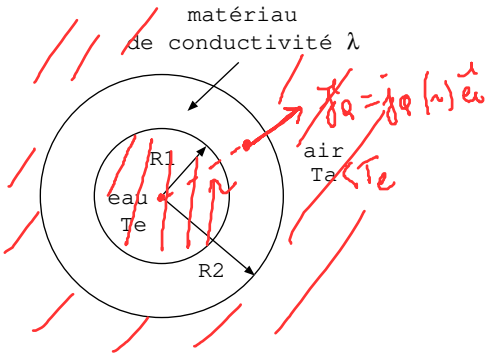
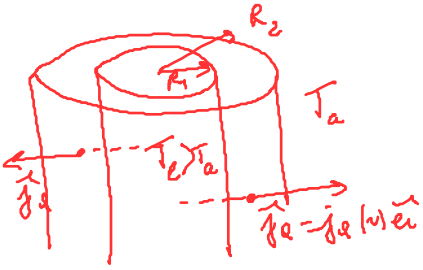
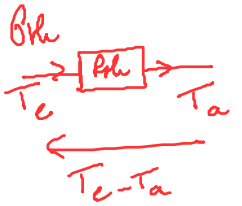
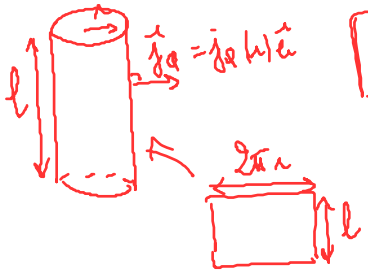
Exercice V : canalisation d'eau





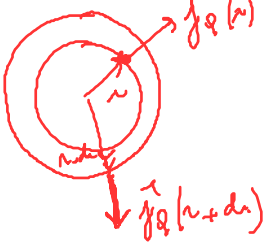


$$R_{th} = \frac{T_e - T_a}{\mathcal{P}_{th}}$$



$$\mathcal{P}_{th}(r) = j_Q(r) \times 2\pi r l$$

Système élémentaire : $r > R_1$ et $r + dr < R_2$



régime stationnaire

$\mathcal{P}_{entrée} = \mathcal{P}_{sortie}$

$\mathcal{P}_{th}(r+dr) = \mathcal{P}_{th}(r)$

$\Rightarrow \frac{d\mathcal{P}_{th}}{dr} = 0$

$\mathcal{P}_{th}$ ne dépend pas de r

Loi de Fourier : $\vec{j}_Q = -\lambda \overrightarrow{\text{grad}}\, T$ ou $j_Q = -\lambda \frac{dT}{dr}$

d'où $\mathcal{P}_{th} = -\lambda \frac{dT}{dr} \times 2\pi r l$

Cette

soit $\mathcal{P}_{th} \int_{r=R_1}^{r=R_2} \frac{dr}{r} = -\lambda 2\pi l \int_{T(r=R_1)=T_e}^{T(r=R_2)=T_a} dT \Rightarrow \mathcal{P}_{th} \ln\left(\frac{R_2}{R_1}\right) = -\lambda 2\pi l (T_a - T_e)$

$= \lambda 2\pi l (T_e - T_a)$

$$R_{th} = \frac{T_e - T_a}{\mathcal{P}_{th}} = \frac{\ln\left(\frac{R_2}{R_1}\right)}{2\pi l \lambda}$$

λ petit, matériau isolant, R_{th} grande