**PEDDI HARISH TEJA**

# DIFFUSION EQUATION

## PROBLEM STATEMENT

Solving the Diffusion Equation for Temperature T using Finite Volume Method and Gauss-Seidel iteration in MATLAB.

## 1a. MESH INDEPENDENCE

- We calculated the Temperature at y = 0.075 for different nodes in X- direction. Then we plotted the Temperature vs Nodex graphs for different meshes i.e, 10*10,20*20,40*40,80*80,160*160. From these graphs we observed that 80*80 and 160*160 meshes, temperature doesnot change much. So we can confirm the mesh independence is occured for 80*80 Mesh.

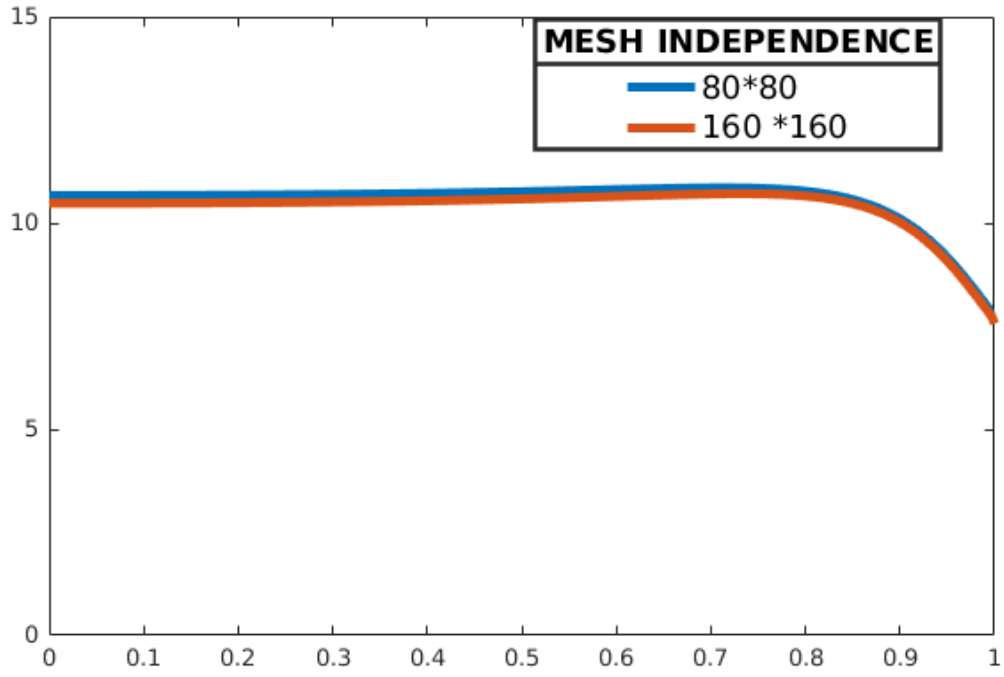
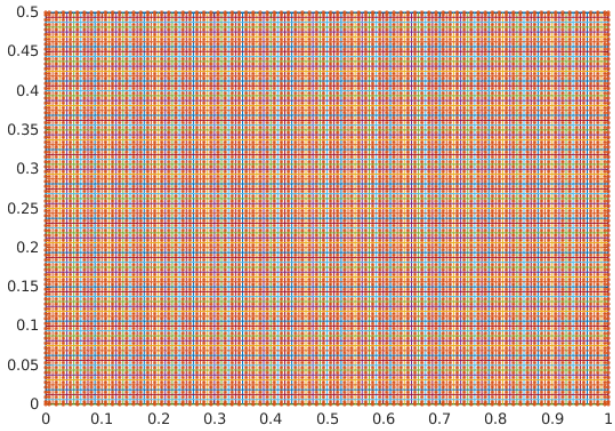


