

Assignment -1 (Computational Method)

Question : Consider the system in which a thin rod of **length $L=10\text{cm}$** is placed between two heat reservoirs kept at 100 and 50°C , respectively. The initial temperature of the rod is 0°C . Write a code to compute heat evolution **for 1st 50sec in the rod** using **explicit method** of solving heat equation. **Plot the result** in a 2D contour or surface plot for two values of $s (=|\otimes t/\otimes x^2|)$ greater and less than 0.5 . **Fill the compliance sheet.**

Initial condition: $u(0 < x < L, t=0) = 0^\circ\text{C}$

Boundary condition: $u(0,t) = 100^\circ\text{C}$ and $u(50,t) = 50^\circ\text{C}$ at all t

Compliance sheet

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Question no: 1

Inputs required by the code (if any): No

Programming Language: Python

For heat equation:

Method used: Explicit

Parameter set 1 ($s < 0.5$)

$\Delta x = 1$; $\Delta t = 1$; $\kappa = 0.1$; $s = 0.1$;

Parameter set 2 ($s > 0.5$)

$\Delta x = 1$; $\Delta t = 1$; $\kappa = 0.9$; $s = 0.9$;

Oscillations observed (Yes/No): Yes

Code:

```
import math

dx,dt = 1,1
L,k=10,0.9
s=k*dt/(dx*dx)

u = [100]
for j in range(9):
    u.append(0)
    u.append(50)

for t in range(50):
    x=0
    for j in range(1,10):
        u[j]=s*u[j-1]+(1-2*s)*u[j]+s*u[j+1]
        x=x+dx

    print('Time ',t)
    for i in range(0,11):
        print(i,u[i])
```

Graphs:



