delta x^2}{\Delta y^2}-\tau\right) + \tau\left(T_L^i\frac{\Delta x^2}{2\Delta y^2} + T_{AM}^i\frac{\Delta x^2}{2\Delta y^2} + T_T^i\right) = T_S^{i+1}$$

Nodo G

$$k\frac{\Delta x \cancel{L}}{\Delta y}(T_B - T_G)^i + k\frac{\Delta x \cancel{L}}{\Delta y}(T_M - T_G)^i + k\frac{\Delta y \cancel{L}}{\Delta x}(T_F - T_G)^i +$$

$$k\frac{\Delta y}{\Delta x}\cancel{L}(T_H - T_G)^i = \rho\, \Delta x \Delta y \cancel{L}\, C_p \left(\frac{T_G^{i+1} - T_G^i}{\Delta t}\right)$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta x^2}{\Delta y}(T_B - T_G)^i + \frac{\Delta x^2}{\Delta y}(T_M - T_G)^i + \Delta y\,(T_F - T_G)^i +$$

$$\Delta y\,(T_H - T_G)^i = \frac{\rho\, \Delta x^2 C_p}{k}\,\Delta y \left(\frac{T_G^{i+1} - T_G^i}{\Delta t}\right)$$

$$= \frac{\Delta x^2}{\alpha}\,\Delta y\, \frac{(T_G^{i+1} - T_G^i)}{\Delta t}$$

$$= \frac{\Delta y}{\tau}\,(T_G^{i+1} - T_G^i)$$

$$\tau\frac{\Delta x^2}{\Delta y^2}(T_B - T_G)^i + \tau\frac{\Delta x^2}{\Delta y^2}(T_M - T_G)^i + \tau(T_F - T_G)^i + \tau(T_H - T_G)^i$$

$$+ T_G^i = T_G^{i+1}$$

$$T_G^i\left(1 - 2\tau\frac{\Delta x^2}{\Delta y^2} - 2\tau\right) + \tau\left(\frac{\Delta x^2}{\Delta y^2}(T_B^i + T_M^i) + T_F^i + T_H^i\right) = T_G^{i+1}$$

C.E. Nodo G, H, I, J, M, N, O, P, Q, T, U, V, W, X, Y

$$1 - 2\tau\frac{\Delta x^2}{\Delta y^2} - 2\tau > 0$$

Ecuaciones para los nodos centrales

$$T_H^{i}\left(1-2\tilde{\tau}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\tau}\right)+\tilde{\tau}\left(\frac{\Delta x^2}{\Delta y^2}\left(T_C^{i}+T_N^{i}\right)+T_G^{i}+T_I^{i}\right)=T_H^{i+1}$$

$$T_I^{i}\left(1-2\tilde{\tau}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\tau}\right)+\tilde{\tau}\left(\frac{\Delta x^2}{\Delta y^2}\left(T_D^{i}+T_O^{i}\right)+T_H^{i}+T_J^{i}\right)=T_I^{i+1}$$

$$T_J^{i}\left(1-2\tilde{\tau}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\tau}\right)+\tilde{\tau}\left(\frac{\Delta x^2}{\Delta y^2}\left(T_E^{i}+T_P^{i}\right)+T_I^{i}+T_K^{i}\right)=T_J^{i+1}$$

$$T_M^{i}\left(1-2\tilde{\tau}\frac{\Delta x^2}{\Delta y^2}-2\tilde{\tau}\right)+\tilde{\tau}\left(\frac{\Delta x^2}{\Delta y^2}\left(T_G^{i}+T_T^{i}\right)+T_L^{i}+T_N^{i}\right)=T_M^{i+1}$$

y así sucesivamente ...

Nodo K

$$k\frac{\Delta y \cancel{L}}{\Delta x}(T_J - T_k)^i + k\frac{\Delta x \cancel{L}}{\Delta y}(T_Q - T_k)^i = \rho \frac{\Delta x \Delta y \cancel{L}}{2} C_p \frac{(T_k^{i+1} - T_k^i)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \Delta y (T_J - T_k)^i + \frac{\Delta x^2}{\Delta y}(T_Q - T_k)^i = \frac{\rho C_p}{k}\frac{\Delta x^2 \Delta y}{2}\frac{(T_k^{i+1} - T_k^i)}{\Delta t}$$

$$= \frac{\Delta x^2 \Delta y}{2\alpha \Delta t}(T_k^{i+1} - T_k^i)$$

$$= \frac{\Delta y}{2\tilde{\tau}}(T_k^{i+1} - T_k^i)$$

$$2\tilde{\tau}(T_J - T_k)^i + 2\tilde{\tau}\frac{\Delta x^2}{\Delta y^2}(T_Q - T_k)^i + T_k^i = T_k^{i+1}$$

$$T_k^i\left(1 - 2\tilde{\tau}\left(1 + \frac{\Delta x^2}{\Delta y^2}\right)\right) + 2\tilde{\tau}\left(T_J^i + \frac{\Delta x^2}{\Delta y^2}T_Q^i\right) = T_k^{i+1}$$

