14/05/2014

ρ_a, c_a, ρ_w, c_w densities & sp. heat for air & wall

γ_{aw}, γ_{we} convective heat xfer coeffs (air/wall, wall/ext)

Energy equations for air & wall

$V_a = L\,H\,W \qquad V_w = H\,W\,T$

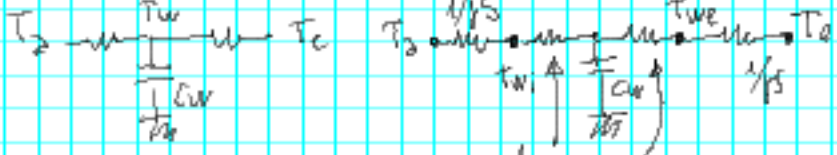
$S = H\,W$

$$\rho_a V_a c_a \frac{dT_a}{dt} = P_h + P_i - \gamma_{aw} S \left(T_a - T_w\right) - W_r c_a \left(T_a - T_e\right)$$

$$\rho_w V_w c_w \frac{dT_w}{dt} = \gamma_{aw} S \left(T_a - T_w\right) - \gamma_{we} S \left(T_w - T_e\right)$$

Note: unreviewed material

This is true if we disregard the wall thermal R_2, or alternatively include it in the contact ones



$$\frac{1}{\lambda S/(Y/2)} = \frac{Y}{2\lambda S}$$

$\lambda \approx 2.5$

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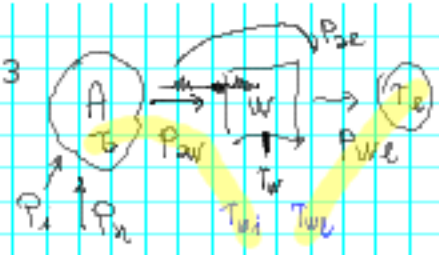
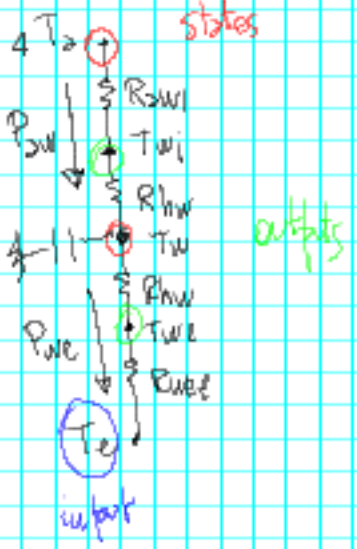


$$R_{pwi} = 1/\gamma_{pw} S$$
$$R_{wee} = l/\gamma_{we} S$$
$$R_{kw} = \tau/2\lambda S$$

$$\begin{cases} \rho_p V_p c_p \dfrac{dT_p}{dt} = P_i + P_h - P_{pe} - P_{pw} \\ \rho_w V_w c_w \dfrac{dT_w}{dt} = P_{pw} - P_{we} \end{cases}$$

$$\begin{cases} P_{pe} = W_p c_p (T_p - T_e) \\ P_{pw} = \dfrac{1}{R_{pwi} + R_{kw}} (T_p - T_w) \\ P_{we} = \dfrac{1}{R_{kw} + R_{wee}} (T_w - T_e) \end{cases}$$



$$T_{wi} = T_w + P_{sw} R_{hw}$$

$$T_{we} = T_w - P_{we} R_{hw}$$

Ideal HP for heating

Parameters

T_h, capacities $C_{h,c}$

T_h, conductances $G_{hp,i,e}$

COP (fixed)

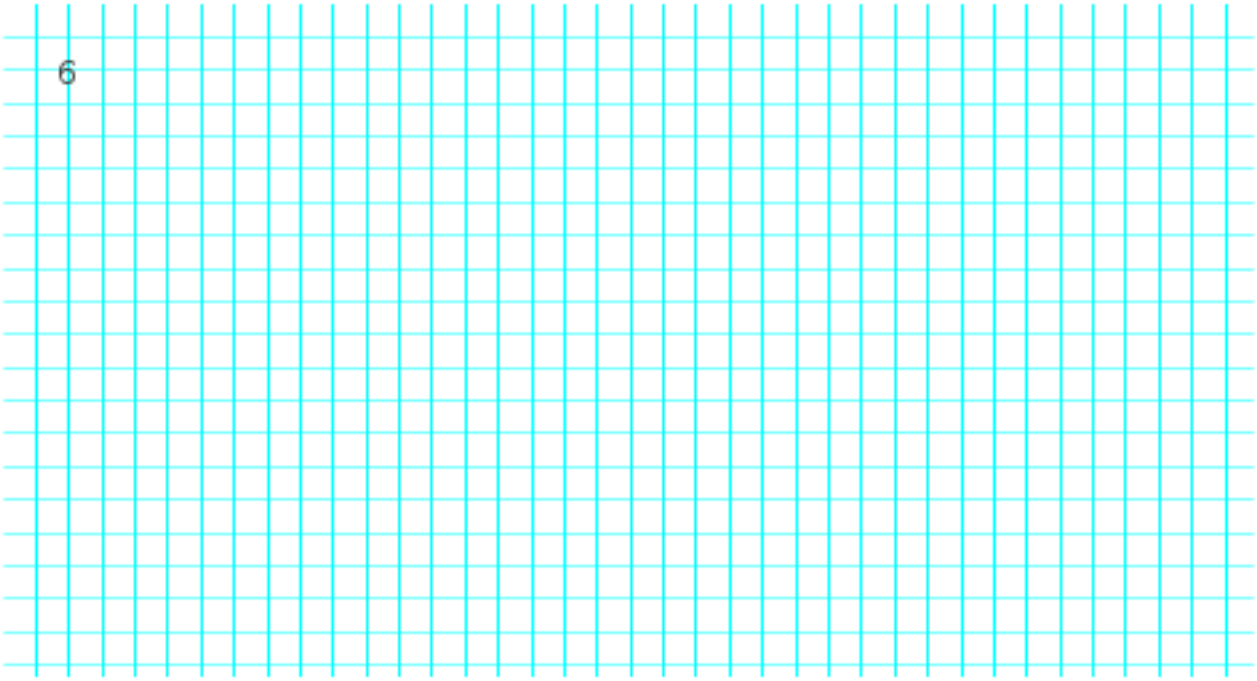
Equations:

$C_h \dot{T}_h = \dot{Q}_h - G_{hpi}(T_h - T_a)$

$C_c \dot{T}_c = G_{hpe}(T_e - T_c) - \dot{Q}_c$

$\dot{Q}_h = \dot{Q}_c + P_{hp}$

$\dot{Q}_h / P_{hp} = COP$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