Python For Chemical Engineering

Assignment 2:

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Aim: To simulate 2d heat flow in a metal plate

Given:

del_x=1 m

alpha=2

del_t=0.01 s

del_y=1 m

x=50 m

y=50 m

Time for which the simulation is to run = t_iter =500

Algorithm:

1) Calculate gamma for given values using the following equation

$$\gamma = \frac{\alpha \triangle t}{\triangle x^2}$$

2) Initialize the temperature matrix as a 3d matrix to vary it with time/iterations as well and set the given boundary conditions
3) For every iterations, calculate the values of temperature at every point using the following equations,
    a. For k varies from 0 to t_iter-1

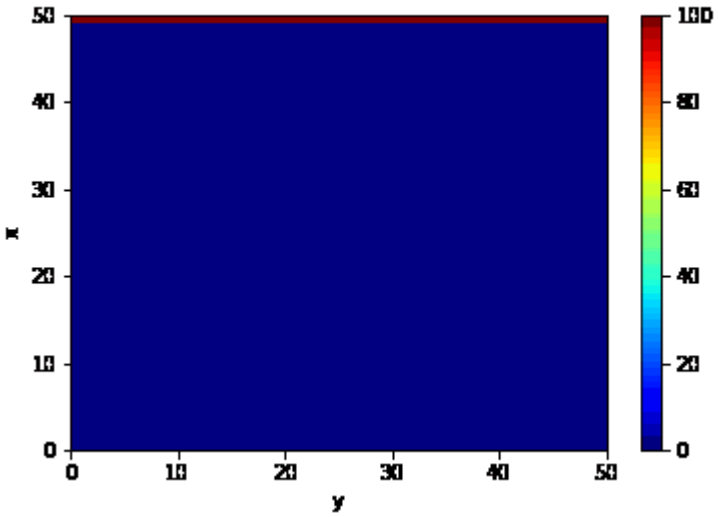
        For i,j varies from 1 to x-1,y-1 respectively:

$$T^{k+1}{}_{x,y} = \gamma(T^{k}{}_{x+1,y} + T^{k}{}_{x-1,y} + T^{k}{}_{x,y+1} + T^{k}{}_{x,y-1} - 4T^{k}{}_{x,y}) + T^{k}{}_{x,y}$$

4) Plot the temperature matrix on a heatmap
5) Using “animation.FuncAnimation” simulate the following heatmap such that it varies with time/ iterations
6) Save the simulation in form of ‘gif’ or ‘mp4’ using “anim.save”.

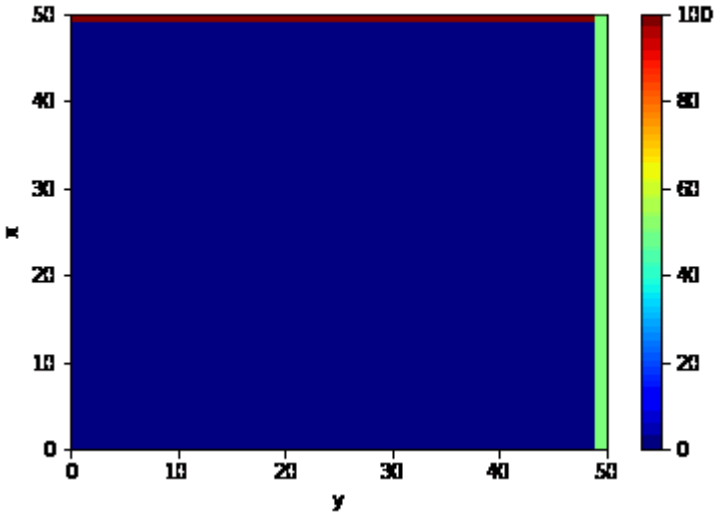
Observations:

A) When only the top plate has T=100K



The flow of heat in the metal plate can be seen easily with the help of the simulation.

B) When the top and the side edge of the plate have temperature of 100K and 50K respectively,



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