C.E Nodo K, R, Z

$$1 - 2\tilde{\tau}\left(1 + \frac{\Delta x^2}{\Delta y^2}\right) > 0 \qquad 1 > \tilde{\tau}\left(2 + 2\frac{\Delta x^2}{\Delta y^2}\right)$$

$$T_R^i\left(1 - 2\tilde{\tau}\left(1 + \frac{\Delta x^2}{\Delta y^2}\right)\right) + 2\tilde{\tau}\left(T_Q^i + \frac{\Delta x^2}{\Delta y^2}T_Y^i\right) = T_R^{i+1}$$

$$T_Z^i\left(1 - 2\tilde{\tau}\left(1 + \frac{\Delta x^2}{\Delta y^2}\right)\right) + 2\tilde{\tau}\left(T_Y^i + \frac{\Delta x^2}{\Delta y^2}T_{AH}^i\right) = T_Z^{i+1}$$

Análisis de Nodos sometidos a radiación

Nodo $\underline{AA}$

$$k\frac{\Delta x L}{2\Delta y}(T_S - T_{AA})^i + k\frac{\Delta y L}{2\Delta x}(T_{AB} - T_{AA})^i + h\frac{\Delta x L}{2}(T_\infty - T_{AA})^i$$

$$+ \sigma\alpha\frac{\Delta x L}{2}(T_{alr}^4 - T_{AA}^4) = \rho\frac{\Delta x\Delta y L}{4}C_p\left(\frac{T_{AA}^{i+1} - T_{AA}^i}{\Delta t}\right)$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta x^2}{2\Delta y}(T_S - T_{AA})^i + \frac{\Delta y}{2}(T_{AB} - T_{AA})^i + \frac{h}{k}\frac{\Delta x^2}{2}(T_\infty - T_{AA})^i$$

$$+ \frac{\sigma\alpha}{k}\frac{\Delta x^2}{2}(T_{alr}^4 - T_{AA}^4) = \frac{\rho C_p}{k}\Delta x^2\frac{\Delta y}{4}\left(\frac{T_{AA}^{i+1} - T_{AA}^i}{\Delta t}\right)$$

$$= \frac{\Delta x^2\Delta y}{\alpha\ 4}\left(\frac{T_{AA}^{i+1} - T_{AA}^i}{\Delta t}\right)$$

$$= \frac{\Delta y}{4\tau}(T_{AA}^{i+1} - T_{AA}^i)$$

$$2\tau\frac{\Delta x^2}{\Delta y^2}(T_S - T_{AA})^i + 2\tau(T_{AB} - T_{AA})^i + 2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}(T_\infty - T_{AA})^i$$

$$+ 2\tau\frac{\Delta x^2}{\Delta y}\frac{\sigma}{k}\alpha(T_{alr}^4 - T_{AA}^4)^i + T_{AA}^i = T_{AA}^{i+1}$$

$$T_{alr}^4 - T_{AA}^4 = \underbrace{(T_{alr}^2 + T_{AA}^2)(T_{alr} + T_{AA})}_{C}(T_{alr} - T_{AA})$$

$$2\tau\frac{\Delta x^2}{\Delta y^2}(T_S - T_{AA})^i + 2\tau(T_{AB} - T_{AA})^i + 2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}(T_\infty - T_{AA})^i$$

$$+ 2\tau C\frac{\Delta x^2}{\Delta y}\frac{\sigma}{k}\alpha(T_{alr} - T_{AA})^i + T_{AA}^i = T_{AA}^{i+1}$$

$$T_{AA}^i\left(1 - 2\tau\frac{\Delta x^2}{\Delta y^2} - 2\tau - 2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y} - 2\tau C\frac{\Delta x^2}{\Delta y}\frac{\sigma}{k}\alpha\right)$$

$$+ 2\tau\left(T_S\frac{\Delta x^2}{\Delta y^2} + T_{AB} + T_\infty\frac{h}{k}\frac{\Delta x^2}{\Delta y} + T_{alrd}\,C\frac{\Delta x^2}{\Delta y}\frac{\sigma}{k}\alpha\right) = T_{AA}^{i+1}$$

