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Numerical Methods for PDE

Assignment -4

Solution

i have created Three c source code files. they are named according to the give problem namly Test1_a.c , Test1_b.c, Test2.c .

TASK 1

Test1_a.c

The code contains smooth solution for both Upwind scheme and Lax-wendroff scheme.

when the user runs the code,

it asks the user to specify number of grid space and followed by asks to select the scheme.

After entering these values it will print the Maximum error value for the entered grid space and scheme.

Following the above procedure , for the values space grids N=10,100,1000 the following Error values are obtained .

for upwind scheme(scheme-1)

```
N=10      0.176679
N=100     0.019521
N=1000    0.001972
```

for lax wendroff scheme(scheme-2)

```
N=10      0.074256
N=100     0.000784
N=1000    0.000008
```

Test1_b.c

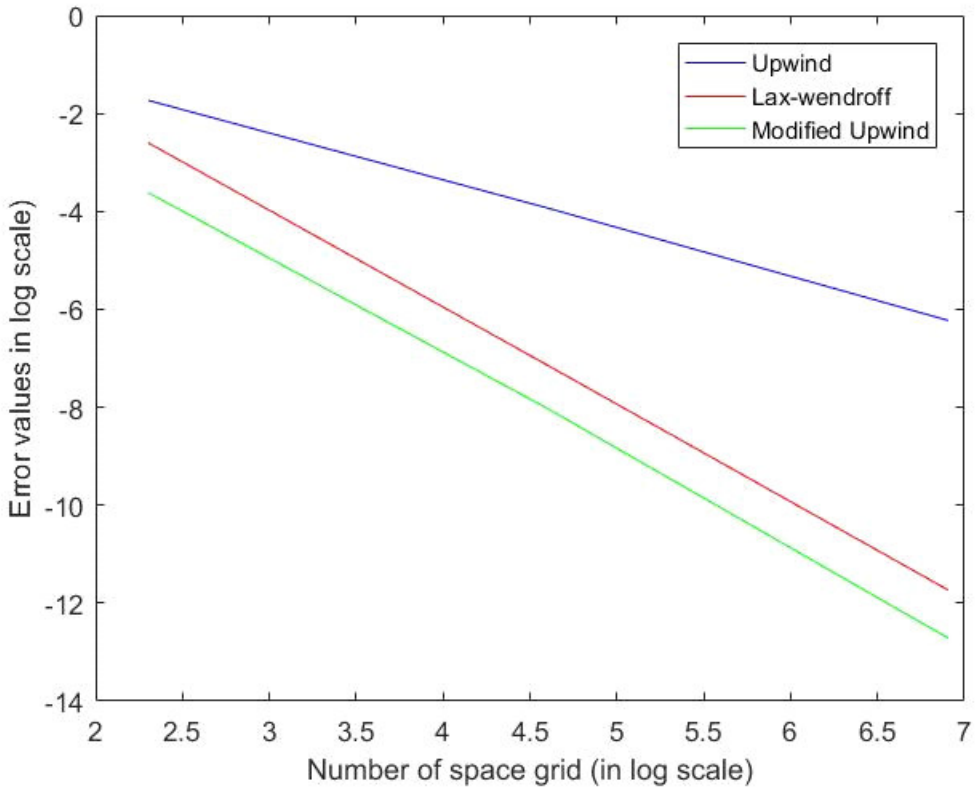
This code contains smooth solution for Modified Upwind scheme.
When the user runs the code, it asks for user to specify the numer of space grids
after entering the value , it will print the maximum error value for the scheme.

Following the above procedure , for the value space grids N=10,100,1000 the following Error values are obtained .

for modified upwind scheme

```
N=10    0.026861
N=100   0.000324
N=1000  0.000003
```

From the above values,the following graph is plotted `using matlab.`



TASK 2

`Test2.c`

The code contains Discontinuous solution for both Upwind scheme and Lax-wendroff scheme.

