The below equations are those used in the modeling of Integrated Concentrating Solar and Heat Losses for a High Temperature Thermal Fluid and Surrounding Air Cavity of a Double Skin Facade.

Definitions:

θ_i = Temperature of water at node "i"

ϕ_i = Temperature of water at node "i"

where:

$T_i = \theta_i;\ T_{i+1} = \phi_i;\ T_{i+2} = theta_{i+1};\ T_{i+3} = \theta_{i+1}$ and so on

0.1 Residual: Heat Balance Between Thermal Fluid and Surrounding Air

0.1.1 Region 1

Pipe region heat balance:

$$Q_{water} = m_{water} C_{p_{water}} (T_{i+2} - T_i) - \frac{\left(\frac{T_{i+3} - T_{i+1}}{2} - \frac{T_{i+2} - T_i}{2}\right)}{R_{Pipe}} = 0$$

$$R_{Pipe} = \frac{1}{h_{intPipe} A_{insideSurface}} + \frac{\frac{r_{o_{tubing}}}{r_{i_{tubing}}}}{k_{siliconTubing} A_{tubingSurface}} + \frac{\frac{r_{o_{insulation}}}{r_{i_{tubing}}}}{k_{Insulation} A_{InsulationSurface}} + \frac{1}{h_{extPipe} A_{outsideSurface}}$$

This equation is then reused for the air balance:

$$Q_{air} = m_{air} C_{p_{air}} (T_{i+3} - T_{i+1}) + \frac{\left(\frac{T_{i+3} - T_{i+1}}{2} - \frac{T_{i+2} - T_i}{2}\right)}{R_{Pipe}} - \frac{T_{interior} - \frac{T_{i+3} + T_P i+1}{2}}{R_{IntToCavity}} - \frac{T_{exterior} - \frac{T_{i+3} + T_P i+1}{2}}{R_{ExtToCavity}} = 0$$

$$R_{IntToCavity} = \frac{L_{glass}}{k_{glass} A_{surface}} + \frac{L_{gap}}{k_{argon} A_{surface}} \frac{L_{glass}}{k_{glass} A_{surface}}$$

$$R_{ExtToCavity} = \frac{L_{glass}}{k_{glass} A_{surface}}$$

0.1.2 Region 2

$$Q_{water} = m_{water} C_{p_{water}} (T_{i+4} - T_{i+2}) + Q_{receiver}$$

$$Q_{air} = m_{air} C_{p_{air}} (T_{i+5} - T_{i+3}) + Q_{receiver}$$