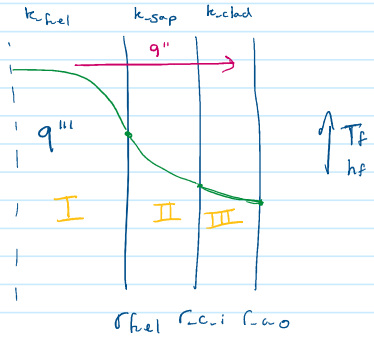
Monday, November 10, 2025 2:15 PM

Start Over



$\nabla k \nabla T + q''' = 0$

$\frac{1}{r}\frac{d}{dr}\left(r\frac{dT_I}{dr}\right) = \frac{-q'(z)}{\pi r^2 \cdot k_{fuel}}$

$r\frac{dT_I}{dr} = \frac{-q'(z)}{\pi \cdot k_{fuel}}\ln(r) + C_1$

$\frac{dT_I}{dr} = \frac{-q'(z)}{\pi \cdot k_{fuel}}\cdot\frac{\ln(r)}{r} + \frac{C_1}{r}$

$T_{I(r)} = \frac{-q'(z)}{2\pi k_{fuel}}\cdot(\ln(r))^2 + C_1\ln(r) + C_2$

$\nabla^2 T = 0$

$\frac{1}{r}\frac{d}{dr}\left(r\frac{dT_{II}}{dr}\right) = 0$

$r\frac{dT_{II}}{dr} = C_3$

$\frac{dT_{II}}{dr} = \frac{C_3}{r}$

$T_{II} = C_3\ln(r) + C_4$

$\nabla^2 T = 0$

$\frac{1}{r}\frac{d}{dr}\left(r\frac{dT_{III}}{dr}\right) = 0$

$r\frac{dT_{III}}{dr} = C_5$

$\frac{dT_{III}}{dr} = \frac{C_5}{r}$

$T_{III}(r) = C_5\cdot\ln(r) + C_6$

① $T_I(r_{fuel}) = T_{II}(r_{fuel})$

② $-k_{fuel}\left.\frac{dT_I}{dr}\right|_{r_{fuel}} = -k_{gap}\left.\frac{dT_{II}}{dr}\right|_{r_{fuel}}$

③ $-k_{gap}\left.\frac{dT_{II}}{dr}\right|_{r_{c,i}} = -k_{clad}\left.\frac{dT_{III}}{dr}\right|_{r_{c,i}}$

⑤ $T_{II}(r_{c,i}) = T_{III}(r_{c,i})$

④ $-k_{clad}\left.\frac{dT_{III}}{dr}\right|_{r_{c,o}} = q'' \Rightarrow h(T_w - T_f)$ if $T_{(w)} \le T_{sat}$

$= \left(\left(S\cdot h_{i\phi}(T_w - T_f)\right)^2 + \left(F h_{NB}(T_w - T_{sat})\right)^2\right)^{\frac{1}{2}}$ if $T_w \ge T_{sat}$

$T_w = T_{III}(r_{c,o})$

calculate $h \rightarrow r_{x_c}$

④ $-k_{clad}\cdot\frac{C_5}{r_{c,o}} = q'' = \begin{cases} h(C_5\ln(r_{c,o}) + C_6 - T_f) \\ \left(\left(S\cdot h_{i\phi}(T_w - T_f)\right)^2 + \left(F\cdot h_{NB}(T_w - T_{sat})\right)^2\right)^{\frac{1}{2}} \end{cases}$

③ $-k_{gap}\cdot\frac{C_3}{r_{c,i}} = -k_{clad}\cdot\frac{C_5}{r_{c,i}} \rightarrow C_3 = \frac{k_{clad}}{k_{gap}}\cdot C_5$

⑤ $C_3\ln(r_{c,i}) + C_4 = C_5\cdot\ln(r_{c,i}) + C_6$

② $\frac{q'(z)}{\pi(r_{fuel})}\cdot\ln(r_{fuel}) - \frac{k_{fuel}\cdot C_1}{r_{fuel}} = -k_{gap}\cdot\frac{C_3}{r_{fuel}}$ → $C_1 = 0$?

$C_3 = \frac{1}{-k_{gap}}\left(\frac{q'(z)}{\pi}\ln(r_{fuel}) - C_1 k_{fuel}\right)$

① $\frac{-q'(z)}{2\pi\cdot k_{fuel}}\left(\ln(r_{fuel})\right)^2 + C_1\ln(r_{fuel}) + C_2 = C_3\cdot\ln(r_{fuel}) + C_4$