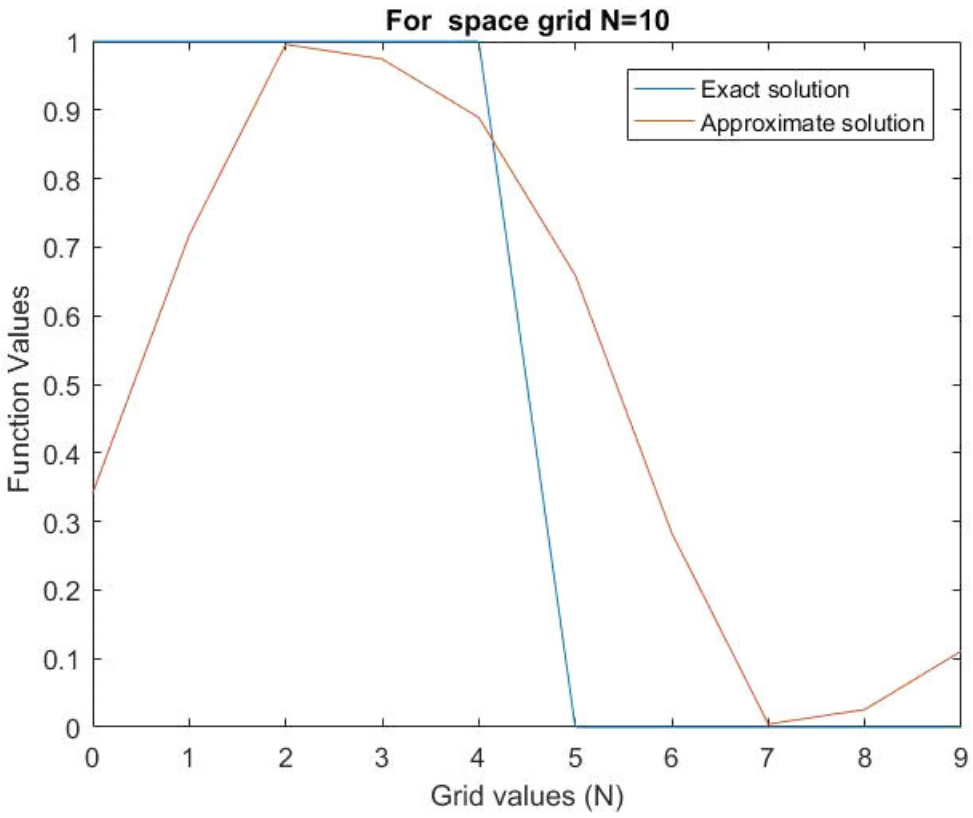
when the user runs the code,

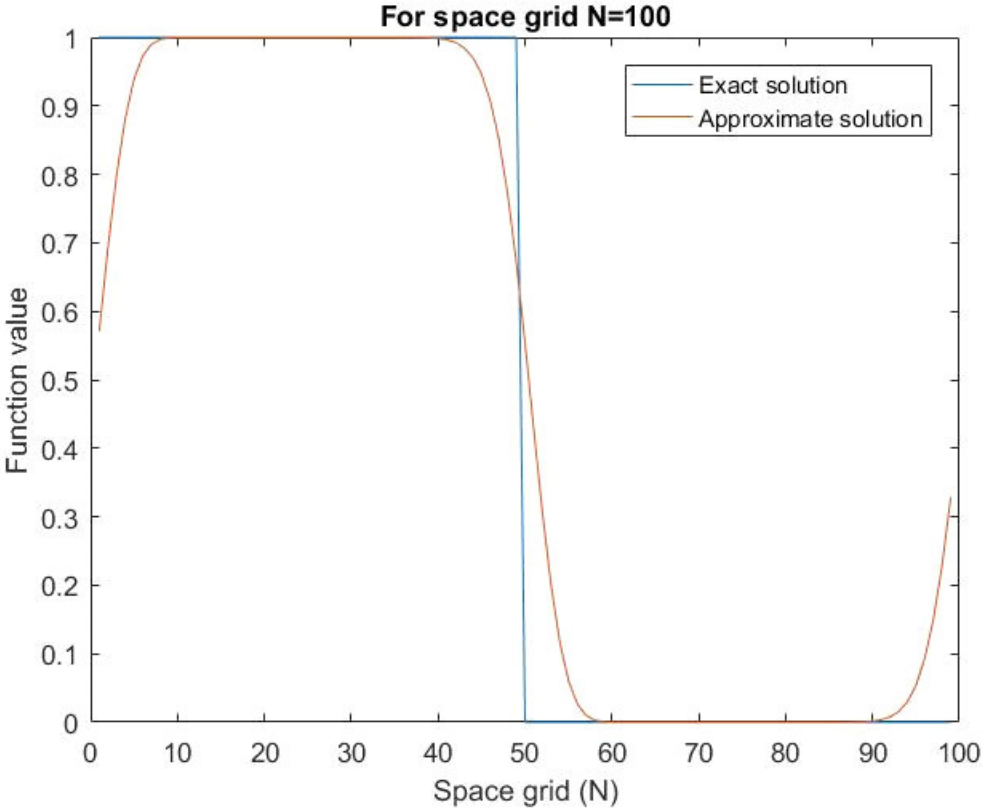
it asks the user to specify number of grid space and followed by asks to select the scheme.

