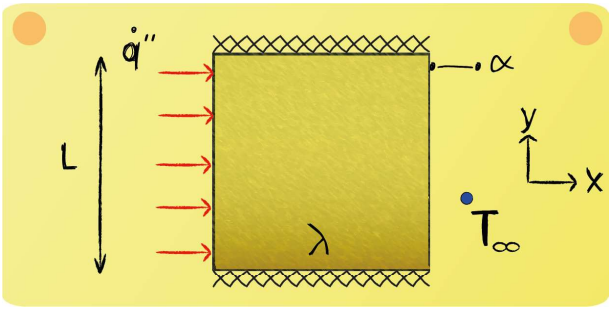
Lecture 6 - Question 7



A constant heat flux is entering a cube on the left side. At the same time is the cube losing heat on the right side due to convection. The other surfaces are fully adiabatic. Assume the process to be steady and the temperature inside the cube to be homogeneous. Develop an energy balance to calculate the cube temperature T_{w}.

Energy balance:

$$\dot{Q}_{x,in} - \dot{Q}_{x,out} = 0$$

The sum of the in- and outgoing heat fluxes of the control volume should equal zero, because of steady-state conditions.

Heat fluxes:

$$\dot{Q}_{x,in} = \dot{q}'' L^2$$

$$\dot{Q}_{x,out} = \alpha L^2 \left(T_w - T_\infty\right)$$