ASSIGNMENT 4

Name :- Ravi shankar
Roll no :- 200778

Topic :-Double pipe heat exchanger

Formula

For inner cylinder

$$\frac{dT_1}{dt} = \frac{\dot{m}_1 C_{p1}\left(T_1(i-1) - T_1(i)\right) + U.2\pi r_1 \Delta x\left(T_2(i) - T_1(i)\right)}{\rho_1 C_{p1} A_{c1} \Delta x}$$

For outer cylinder

$$\frac{dT_2}{dt} = \frac{\dot{m}_2 C_{p2}\left(T_2(i-1) - T_2(i)\right) - U.2\pi r_1 \cdot \Delta x\left(T_2(i) - T_1(i)\right)}{\rho_2 C_{p2} A_{c2} \Delta x}$$

Assignment Question

Solve, and obtain the transient response of Temperature with time for the concentric cylinder double pipe heat exchanger, as shown above. Details:

1) Length of pipe = L = 60 m
2) Inner radius = r1 = 0.1 m
3) Outer radius = r2 = 0.15 m
4) Number of internal points = n = 100 (Can increase this for better accuracy)

5) For fluid 1 (Water here):
    1) m1 = Mass flow rate = 3 kg/s
    2) Cp1 = Heat capacity of fluid (water) = 4180 J/kg.K3) rho1 = Density of fluid (water) = 1000 kg/m^3 6) For fluid 2 (Water here again):
    1) m2 = Mass flow rate = 5 kg/s

2) Cp2 = Heat capacity of fluid (water) = 4180 J/kg.K
3) rho2 = Density of fluid (water) = 1000 kg/m^3

7) Initial temperature of fluid throughout the pipe = T0 = 300K
8) Inlet temperature of fluid 1 = T1i = 400 K
9) Inlet temperature of fluid 2 = T2i = 800 K
10) Overall heat transfer coefficient = U = 340 W/m^2 Simulate for t_final = 1000 seconds,with a time step (Δt) of 1 sec for each step.

For each time step, get the temperature profile (T1 and T2 for the whole pipe) and plot them in a single figure. Clear the figure, and update that plot with the next figure (next time step).

Temperature profile of inner and outer cylinder