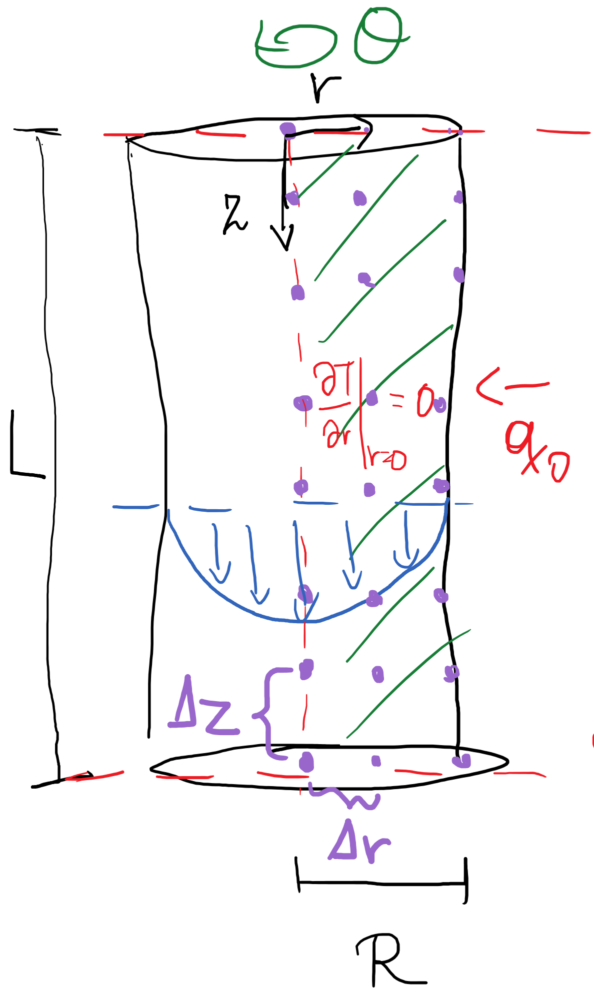
IIQ2003 - Python S3.2.2 - SOR - discretización dominio*



$T(r, z=0) = T_1$

Supuestos

* Estado estacionario
* Simetría angular $\rightarrow T = T(r,z)$
* Prop. termofísicas constantes.
* Flujo C.D. en la entrada.

$$\frac{\partial T}{\partial z}(r, z=L) = 0$$

$$\frac{\partial T}{\partial r}\Big|_{r=L} = \frac{q_0}{k}$$

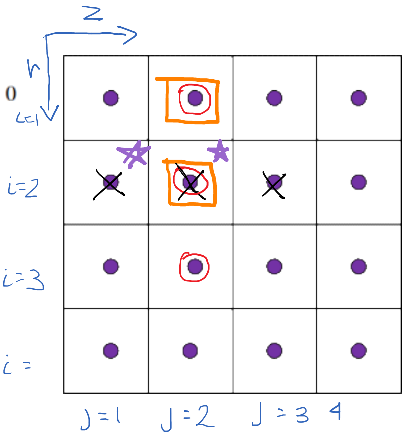
* $\Delta r = \frac{R}{N_R}$; $\Delta z = \frac{L}{N_z}$

$N_R + 1$ nodos en R

$N_z + 1$ nodos en z

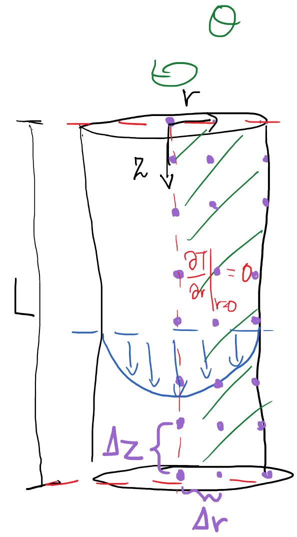
$r_i = i\Delta r \quad 0 \leq i \leq N_R$; $z_i = j\Delta z, \quad 0 \leq j \leq N_z$

$$k\frac{\partial^2 T}{\partial r^2} + k\frac{\partial^2 T}{\partial z^2} + \underline{\frac{k}{r}\frac{\partial T}{\partial r}} - \underbrace{\rho \hat{c}_p v_{max}}_{D}\left(1-\left(\frac{r}{R}\right)^2\right)\frac{\partial T}{\partial z} = 0$$



$r_i = i\Delta r$; $z_i = j\Delta z$

Donde $\Delta r = \frac{R}{N_R-1}$; $\Delta z = \frac{L}{N_z-1}$



$$k\frac{\partial^2 T}{\partial r^2}\Big|_{i,j} \approx \frac{k(T_{i-1,j}-2T_{i,j}+T_{i+1,j})}{\Delta r^2}$$

$$k\frac{\partial^2 T}{\partial z^2} \approx \frac{k(T_{i,j-1}-2T_{i,j}+T_{i,j+1})}{\Delta z^2}$$

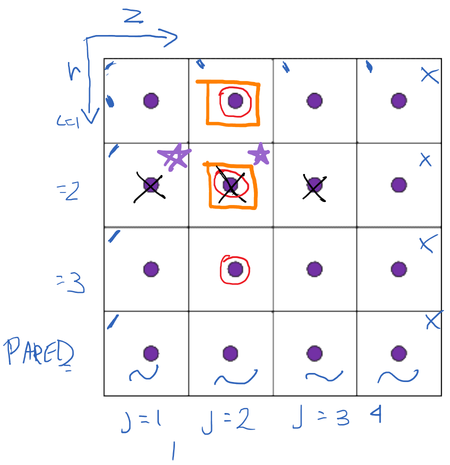
$$\frac{k}{r}\frac{\partial T}{\partial r} \approx \frac{k}{r_{i,j}}\frac{T_{i-1,j}-T_{i,j}}{\Delta r}$$

$$D\left(1-\left(\frac{r}{R}\right)^2\right)\frac{\partial T}{\partial z} \approx D\left(1-\left(\frac{r_{i,j}}{R}\right)^2\right)\frac{(T_{i,j-1}-T_{i,j})}{\Delta z}$$

$r_i = (i-1)\Delta r$; $z_i = (j-1)\Delta z$

$1 \le i \le N_{R+1}$; $1 \le j \le N_{z+1}$

Condiciones de Borde:



CB1) $T_{i,j=1} = T_1$

CB2) $\frac{T_{2,j}-T_{1,j}}{\Delta r} =$

$\Rightarrow T_{1,j} = T_{2,j}$

CB3) $\frac{T_{i,N_j+1}-T_{i,N_j}}{\Delta z} = 0$

$\Rightarrow T_{i,N_j} = T_{i,N_j+1}$

/ $T(r,z=0) = T_1$ ⟶

\ $\frac{\partial T}{\partial r}\Big|_{r=0,z} = 0$

× $\frac{\partial T}{\partial z}\Big|_{r,z=L} = 0$

∼ $k\frac{\partial T}{\partial r}\Big|_{r=R,z} = q_0$

CB4): $\frac{T_{N_R+1,j}-T_{N_R,j}}{\Delta r} = \frac{q_0}{k}$

$\Rightarrow T_{N_R+1,j} = T_{N_R,j} + \frac{q_0\Delta r}{k}$

$\forall j \in [1,\dots,N_z+1]$