C.E Nodo AA

$$1 - 2\tau\frac{\Delta x^2}{\Delta y^2} - 2\tau - 2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y} - 2\tau C\frac{\Delta x^2}{\Delta y}\frac{\sigma}{k}\alpha > 0$$

Nodo AB

$$k\frac{\Delta y}{2}\frac{\cancel{L}}{\Delta x}(T_{AA}-T_{AB})^i + k\frac{\Delta y}{2\Delta x}\cancel{L}(T_{AC}-T_{AB})^i + k\frac{\Delta x\cancel{L}}{\Delta y}(T_T-T_{AB})^i$$

$$+ h\Delta x\cancel{L}(T_\infty-T_{AB})^i + \sigma\Delta x\cancel{L}\alpha(T_{alr}^4-T_{AB}^4) = \rho\frac{\Delta x\Delta y}{2}\cancel{L}c_p\frac{(T_{AB}^{i+1}-T_{AB}^i)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right)\quad \frac{\Delta y}{2}(T_{AA}-T_{AB})^i + \frac{\Delta y}{2}(T_{AC}-T_{AB})^i + \frac{\Delta x^2}{\Delta y}(T_T-T_{AB})^i$$

$$+\frac{h}{k}\Delta x^2(T_\infty-T_{AB})^i + \frac{\sigma}{k}\Delta x^2\alpha(T_{alr}^4-T_{AB}^4) = \frac{\rho c_p}{k}\Delta x^2\frac{\Delta y}{2}\frac{(T_{AB}^{i+1}-T_{AB}^i)}{\Delta t}$$

$$= \frac{\Delta x^2\Delta y}{2\alpha}\frac{(T_{AB}^{i+1}-T_{AB}^i)}{\Delta t}$$

$$= \frac{\Delta y}{2\tau}(T_{AB}^{i+1}-T_{AB}^i)$$

$$\tau(T_{AA}-T_{AB})^i + \tau(T_{AC}-T_{AB})^i + 2\tau\frac{\Delta x^2}{\Delta y^2}(T_T-T_{AB})^i +$$

$$2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}(T_\infty-T_{AB})^i + 2\tau\frac{\sigma}{k}\frac{\Delta x^2}{\Delta y}\alpha(T_{alr}^4-T_{AB}^4)^i + T_{AB}^i = T_{AB}^{i+1}$$

$$\tau(T_{AA}-T_{AB})^i + \tau(T_{AC}-T_{AB})^i + 2\tau\frac{\Delta x^2}{\Delta y^2}(T_T-T_{AB}) + 2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}(T_\infty-T_{AB})^i$$

$$+ 2\tau\frac{\sigma}{k}\frac{\Delta x^2}{\Delta y}c\alpha(T_{alr}-T_{AB})^i + T_{AB}^i = T_{AB}^{i+1}$$

$$T_{AB}^i\left(1-2\tau-2\tau\frac{\Delta x^2}{\Delta y^2}-2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}-2\tau\frac{\sigma}{k}\frac{\Delta x^2}{\Delta y}c\alpha\right)$$

$$+\tau\left(T_{AA}^i + T_{AC}^i + 2\frac{\Delta x^2}{\Delta y^2}T_T^i + T_\infty 2\frac{\Delta x^2}{\Delta y}\frac{h}{k} + 2\frac{\sigma}{k}\frac{\Delta x^2}{\Delta y}c\right)$$

$$= T_{AB}^{i+1}$$

C.E Nodos AB, AC, AD, AE, AF, AG, AH

$$1-2\tau-2\tau\frac{\Delta x^2}{\Delta y^2}-2\tau\frac{h}{k}\frac{\Delta x^2}{\Delta y}-2\tau\frac{\sigma}{k}\frac{\Delta x^2}{\Delta y}c\alpha > 0$$

Nodo AI

$$k \frac{\Delta y}{2} \cancel{L} \frac{(T_{AH} - T_{AI})^i}{\Delta x} + h \frac{\Delta x}{2} \cancel{L} (T_\infty - T_{AI})^i + \sigma \alpha \frac{\Delta x}{2} \cancel{L} \left(T_{alr}^4 - T_{AI}^4 \right)^i$$

$$= \rho C_p \frac{\Delta x \Delta y}{8} \cancel{L} \frac{(T_{AI}^{i+1} - T_{AI}^i)}{\Delta t}$$

