Heat Diffusion Solution

The Unsteady Heat Diffusion equation has been solved with the given initial condition and boundary conditions.The file udiff.cpp contains c++ program which solves the equation and the file plotdata.m contains MATLAB program to plot data generated from solving the equation.
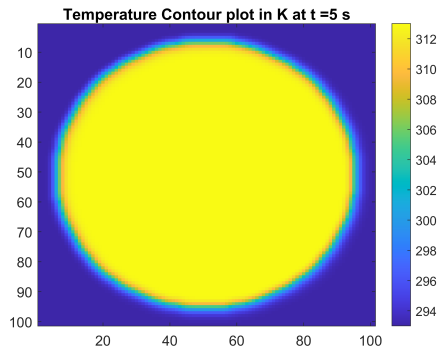
The unsteady heat diffusion equation (heat conduction where T is temperature) as follows,

$$\frac{\partial T}{\partial t} = \alpha * \left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} \right)$$
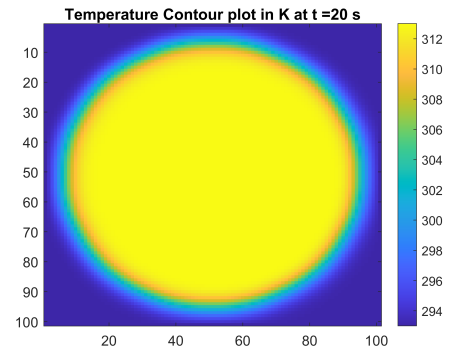
Finite Difference explicit scheme was used to discretize the equation.For time Forward Difference scheme of first order was used and for spatial discretization central diffrencing scheme of second order was used. The final discretized equation is as follows,

$$T_{i,j}^{n+1} = T_{i,j}^{n} + \left(\frac{\alpha * \Delta t}{\Delta^2} \right) * \left[T_{i+1,j}^{n} + T_{i-1,j}^{n} - 4 * T_{i,j}^{n} + T_{i,j+1}^{n} + T_{i,j-1}^{n} \right]$$
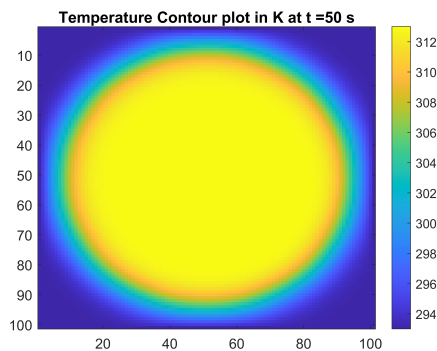
where α is coefficient of thermal expansion, n is time index and i,j are space index. The Temperature output was saved for t= 5, 20 , 50 and 7200 seconds. The imagesc plot is as follows,
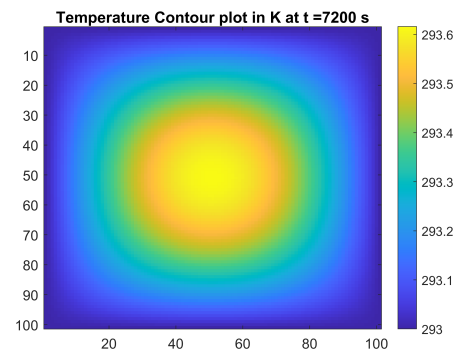

(a)

(b)

(c)

(d)

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