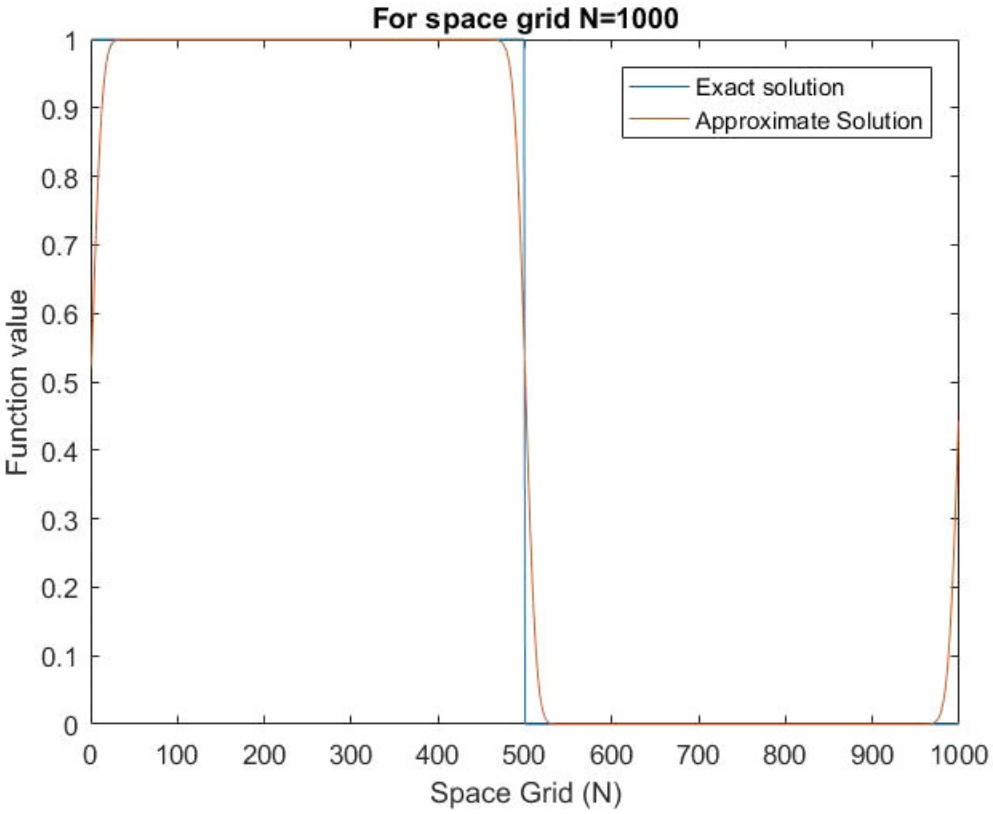
After entering these values it will print the Eaxct values and Difference approximation values and also it will produce a .Edil.csv file (This file will be stored , where the test2.c source code is stored.).

I imported these csv file in Matlab and plotted the following graphs using Matlab.