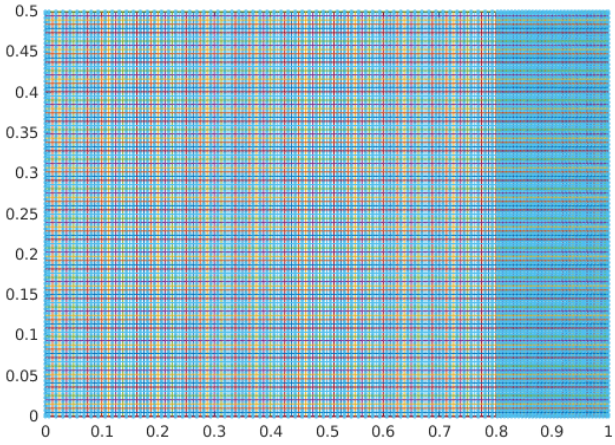

Figure 1: Mesh Independence Test

## 1b. REFINED THE MESH

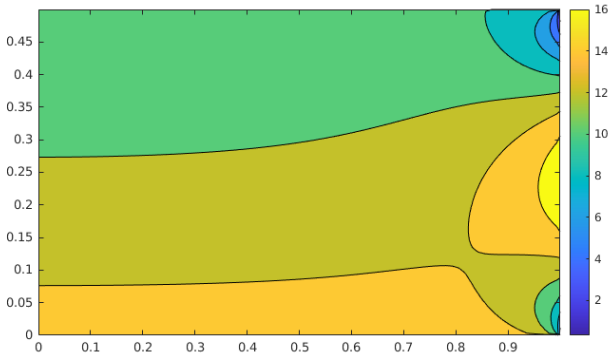
- From the temperature contour we observe the temperature gradients are more near the boundary2. So we Refined the mesh from x=0.8 to 1. The refined temperature contour is shown.



