Department of Mechanical Engineering
Indian Institute of Technology Kanpur
ME685A: Home Assignment 10

Due: on or before November 11, 2021

This assignment must be your own work. Taking help from others or helping others are not allowed.

As discussed in class, numerically solve the following Equation of transient heat conduction in a triangular fin for $m = 100$

$$\frac{\partial \theta}{\partial \tau} = \frac{\partial^2 \theta}{\partial z^2} + \frac{1}{z-1}\frac{\partial \theta}{\partial z} + \frac{m}{z-1}\theta; \theta(\tau = 0) = 0; \theta(z = 0) = 1; \frac{\partial \theta}{\partial z}(z = 1) = 0 \qquad (1)$$

1. Write a pseudocode for solving the above problem
2. Write a computer program in any language without using any built-in PDE-solver libraries
3. Solve the above problem numerically. For the numerical solution, the resulting linear system should be solved applying Thomas algorithm repetitively. All discretizations must be at least second-order accurate.
4. Plot (a) temperature vs. distance at three different times (on the same plot), so that we can see the transient variation (one at steady state, one near $\tau = 0$, and one in between), (b) on the same plot compare the steady state solution with the results obtained from the steady solver (HW 9); plot the results of steady solver as points, keep reasonable distance between the points. If your computation is right, the points (obtained from the steady solver) will match with the steady-state temperature profile (plotted as a line), obtained from the transient solver Plot may be created using any standard software; hand-drawn plots will not be accepted
5. Create a *pdf* document that includes pseudocode, plot and other relevant information/calculations. Write your name and roll no at the top of each page. Also write your name and roll no in the computer program (duly commented). Put the above *pdf* document and the computer program in a folder. Name the folder as $< name > \_ < roll > \_ < hw10 >$. Zip the folder and upload in MooKit.

Your program file must be a plain text file. The file extension should be as per your programming language (*.c, *.cpp,*.f90,*.py etc.)