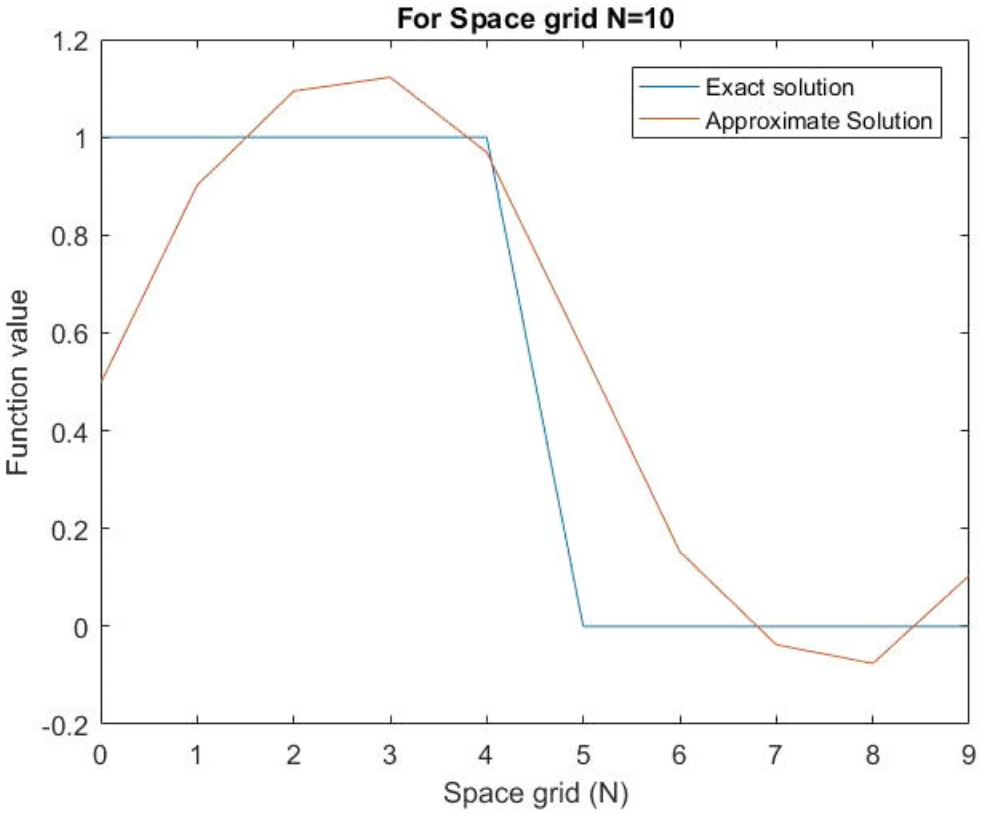
For Upwind scheme

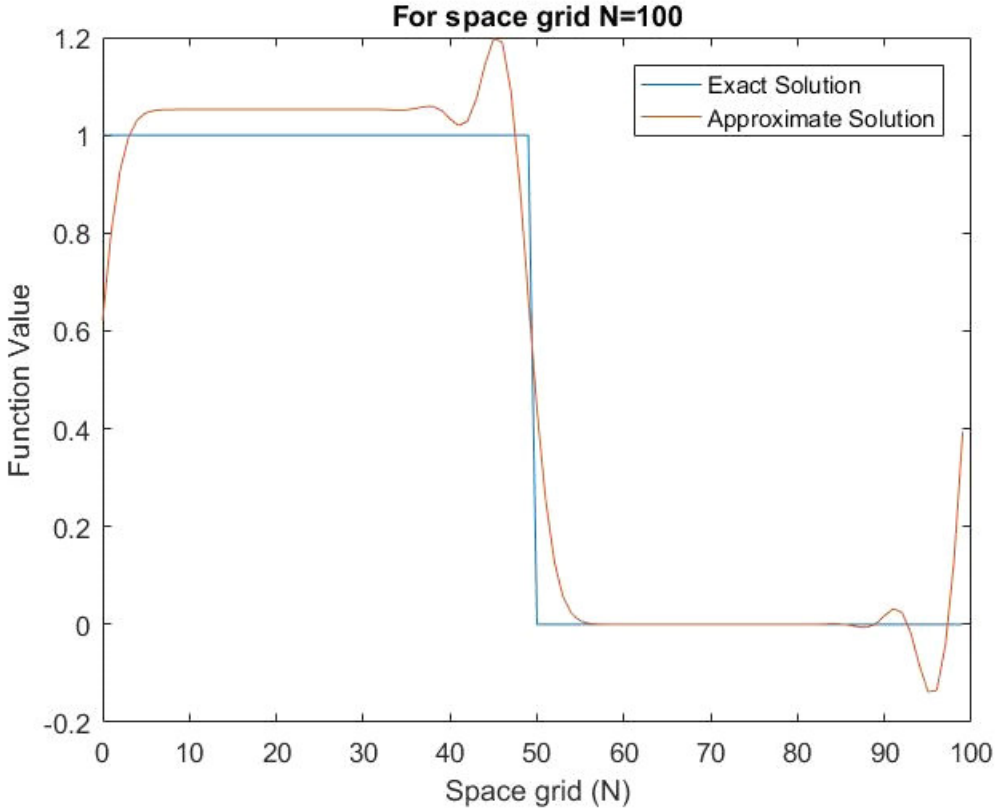


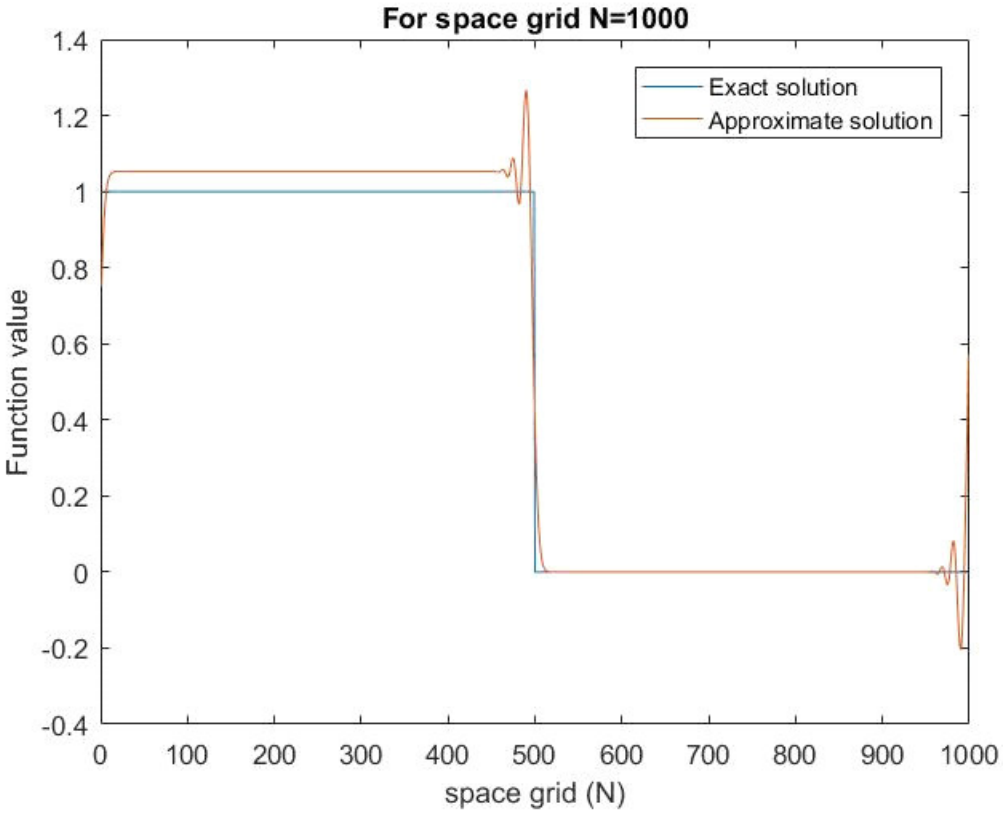

For space grid N=100
Exact solution
Approximate solution
Function value
Space grid (N)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100



For Lax-Wendroff scheme


For Space grid N=10
Exact solution
Approximate Solution
Function value
Space grid (N)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
1
2
3
4
5
6
7
8
9


For space grid N=100
Exact Solution
Approximate Solution
Function Value
Space grid (N)
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
10
20
30
40
50
60
70
80
90
100


For space grid N=1000
Exact solution
Approximate solution
Function value
space grid (N)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
0
100
200
300
400
500
600
700
800
900
1000