$$\div \left(\frac{\Delta x}{k}\right) \quad \frac{\Delta y}{2} (T_{AH} - T_{AI})^i + \frac{h}{k} \frac{\Delta x^2}{2} (T_\infty - T_{AI})^i + \frac{\sigma}{k} \alpha \frac{\Delta x^2}{2} \left(T_{alr}^4 - T_{AI}^4 \right)^i$$

$$= \frac{\Delta x^2}{\alpha} \frac{\Delta y}{8} \frac{\left(T_{AI}^{i+1} - T_{AI}^i \right)}{\Delta t}$$

$$= \frac{\Delta y}{8 \tau} \left(T_{AI}^{i+1} - T_{AI}^i \right)$$

$$4\tau (T_{AH} - T_{AI})^i + 4\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} (T_\infty - T_{AI})^i + 4\tau \frac{\sigma}{k} \alpha \frac{\Delta x^2}{\Delta y} (T_{alr}^4 - T_{AI}^4)^i$$

$$+ T_{AI}^i = T_{AI}^{i+1}$$

$$4\tau (T_{AH} - T_{AI})^i + 4\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} (T_\infty - T_{AI})^i + 4\tau \frac{\sigma}{k} \alpha C \frac{\Delta x^2}{\Delta y} (T_{alr} - T_{AI})^i$$

$$+ T_{AI}^i = T_{AI}^{i+1}$$

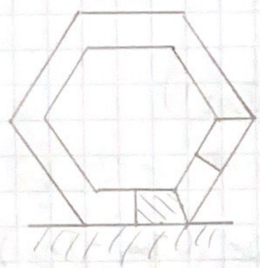
$$T_{AI}^i \left(1 - 4\tau - 4\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} - 4\tau \frac{\sigma}{k} \alpha C \frac{\Delta x^2}{\Delta y} \right) + 4\tau \left(T_{AH}^i + T_\infty \frac{h}{k} \frac{\Delta x^2}{\Delta y} \right.$$

$$\left. + \frac{\sigma}{k} \alpha C \frac{\Delta x^2}{\Delta y} T_{alr} \right) = T_{AI}^{i+1}$$

C.E. Nodo AI

$$1 - 4\tau \left(1 + \frac{h}{k} \frac{\Delta x^2}{\Delta y} + \frac{\sigma}{k} \alpha C \frac{\Delta x^2}{\Delta y} \right) > 0$$

Ahora realizamos el análisis para la parte de la pieza sometida a una pared adiabática.



Nodo E

$$k \frac{\Delta y \cancel{L}}{2\,\Delta x} (T_D - T_E)^i + k \frac{\Delta x \cancel{L}}{\Delta y} (T_J - T_E)^i + k \frac{\cancel{\Delta x}\,\cancel{L}}{2 \cos\theta\, \cancel{\Delta x}} (T_{E'} - T_E)^i$$

$$+ h \frac{\Delta x}{2}\cancel{L} (T_\infty - T_E)^i = \rho C_p \frac{3}{8} \Delta x \Delta y \cancel{L} \left(\frac{T_E^{i+1} - T_E^i}{\Delta t} \right)$$

$$\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta y}{2} (T_D - T_E)^i + \frac{\Delta x^2}{\Delta y} (T_J - T_E)^i + \frac{\Delta x}{2 \cos\theta} (T_{E'} - T_E)^i + \frac{h}{k} \frac{\Delta x^2}{2} (T_\infty - T_E)^i$$

$$= \frac{3}{8} \frac{\Delta x^2}{\alpha} \Delta y \frac{(T_E^{i+1} - T_E^i)}{\Delta t}$$

$$= \frac{3}{8} \frac{\Delta y}{\tau} (T_E^{i+1} - T_E^i)$$

$$\frac{4}{3}\tau (T_D - T_E)^i + \frac{8}{3}\tau \frac{\Delta x^2}{\Delta y} (T_J - T_E)^i + \frac{4}{3}\tau \frac{\Delta x}{\Delta y \cos\theta} (T_{E'} - T_E)^i + \frac{4}{3}\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} (T_\infty - T_E)^i$$

$$+ T_E^i = T_E^{i+1}$$

$$T_E^i \left(1 - \frac{4}{3}\tau - \frac{8}{3}\tau \frac{\Delta x^2}{\Delta y} - \frac{4}{3}\tau \frac{\Delta x}{\Delta y \cos\theta} - \frac{4}{3}\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} \right)$$

$$+ \frac{4}{3}\tau \left(T_D^i + 2 \frac{\Delta x^2}{\Delta y} T_J^i + \frac{\Delta x}{\Delta y \cos\theta} T_{E'}^i + \frac{h}{k} \frac{\Delta x^2}{\Delta y} T_\infty \right) = T_E^{i+1}$$

