**Moderator Heat Transfer**

Natural convection heat transfers given by churchil and chu correlation

$$ Nu\_{D}=\left\{0.6+\frac{0.387 Ra\_{D}^{^{1}/\_{6}}}{\left[1+\left(^{0.559}/\_{Pr}\right)^{^{9}/\_{16}}\right]^{^{8}/\_{27}}}\right\}^{2}$$

Whereas the nucleate boiling heat transfer is calculated by *Rohsenow* correlation simplified at moderator conditions.

$$q=C\left(T\_{w}-T\_{s}\right)^{3}$$

The critical Heat flux (CHF) for sub-cooled pool boiling is calculated using *Thibault* correlation,

$$\frac{q\_{chf sub}}{q\_{chf sat}}=1.006+0.0436\left(T\_{sat}-T\_{b}\right)$$

The saturated pool boiling CHF is calculated using Modified *Zuber* correlation.

$$q\_{chf sat}=0.118h\_{fg}\left(σgρ\_{g}^{2}\left(ρ\_{f}-ρ\_{g}\right)\right)^{0.25}$$

The Minimum Film Boiling Temperature as function of fluid sub-cooling is given by *COG* correlation,

$$∆T\_{mfb}=5.86∆T\_{sub}+341.9$$

The rounding of the boiling curve at the top was approximated by a constant heat flux equal to the critical heat flux for an interval of 10°C beginning at the temperature of the critical heat flux. The heat flux in the transition boiling regime was assumed to decrease from critical heat flux to the minimum film boiling heat flux along two straight lines which intersected at a heat flux of

$$q=\frac{q\_{chf}-q\_{min}}{3}$$

and temperature of

$$T=\frac{2}{3}\left(T\_{CHF}-T\_{MIN}\right)$$

The minimum heat flux is calculated using *COG* correlation given above.

The film boiling heat transfer is given by *Gillespie and Moyer* correlation

$$q\_{fb}=0.2\left(1+0.031\left(T\_{sat}-T\_{b}\right)\right)$$