Report on 1-D Diffusion problem using TDMA algorithm for distribution of Temperature in a rod with temperature at end points is given

Let temperature at starting point = T_s

Let temperature at last point = T_l

Let the number of points/nodes (including first and last node) = n

Using the standard diffusion equation $\nabla^2 \phi = 0$ we get -

$T_{i-1} - 2T_i + T_{i+1} = 0 \quad 1 \le i \le n-2$

Therefore, it is a system of n-2 equations which can be solved using TDMA algorithm.

For n=10 -

T at start= -12.344000

Temperature at the end= 29.492000

In Middle, Temperature varies as follows:

1) -7.695556

2) -3.047111

3) 1.601333

4) 6.249778

5) 10.898222

6) 15.546667

7) 20.195111

8) 24.843556

Time taken to run code: 0.000190s

For n=20 -

T at start= -32.294000

Temperature at the end= 199.224900

In Middle, Temperature varies as follows:

1) -20.108795

2) -7.923589

3) 4.261616

4) 16.446821

5) 28.632026

6) 40.817232

7) 53.002437

8) 65.187642

9) 77.372847

10) 89.558053

11) 101.743258

12) 113.928463

13) 126.113668

14) 138.298874

15) 150.484079

16) 162.669284

17) 174.854489

18) 187.039695

Time taken to run code: 0.000239s

n	T_s	T_l	Time taken in s
100	-79.349	87.934	0.001410
500	-24.882	99.828	0.009365
1000	-90.9842	932.8222	0.009302
2000	-743.90230	813.82311	0.014103
5000	232.488	109.828	0.047800
10000	902.8845	-140.902	0.061544