Department of Mechanical Engineering
Indian Institute of Technology Kanpur
ME685A: Home Assignment 9

Due: on or before November 01, 2021

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

Solve the following BVP using finite difference

$$\frac{d^2\theta}{dx^2} - m^2\theta = 0 \tag{1}$$

with the boundary conditions

$$\theta\,(x=0) = 1; \quad \frac{d\theta}{dx}\,(x=1) = 0 \tag{2}$$

use $m = 50$, $\Delta x = 0.01$

1. Write a pseudocode for solving the above problem

2. Write a computer program in any language without using any built-in ODE-solver libraries

3. Solve the above problem both analytically and numerically. For the numerical solution, the resulting linear system should be solved using Thomas algorithm. All discretizations must be at least second-order accurate.

4. In one figure, plot θ (numerical solution) and the θ_a (analytical solution) vs. x

5. Create a *pdf* document that includes pseudocode, plot, analytical solution 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 $< name > \_ < roll > \_ < hw9 >$. 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.)