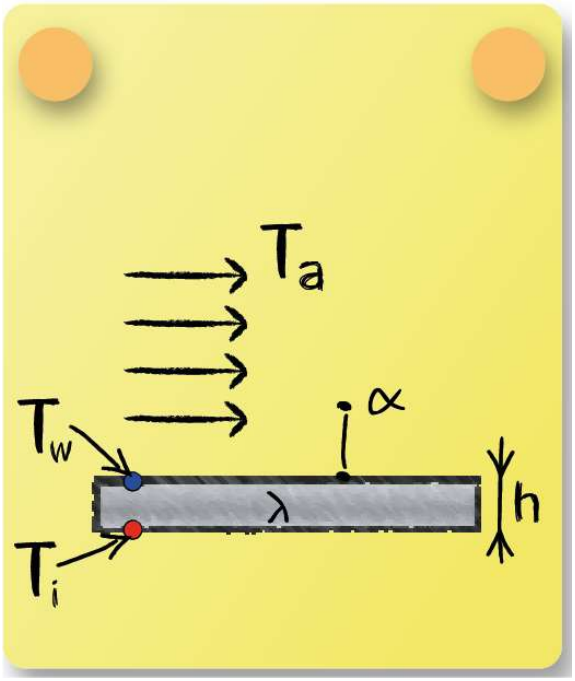
Lecture 6 - Question 3



Air blows over a horizontal steel hot plate. The plate surface is maintained at a constant temperature. Determine the heat transfer coefficient α. Take T_a= 20 $°C$, h = 0.1 m, T_w = 30 $°C$, T_i = 100 $°C$, λ = 2 W/mK.

In case of steady state heat transfer, the conductive and convective heat fluxes must equal each other in order to satisfy the energy conservation.

$$\dot{Q}_{cond} = \dot{Q}_{conv}$$

$$-\lambda \cdot A_s \cdot \frac{T_w - T_i}{dx} = \alpha \cdot A_s \cdot (T_w - T_\infty)$$

Rewriting yields:

$$\alpha = -\lambda \cdot \frac{T_w - T_i}{dx} \frac{1}{(T_w - T_\infty)}$$

Filling in the numerical values:

$$\alpha = -2 \cdot \frac{30-100}{0.1} \frac{1}{(30-20)} = 140\ W/m^2K$$