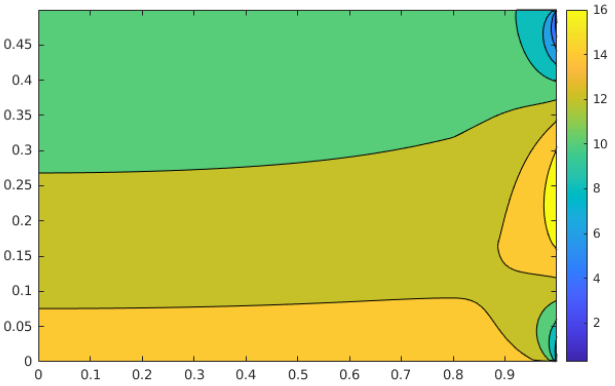

(a) NORMAL MESH GRID




(b) REFINED MESH GRID




(a) TEMP CONTOUR OF NORMAL MESH




(b) TEMP CONTOUR OF REFINED MESH

## 2. Error vs Number of Iterations

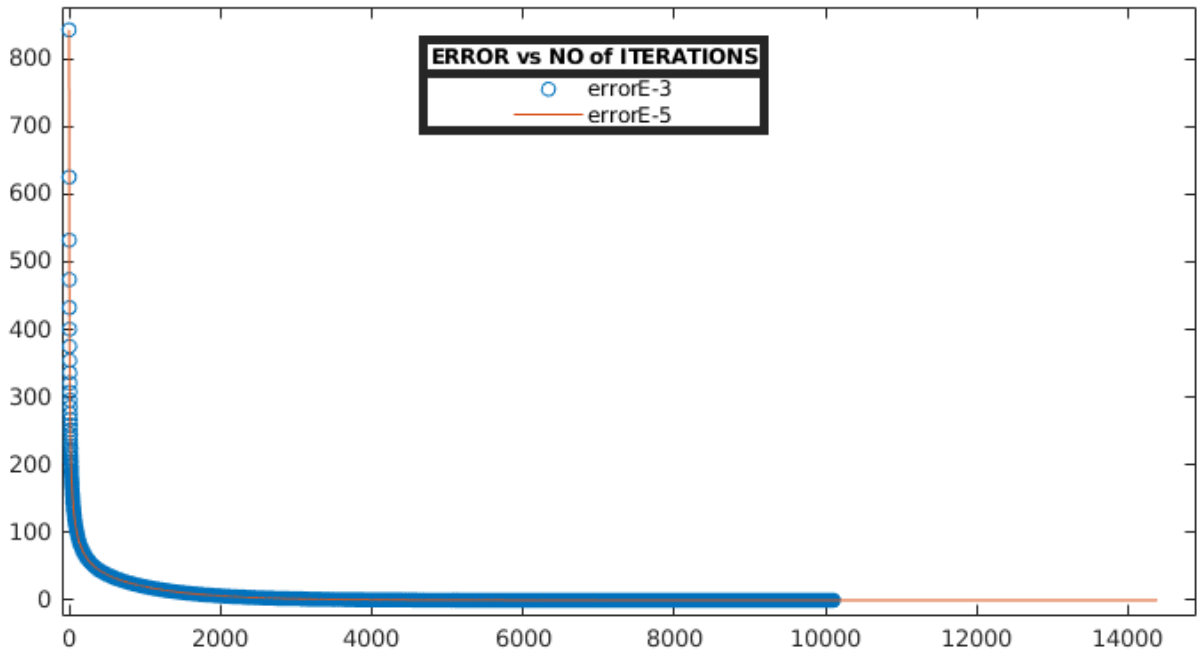



Figure 4: Plot of Error vs Iterations for different error tolerance

- Here we performed calculations using two error tolerances one with 0.001 and other with 0.00001. We infer that more number of iterations are taken for the small error tolerance. So if we decrease the error to even smaller it takes more iterations.

### 3. CHANGE NEUMANN to DIRICHLET AND DIRICHLET to NEUMANN

- We changed the neumann condition of boundary 4 to dirichlet condition. And dirichlet condition of boundary 3 to neumann condition. The results obtained are attached below.

