Electronic Supplementary Information

Steam generator energy balance:

1-Heat source energy balance

$$\left[\left(M_{hw}.Cp_{hw}\right)\right]\frac{dT_{hw}}{dt}=\left(\dot{m}_{hw,}\,h_{f,Thw,in}\right)-\left(\dot{m}_{hw}\,h_{f,Thw,out}\right)-h_{in,o}.A_{in,i}\left(T_{hw}-T_{tube,i}\right)$$

2- Tube metal energy balance

$$\left[\left(M_{HX,i}.Cp_{hx,i}\right)\right]\frac{dT_{tube,i}}{dt}=h_{in,i}.A_{in,i}\left(T_{hw,i}-T_{tube,i}\right)-h_{out,i}.A_{out,i}\left(T_{tube,i}-T_{v,i}\right)$$

3- Brine inventory balance

$$\frac{dM_{b,i}}{dt}=\dot{m}_{f,i}-\dot{m}_{b,i}-\dot{m}_{v,i}$$

4- Evaporator energy balance

$$\left[\left(M_{b,i}.Cp_{b,Tb}\right)+\left(M_{HX,i}.Cp_{HX}\right)\right]\frac{dT_{i}}{dt}=\left(\dot{m}_{f,i}\,h_{f,Tf}\right)-\left(\dot{m}_{b,i}\,h_{f,Tb}\right)-\left(\dot{m}_{v,i}\,h_{g,Tv}\right)+Q_{in,i}$$

5-Salt balance

$$M_{b,i}\,\frac{dX_{b,i}}{dt}=\left(\dot{m}_{f,i}\,X_{f,i}\right)+\left(\dot{m}_{b,i}\,X_{b,i}\right)-\left(\dot{m}_{v,i}\,X_{v,i}\right)$$

6- Connective heat transfer coefficient[35]

$$Nu=\frac{h_{in,i}d_{in,i}}{K_{tube,i}}=0.023\,\mathrm{Re}_{l}^{0.80}\,\mathrm{Pr}_{l}^{0.40}$$

7- Falling film heat transfer coefficient[36]

$$h_{o}=\left[0.277\left\{\frac{\mu_{l}^{2}}{g.\rho_{l}^{2}.k_{l}^{3}}\right\}^{-0.333}\mathrm{Re}_{\Gamma}^{-2.11}\,\mathrm{Pr}^{4.55}\left\{2.\exp\left(\frac{S}{S_{o}}\right)-1\right\}^{-0.41}\left(\frac{T_{sat}}{T_{ref}}\right)^{14.70}\right]+\left[0.885\left(\frac{q}{\Delta T}\right).\left(\frac{v_{g}}{v_{ref}}\right)^{-0.34}\right]$$

$$Q_{in}=h_{o,i}A_{i}\left(T_{t}-T_{v,i}\right)$$

8- Condensation heat transfer coefficient

$$Nu = \frac{h_{in,i+1} L_{i+1}}{K_{tube,i+1}} = 0.728 \left[\frac{g h_{fg,Tcond} \rho_{l,Tcond} \left(\rho_l - \rho_v\right)_{Tcond} K^3_{l,Tcond}}{\mu_{l,Tcond} d_i \left(T_{v,i+1} - T_{tube,i+1}\right)} \right]^{1/4}$$

9- Overall heat transfer coefficient

$$U_i A_i = \frac{1}{\frac{1}{h_{in,i} A_{in,i}} + R_{wall,i} + \frac{1}{h_{out,i} A_{out,i}}}$$

10- Condenser side energy balance

$$\left[\left(M_{l,i+1}.Cp_{l,Tcond}\right)\right]\frac{dT_{cond,i+1}}{dt} = \left[\dot{m}_{v,}\, h_{fg,Tv}\right]_i - \left[h_{in}.A_{in}\left(T_{cond} - T_{tube}\right)\right]_{i+1}$$

Intermediate stages model

11- Tube material energy balance

$$\left[\left(M_{HX,i+1}.Cp_{hx,i+1}\right)\right]\frac{dT_{tube,i+1}}{dt} = h_{in,i+1}.A_{in,i+1}\left(T_{cond,i+1} - T_{tube,i+1}\right) - h_{out,i+1}.A_{out,i+1}\left(T_{tube,i+1} - T_{v,i+1}\right)$$

12- Evaporator side energy balance

$$\left[\left(M_{b,i+1}.Cp_b\right) + \left(M_{HX,i+1}.Cp_{HX,i+1}\right)\right]\frac{dT_{i+1}}{dt} = \left(\dot{m}_{f,i+!}\, h_{f,Tf}\right) - \left(\dot{m}_{b,i+1}\, h_{f,Tb}\right) - \left(\dot{m}_{v,i+1}\, h_{g,Tv}\right) + Q_{in,i+1}$$

$$Q_{in,i+1} = h_{out,i+1} A_{i+1}\left(T_{t,i+1} - T_{v,i+1}\right)$$

13- Brine inventory balance

$$M_{b,i+1}\frac{dX_{b,i+1}}{dt} = \left(\dot{m}_{f,i+1}\, X_{f,i+!}\right) - \left(\dot{m}_{b,i+1}\, X_{b,i+1}\right) - \left(\dot{m}_{v,i+!}\, X_{v,i+!}\right)$$

14- Salt balance

$$M_{b,i+1}\frac{dX_{b,i+1}}{dt}=\left(\dot{m}_{f,i+1}\,X_{f,i+!}\right)-\left(\dot{m}_{b,i+1}\,X_{b,i+1}\right)-\left(\dot{m}_{v,i+!}\,X_{v,i+!}\right)$$

15- Energy balance of last stage of MED integrated with AD

$$\left[\left(M_{b,n}.Cp_{b}\right)+\left(M_{HX,n}.Cp_{HX,n}\right)\right]\frac{dT_{n}}{dt}=\left(\dot{m}_{f,n}\;h_{f,Tf}\right)-\left(\dot{m}_{b,n}\;h_{f,Tb}\right)-\left(M_{sg}\,h_{g,Tv}\right)\frac{dq_{ads}}{dt}+Q_{in,n}$$