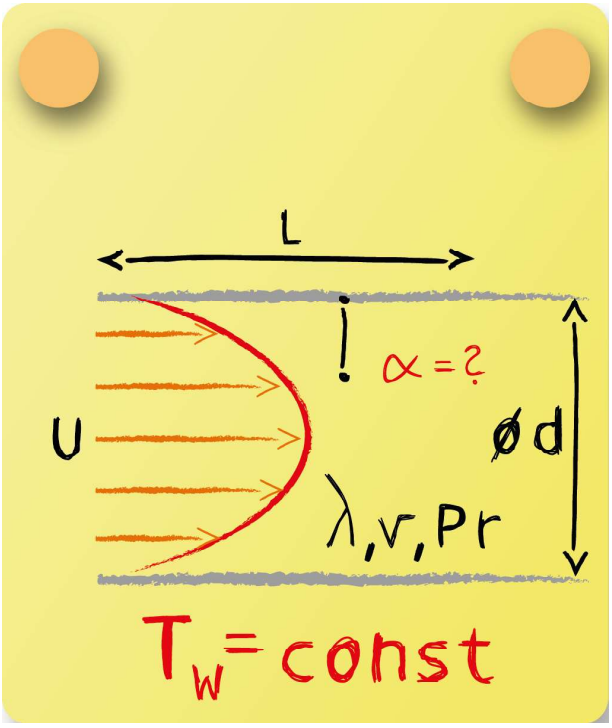
Heat Transfer Correlation 13.2



A fluid flows through a pipe with isothermal surface. Calculate the mean heat transfer coefficient $\bar{\alpha}$.

Reynolds number:

$$\mathrm{Re_d} = \frac{u \cdot d}{\nu} = 1266.67$$

Thermal entry length:

$$L_{\mathrm{th}} = 0.05 \cdot \mathrm{Re_d} \cdot \mathrm{Pr} \cdot d = 0.58 \text{ m} > L$$

Nusselt number:

$$\overline{\mathrm{Nu_d}} = \left(3.66 + \frac{0.0677 \cdot \left(\mathrm{Re_d} \cdot \mathrm{Pr} \cdot \frac{d}{L}\right)^{1.33}}{1 + 0.1 \cdot \mathrm{Pr} \cdot \left(\mathrm{Re_d} \cdot \frac{d}{L}\right)^{0.83}}\right) \cdot \left(\frac{\eta}{\eta_{\mathrm{w}}}\right)^{0.14} = 5.56$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\mathrm{Nu_d}} \cdot \lambda_{\mathrm{f}}}{d} = 30.03 \text{ W/m}^2\text{K}$$