C.E Nodo E

$$1 - \frac{4}{3}\tau - \frac{8}{3}\tau \frac{\Delta x^2}{\Delta y} - \frac{4}{3}\tau \frac{\Delta x}{\Delta y \cos\theta} - \frac{4}{3}\tau \frac{h}{k} \frac{\Delta x^2}{\Delta y} > 0$$

Nodo R

$$k \frac{\Delta y}{\Delta x} \cancel{L} (T_Q - T_R)^i + k \frac{\Delta x}{\Delta y} \cancel{L} (T_Y - T_R)^i + k \frac{\cancel{\Delta x} \cancel{L}}{\cos\theta \, \cancel{\Delta x}} (T_R' - T_R)^i$$

$$= \rho c_p \cancel{L} \frac{\Delta x \Delta y}{2} \frac{(T_R^{i+1} - T_R^i)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \Delta y (T_Q - T_R)^i + \frac{\Delta x^2}{\Delta y} (T_Y - T_R)^i + \frac{\Delta x}{\cos\theta} (T_R' - T_R)^i = \frac{\Delta x^2 \Delta y}{2\alpha} \frac{(\quad)}{\Delta t}$$

$$= \frac{\Delta y}{2\tilde{\tau}} (T_R^{i+1} - T_R^i)$$

$$2\tilde{\tau} (T_Q - T_R)^i + 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} (T_Y - T_R)^i + \frac{2\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y} (T_R' - T_R)^i + T_R^i = T_R^{i+1}$$

$$T_R^i \left(1 - 2\tilde{\tau} - 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} - \frac{2\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y}\right) + 2\tilde{\tau}\left(T_Q^i + \frac{\Delta x^2}{\Delta y^2} T_Y^i + \frac{T_R'^i}{\cos\theta} \frac{\Delta x}{\Delta y}\right)$$

$$= T_R^{i+1}$$

C.E Nodo R

$$1 - 2\tilde{\tau} - 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} - \frac{2\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y} > 0$$

Nodo AI

$$k \frac{\Delta y}{2\Delta x} \cancel{L} \left(T_{AH} - T_{AI} \right)^i + \frac{k \cancel{\Delta x} \cancel{L}}{2 \cos\theta \cancel{\Delta x}} \left(T_{AI'} - T_{AI} \right)^i = \rho C_P \frac{\Delta x \Delta y \cancel{L}}{8} \frac{\left(T_{AI}^{i+1} - T_{AI}^i \right)}{\Delta t}$$

$$*\left(\frac{\Delta x}{k}\right) \quad \frac{\Delta y}{2} \left(T_{AH} - T_{AI} \right)^i + \frac{\Delta x}{2\cos\theta} \left(T_{AI'} - T_{AI} \right)^i = \frac{\Delta x^2}{\alpha} \frac{\Delta y}{8} \frac{\left(T_{AI}^{i+1} - T_{AI}^i \right)}{\Delta t}$$

$$= \frac{\Delta y}{8\tilde{\tau}} \left(T_{AI}^{i+1} - T_{AI}^i \right)$$

$$4\tilde{\tau} \left(T_{AH} - T_{AI} \right)^i + \frac{4\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y} \left(T_{AI'} - T_{AI} \right)^i + T_{AI}^i = T_{AI}^{i+1}$$

$$T_{AI}^i \left(1 - 4\tilde{\tau} - \frac{4\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y} \right) + 4\tilde{\tau} \left(T_{AH}^i + \frac{\Delta x}{\cos\theta \, \Delta y} T_{AI'}^i \right) = T_{AI}^{i+1}$$

C.E Nodo AI

$$1 - 4\tilde{\tau} - \frac{4\tilde{\tau}}{\cos\theta} \frac{\Delta x}{\Delta y} > 0$$

Nodo AE

$$T_{AE}^i \left(1 - 2\tilde{\tau} - 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} \right) + \tilde{\tau} \left(T_{AD}^i + 2 T_W^i \frac{\Delta x^2}{\Delta y^2} + T_{AF}^i \right) = T_{AE}^{i+1}$$

CE Nodo AE, AA

$$1 - 2\tilde{\tau} - 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} > 0$$

Nodo AA

$$T_{AA}^i \left(1 - 2\tilde{\tau} \frac{\Delta x^2}{\Delta y^2} - 2\tilde{\tau} \right) + 2\tilde{\tau} \left(T_S^i \frac{\Delta x^2}{\Delta y^2} + T_{AB}^i \right) = T_{AA}^{i+1}$$