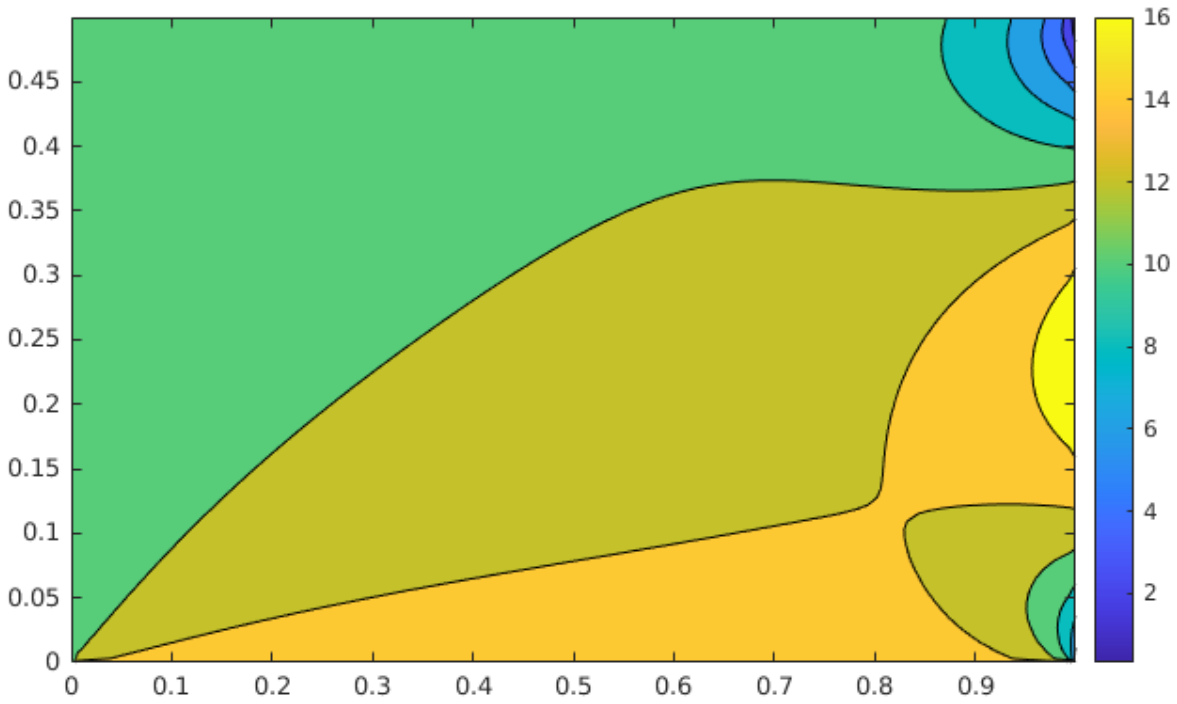



Figure 5: Temperature Contour

## 4.HEAT FLUX VECTOR

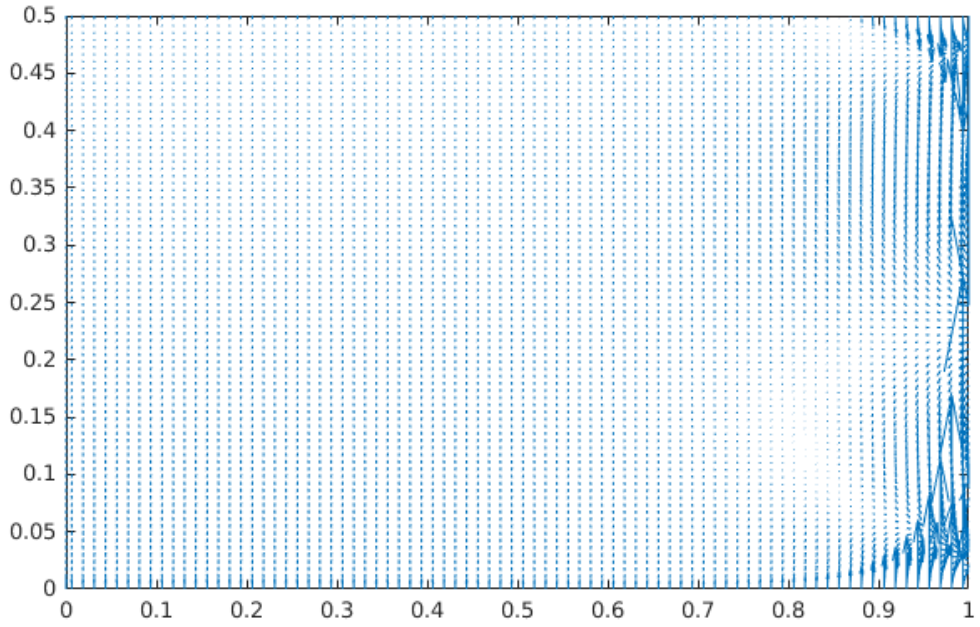



Figure 6: HEAT FLUX VECTOR

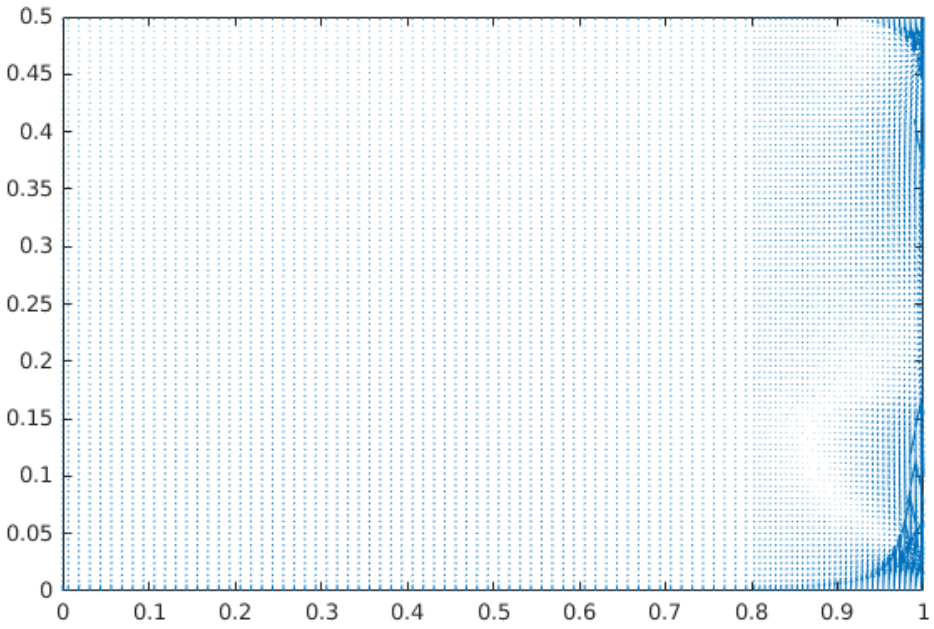



Figure 7: HEAT FLUX VECTOR REFINED MESH

- From this vector plot we conclude that heat flow is from boundary 1 to the boundary 3. And near the boundary 2 we observe the sinusodial behaviour.