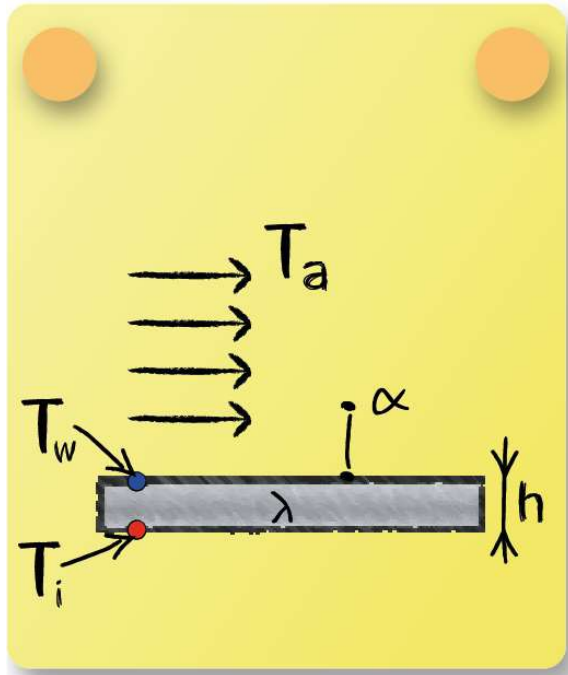


Lecture 6 - Question 3



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

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

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

$$-\lambda \cdot A_s \cdot \frac{T_w - T_i}{h} = \alpha \cdot A_s \cdot (T_w - T_a)$$



Rewriting yields:

$$\alpha = -\lambda \cdot \frac{T_w - T_i}{h} \frac{1}{(T_w - T_a)}$$

Filling in the numerical values:

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