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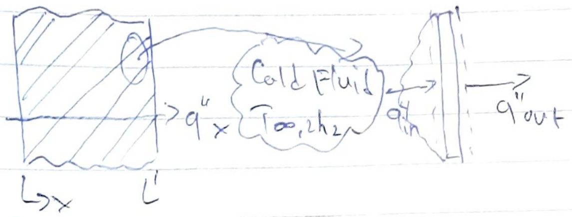
(1) Dik: Satu dimensi, sisi dinding memisahkan aliran panas dan dingin $T_{\infty,1}$ dan $T_{\infty,2}$, masing-masing

Dit: Distribusi temperatur, $T(x)$ dan heat flux, $q''_x$, dengan ketentuan $T_{\infty,1}, T_{\infty,2}, h_1, h_2, k$ dan L

Jawab




asumsi:
1. Kondisi satu dimensi
2. Kondisi Steady
3. Constant
4. Radiasi diabaikan
5. tidak ada generation

$T(x) = C_1 x + C_2$

$$-k\frac{dT}{dx}\Big]_{x=0} = h_1\left[T_{\infty,1} - T(0)\right] \qquad -k\frac{dT}{dx}\Big]_{x=L} = h_2\left[T(L) - T_{\infty,2}\right]$$

For BC at x: L to find

$$-k(C_1 + 0) = h_2\left[(C_1 + C_2) - T_{\infty,2}\right]$$

$$C_1 = -\frac{(T_{\infty,1} - T_{\infty,2})}{k\left[\frac{1}{h_1} + \frac{1}{h_2} + \frac{L}{k}\right]} \qquad C_2 = -\frac{(T_{\infty,1} - T_{\infty,2})}{h_1\left[\frac{1}{h_1} + \frac{1}{h_2} + \frac{1}{k}\right]} + T_{\infty,1}$$

$$T(x) = -\frac{(T_{\infty,1} - T_{\infty,2})}{\left[\frac{1}{h_1} + \frac{1}{h_2} + \frac{L}{k}\right]}\left[\frac{x}{k} + \frac{1}{h_1}\right] + T_{\infty,1}$$

menurut hukum Fourier, heat flux constan dan jadi:

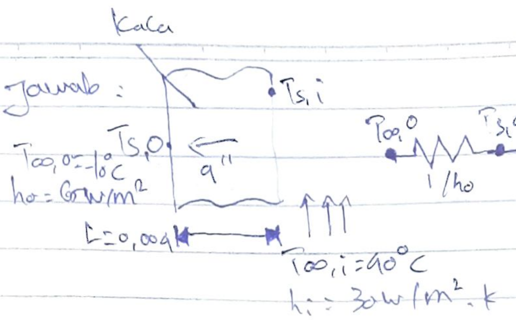
$$q''_x = -k\frac{dT}{dx} = -kC_1 = \frac{(T_{\infty,1} - T_{\infty,2})}{\left[\frac{1}{h_1} + \frac{1}{h_2} + \frac{L}{k}\right]}$$

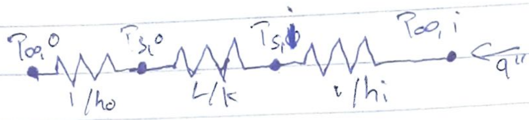
(2a) Dik: Temperatur dan koefisien konveksi terkait dengan udara didalam dan diluar permukaan dibelakang dinding

Dit: a) Temperatur di dalam dan diluar permukaan $T_{s,i}$ dan $T_{s,o}$

b) $T_{s,i}$ dan $T_{s,o}$ fungsi dari temperatur udara luar $T_{\infty,o}$ dan koefisien konveksi di luar.

Jawab :




Asumsi : 1) kondisi steady
2) konduksi satu dimensi
3) radiasi diabaikan
4) ~~tidak~~ barang konstant

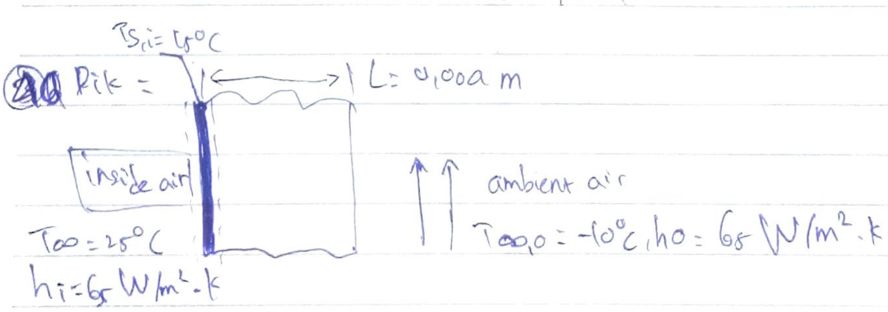
$$q'' = \frac{T_{\infty,i} - T_{\infty o}}{\frac{1}{h_o} + \frac{L}{k} + \frac{1}{h_i}} = \frac{40°C - (-10°C)}{\frac{1}{65 W/m^2.K} + \frac{0,004}{1,4 W/m.K} + \frac{1}{30 W/m^2.K}}$$

$$q'' = \frac{50°C}{(0,0154 + 0,0029 + 0,0333) m^2.K/W} = 968 W/m^2$$

$$T_{s,i} = T_{\infty,i} - \frac{q''}{h_i} = 40°C - \frac{968 W/m^2}{30 W/m^2.K} = 7,7°C$$

$$T_{s,o} = T_{\infty o} - \frac{q''}{h_o} = -10° - \frac{968 W/m^2}{65 W/m^2.K} = 4,9°C$$

**(4)** Rik =



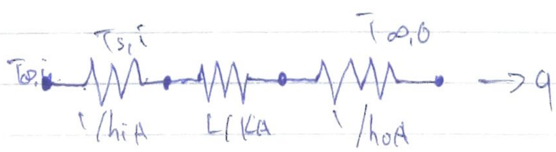




Table 3-4. Glass (300k) : $k = 1,4 W/m.K$

$$\frac{T_{\infty,i} - T_{s,i}}{1/h_i} + q''h = \frac{T_{s,i} - T_{\infty,o}}{L/k + 1/h_o}$$

$$q''h = \frac{T_{s,i} - T_{\infty,o}}{L/k + 1/h_o} - \frac{T_{\infty,i} - T_{s,i}}{1/h_i} = \frac{15°C - (-10°C)}{\frac{0,004 m}{1,4 W/m.K} + \frac{1}{65 W/m^2.K}} - \frac{25°C - 15°C}{\frac{1}{10 W/m^2.K}}$$

$$q''h = (1370 - 100) W/m^2$$
$$= 1270 W/m^2$$