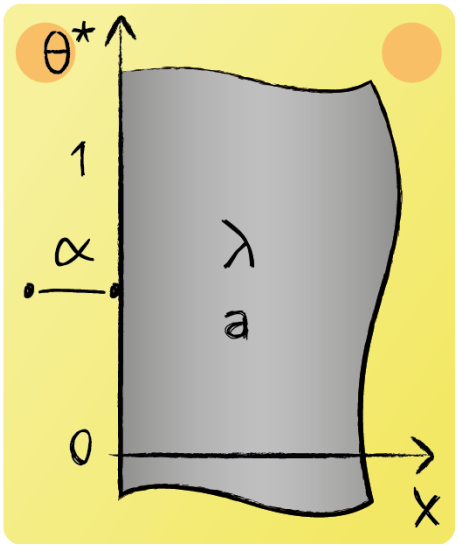
Lecture 16 Question 4

Consider a plate for which $\mathrm{Bi} \approx 1$. Which transient model is applicable for determening the change of its temperature over time?
Hint: The given temperature change has not yet penetrated deep under the surface and heat transfer is one-dimensional.



$$\Theta^* = \frac{T(t)-T_0}{T_\infty - T_0} = 1 - \mathrm{erf}\left(\frac{1}{\sqrt{4 \cdot \mathrm{Fo}}}\right) - \left[\exp\left(\mathrm{Bi_x} + \mathrm{Fo} \cdot \mathrm{Bi_x^2}\right)\right] \cdot \left[1 - \mathrm{erf}\left(\frac{1}{\sqrt{4 \cdot \mathrm{Fo}}} + \sqrt{\mathrm{Fo}} \cdot \mathrm{Bi_x}\right)\right]$$

The model given above is applicable for a semi-infinite plate, non negligible heat transfer resistance: