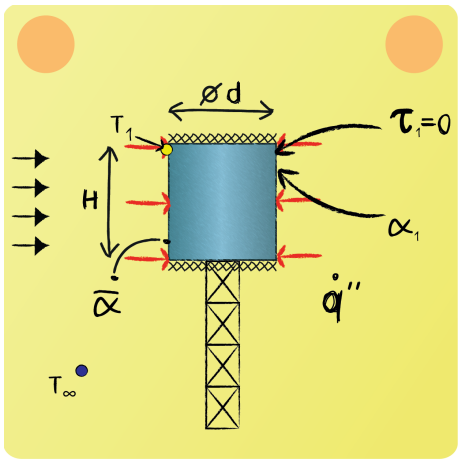
Exam Preparation Convection/Radiation 01

A cylindrical solar receiver with a homogeneous temperature T_1 is subjected to solar radiation. Assume steady-state conditions. Give an expression for the rate of heat loss from the solar receiver.



Rate of heat loss:

$$\dot{Q}_{\text{loss}} = \dot{Q}_{\text{emission}} + \dot{Q}_{\text{reflection}} + \dot{Q}_{\text{convection}} \tag{4}$$

Where:

$$\dot{Q}_{\text{emission}} = \alpha_1 dH\sigma T_1^4 \tag{5}$$

$$\dot{Q}_{\text{reflection}} = (1-\alpha_1)\,\dot{q}'' dH \tag{6}$$

$$\dot{Q}_{\text{convection}} = \overline{\alpha} dH\,(T_1 - T_\infty) \tag{7}$$

And thus:

$$\dot{Q}_{\text{loss}} = \dot{q}'' dH + \alpha_1 \left(dH\sigma T_1^4 - \dot{q}'' dH\right) + \overline{\alpha} dH\,(T_1 - T_\infty) \tag{8}$$