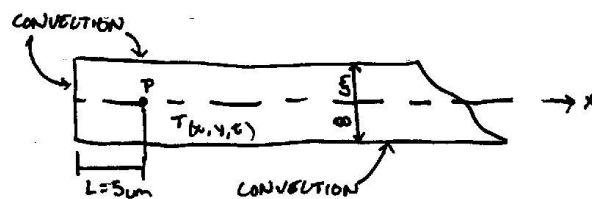


MICHAEL DELACRUZ

MET 440

HW 3.2

35) $T_i = 250^\circ\text{C}$ $x = L = 5\text{ cm}$ $\alpha = 5.4 \times 10^{-7} \text{ m}^2/\text{s}$
 $T_\infty = 25^\circ\text{C}$ $t = 2\text{ h}$
 $h = 100 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$ $k = 1 \text{ W}/(\text{m} \cdot ^\circ\text{C})$



B_i @ $L = 5 \text{ cm}$

$$B_i = \frac{hL}{k} = \frac{100(0.05)}{1} = 5$$

$$Z_1 = 1.3138 \quad C_1 = 1.2402$$

F_o @ $L = 5 \text{ cm}$

$$F_o = \frac{\alpha t}{L^2} = \frac{(5.4 \times 10^{-7})(7200)}{0.05^2} = 0.0776$$

~~$t = 2\text{ h} \times \frac{60\text{ min}}{1\text{ h}} \times \frac{60\text{ s}}{1\text{ min}} = 7200\text{ s}$~~

~~$2\text{ h} \times \frac{60\text{ min}}{1\text{ h}} = 120\text{ min}$~~

~~$\theta_0 = C_1 e^{-Z_1^2 t} = 1.2402 e^{-(1.3138^2)(7200)}$~~

~~$\theta_0 = C_1 e^{-Z_1^2 t} = 1.2402 e^{-(1.3138^2)(120)}$~~

~~$\frac{T(x, t) - T_\infty}{T_i - T_\infty} = \theta_0$~~

~~$\frac{T(x, t) - 25^\circ\text{C}}{250^\circ\text{C} - 25^\circ\text{C}} = \theta_0$~~

~~$T(x, t) = \theta_0(225^\circ\text{C}) + 25^\circ\text{C}$~~

$$\frac{T(x, y, z) - T_\infty}{T_i - T_\infty} = C_1 \exp(-Z_1^2 t)$$

$$\frac{T(x, y, z) - 25}{250 - 25} = 1.2402 \exp(-1.3138^2 \cdot 2)$$

$$= 0.039287(225) + 25 = \boxed{28.8^\circ\text{C}}$$