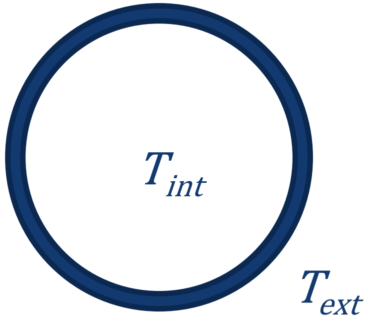
Conduction dans un cylindre

$$k\Delta T + P = \rho \hat{c}_p \frac{\partial T}{\partial t}$$

$$k\Delta T = 0 \text{ donc } \Delta T = 0$$

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial T}{\partial r}\right) + \frac{1}{r^2}\frac{\partial^2 T}{\partial \varphi^2} + \frac{\partial^2 T}{\partial z^2} = 0$$

$$\partial\left(r\frac{\partial T}{\partial r}\right) = 0 \Rightarrow \frac{\partial T}{\partial r} = \frac{C_1}{r} \Rightarrow T = C_1 ln(r) + C_2$$



Conduction dans un cylindre

$$T = C_1 ln(r) + C_2$$

$$\left.\begin{array}{ll} r = r_{int} & T = T_{int} \\ r = r_{ext} & T = T_{ext} \end{array}\right\} \Rightarrow \left\{\begin{array}{l} T_{int} = C_1 ln(r_{int}) + C_2 \\ T_{ext} = C_1 ln(r_{ext}) + C_2 \end{array}\right.$$

$$C_1 = \frac{T_{int} - T_{ext}}{ln\left(\frac{r_{int}}{r_{ext}}\right)}$$

$$C_2 = T_{int} - C_1 ln(r_{int})$$

$$\frac{T_{int} - T}{T_{int} - T_{ext}} = \frac{ln\left(\frac{r}{r_{int}}\right)}{ln\left(\frac{r_{ext}}{r_{int}}\right)}$$

Conduction dans un cylindre

$$q\Big|_r = -k\frac{\partial T}{\partial r} = -k\frac{C_1}{r} = -\frac{k}{r}\frac{T_{int} - T_{ext}}{ln\left(\frac{r_{int}}{r_{ext}}\right)}$$

$$\dot{Q} = (2\pi r_{int}L)q|_{r_{int}} = 2\pi kL\frac{T_{int}-T_{ext}}{ln\left(\frac{r_{ext}}{r_{int}}\right)}$$

$$R = \frac{1}{2\pi kL}ln\left(\frac{r_{ext}}{r_{int}}\right)$$