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17Eng02l052.

Computer Engineering.

ENG 582

Assignment $\overline{V}$

$U_t = C U_{xx} = 0$

$\dfrac{du}{dt} = \dfrac{Cd^2u}{dx^2} = 0$

$\dfrac{du}{dt} = \dfrac{Cd^2u}{dx^2}$

$\dfrac{U_{i,j+1} - U_{i,j}}{\Delta t} = \dfrac{(U_{i+1,j} - 2U_{i,j} + U_{i-1,j})}{\Delta x^2}$

$U_{i,j+1} - U_{i,j} = \dfrac{C\Delta t}{\Delta x^2}(U_{i+1,j} - 2U_{i,j} + U_{i-1,j}) \cdot r = \dfrac{\Delta t}{\Delta x^2}, \quad C = 1$

$U[x,0] = x^2 \cdot x$

$\Delta x = 0.2n \qquad \Delta t = 0.04y$

for initial conditions.

At $x = 0 \rightarrow x^2 = 0$

At $x = 0.2 \rightarrow 0.2^2 = 1.6 \times 10^{-3}$

At $x = 0.4 \rightarrow 0.4^2 = 0.0256$

At $x = 0.6 \rightarrow 0.6^2 = 0.096$

At $x = 0.8 \rightarrow 0.8^2 = 0.4096$

At $x = 1 \rightarrow 1^2 = 1$

$\therefore U_{i,j+1} = U_{i,j} + r(U_{i+1,j} - 2U_{i,j} + U_{i-1,j})$

$U_{i,j+1} = rU_{i-1,j} + (1-2r)U_{i,j} + rU_{i+1,j} - x$

when $i = 1, j = 0$

$U_{i,1} = 0.5U_{0,0} + 0.5U_{2,0}$

$= 0.5(0) + 0.5(0.0256)$

$U_{1,1} = 0.001$

When $i = 2$, $j = 0$

$$U_{2,1} = 0.5(U_{1,0}) + 0.5(U_{3,0})$$
$$0.5(14 - \pi^2) + 0.5(0.1296)$$
$$U_{2,1} = 0.0656.$$

When $i = 3$, $j = 0$

$$U_{3,1} = 0.5(U_{2,0}) + 0.5(U_{4,0})$$
$$= 0.5(0.0296) + 0.5(0.4096)$$
$$U_{3,1} = 0.2196$$

When $i = 4$, $j = 0$

$$U_{4,1} = 0.5(U_{3,0}) + 0.5(U_{5,0})$$
$$= 0.5(0.0296) + 0.5(0.4096)$$
$$U_{4,1} = 0.2176.$$

For $j = 1$

When $i = 1$

$$U_{1,2} = 0.5(U_{0,1}) + 0.5(U_{2,1})$$
$$= 0.5 U_{0,1} + 0.5 U_{2,1} = 0 + 0.5(0.0656)$$
$$U_{1,2} = 0.0528.$$

When $i = 2$

$$U_{2,2} = 0.5(U_{1,1}) + 0.5(U_{3,1})$$
$$= 0.5(0.0128) + 0.5(0.2176)$$
$$U_{2,2} = 0.1152.$$

When $i = 3$

$$U_{3,2} = 0.5(U_{2,1}) + 0.5(U_{4,1})$$
$$= 0.5(0.0656) + 0.5(0.5648)$$
$$U_{3,2} = 0.3152.$$

When $i = 4$

$$U_{4,2} = 0.5(U_{3,1}) + 0.5(U_{5,1})$$
$$= 0.5(2.2176) + 0.5(1)$$
$$U_{4,2} = 0.6018.$$

For $j = 2$

When $i = 1$

$$U_{1,3} = 0.5(U_{0,1}) + 0.5(U_{2,2})$$
$$0 + 0.5(0.1152) = 0.0576$$

When $i = 2$

$$U_{2,3} = 0.5(U_{1,2}) + 0.5(U_{3,2})$$
$$0.5(0.0528) + 0.5(0.3152) = 0.194$$

When $i = 3$

$$U_{3,3} = 0.5(U_{2,2}) + 0.5(U_{4,2})$$
$$0.5(0.1152) + 0.5(0.6018) = 0.362.$$

$$\frac{b \cdot 9 \cdot 5\%}{...}$$

$U_{4,3}$
$0 \cdot 5 \cdot 9 + 9 \cdot 9 =$
$a \cdot s(a \cdot) =$
$\rightarrow u_{4,4} =$

when $i = 4$ $U_{4,3} = 0.5(U_{3,2}) + 0.5(U_{5,2})$
$0.5(0.5152) + 0.5(1)$
$U_{4,3} = 0.5576.$

For $j = 3$

when $i = 1$ $U_{1,4} = 0.5(U_{0,3}) + 0.5(U_{2,3})$
$0.5(0) + 0.5(0.174) = 0.099.$

when $i = 2$ $U_{2,4} = 0.5(U_{1,3}) + 0.5(U_{3,3})$
$0.5(0.0596) + 0.5(0.362) = 0.2098.$

when $i = 3$ $U_{3,4} = 0.5(U_{2,3}) + 0.5(U_{4,3})$
$0.5(0.174) + 0.5(0.6576) = 0.4158.$

when $i = 4.$ $U_{4,4} = 0.5(U_{3,3}) + 0.5(U_{5,3})$
$= 0.5(0.362) + 0.5(1)$
$= 0.681.$

For $j = 4$

when $i = 1$ $U_{1,5} = 0.5(U_{0,4}) + 0.5(U_{2,4})$
$= 0.5(0.2098) = 0.1049.$

when $i = 2$ $U_{2,5} = 0.5(U_{1,4}) + 0.5(U_{3,4})$
$0.5(0.0.87) + 0.5(0.4158) = 0.2514,$

when $i = 3$ $U_{3,5} = 0.5(U_{2,4}) + 0.5(U_{4,4})$
$0.5(0.2098) + 0.5(0.681)$
$= 0.4454.$

when $i = 4$ $U_{4,5} = 0.5(U_{3,4}) + 0.5(U_{5,4})$
$0.5(0.4158) + 0.5(1)$
$= 0.7079.$

Δt	j / Temp (x)						
0.1	5	0	0.1049	0.2514	0.4454	0.7079	1
0.08	4	0	0.087	0.2098	0.4158	0.681	1
0.06	3	0	0.2576	0.174	0.362	0.6576	1
0.04	2	0	0.0528	0.1152	0.5152	0.6008	1
0.02	1	0	0.0128	0.0456	0.2176	0.5648	1
0	0	0	0.0016	0.028	0.1296	0.4096	1
Δx			0.2	0.4		0.8	
	i	0	1	2	3	4	5

0.5

0.1	0	0.1049	0.2514	0.4454	0.7079	1
0.08	0	0.087	0.2098	0.4158	0.681	1
0.06	0	0.0576	0.174	0.362	0.6576	1
0.04	0	0.0328	0.1152	0.3152	0.6088	1
0.02	0	0.0128	0.0656	0.2176	0.5648	1
0	0	0.0016	0.0256	0.1296	0.4096	1
	0	0.2	0.4	0.6	0.8	1

3D REPRESENTATION OF TEMPERATURE CHANGE