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$u_t - Cu_{xx} = 0$

$\frac{du}{dt} = C\frac{d^2u}{dx^2} = 0$

$\frac{du}{dt} = C\frac{d^2u}{dx^2}$

$\frac{u_{i,j+1} - u_{i,j}}{\Delta t} = C \cdot \frac{u_{i+1,j} - 2u_{i,j} + u_{i-1,j}}{\Delta x^2}$

$u_{i,j+1} - u_{i,j} = C\Delta t \left[\frac{u_{i+1,j} - 2u_{i,j} + u_{i-1,j}}{\Delta x^2}\right] \frac{\Delta t}{\Delta x^2}, c=1$

$u[x,0] = x^4 r.$

$\Delta x = 0.2m , \quad \Delta t = 0.02 \, day.$

for initial Conditions

At $x=0 \rightarrow x^4 = 0$

At $x = 0.2 \rightarrow 0.2^4 = 1.6 \times 10^{-3}$

At $x = 0.4 \rightarrow 0.4^4 = 0.025$

At $x = 0.6 \rightarrow 0.6^4 = 0.1296$

At $x = 0.8 \rightarrow 0.8^4 = 0.4096$

At $x = 1 \rightarrow 1^4 = 1$

∴

$u_{i,j+1} = u_{i,j} + r[u_{i+1,j} - 2u_{i,j} + u_{i-1,j}]$

$u_{i,j+1} = u_{i,j} + (1-2r)u_{i,j} + 6u_{i+1,j}$ ———— *

when $i=1, j=0$

$u_{1,1} = 0.5u[0,0.1] + 0.5u_{2,0}$

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

$$U_{1,1} = 0.0128$$

when $i = 2, j = 0$

$$U_{2,1} = 0.5(U_{1,0}) - 0.5(U_{0,0}).$$

$$= 0.5(1.6 \times 10^{-3}) + 0.5(0.1296)$$

$$U_{2,1} = 0.0656$$

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

$$= 0.5(0.0256) + 0.5(0.4076)$$

$$U_{3,1} = 0.2196$$

when $i = 4, j = 0$ $U_{4,1} = 0.5(U_{3,0}) + 0.5(U_{5,0})$

$$= 0.5(0.0256) + 0.5(0.4096)$$

$$U_{4,1} = 0.5648$$

For $j = 1$

when $i = 1$ $\therefore$ $U_{1,2} = 0.5(U_{0,1}) + 0.5(U_{2,1})$

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

$$U_{1,2} = 0.0328$$

when $i = 2$ $\therefore$ $U_{2,2} = 0.5(U_{0,1}) + 0.5(U_{4,1})$

$$0.5(0.0628) + 0.5(0.2176)$$

$$U_{2,2} = 0.1152$$

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

$$0.5(0.0656) + 0.5(0.5648)$$

$$U_{3,2} = 0.3152$$

When $i = 4$ $u_{4,2} = 0.5 (u_{2,1}) + 0.5 (u_{5,1})$

$$= 0.5(0.2126) + 0.5(1)$$

$$u_{4,2} = 0.6068$$

For $J = 2$

when $i = 1$ $\therefore u_{1,3} = 0.5 (u_{0,1}) + 0.5 (u_{2,2})$

$$= 0 + 0.5 (0.1152) = 0.0576$$

when $i = 2$ $u_{2,3} = 0.5 (u_{1,2}) + 0.5 (u_{3,2})$

$$= 0 + 0.5 (0.0328) + 0.5 (0.2152) = 0.124$$

when $i = 3$ $u_{3,3} = 0.5 (u_{2,2}) + 0.5 (u_{4,2})$

$$= 0.5 (0.1152) + 0.5 (0.6088) = 0.362$$

when $i = 4$ $u_{4,3} = 0.5 (u_{3,2}) + 0.5 (u_{4,2})$

$$= 0.5 (0.3152) + 0.5 (1)$$

$$u_{4,3} = 0.6576$$

For $J = 3$

when $i = 1$ $u_{1,4} = 0.5 (u_{0,3}) + 0.5 (u_{2,3})$

$$= 0.5 (0) + 0.5 (0.134) = 0.084u$$

when $i = 2$ $u_{2,4} = 0.5 (u_{1,3}) + 0.5 (u_{3,3})$

$$= 0.5 (0.0576) + 0.5 (0.362) = 0.2078u$$

when $i = 3$ $u_{3,4} = 0.5 (u_{2,3}) + 0.5 (u_{4,3})$

$$= 0.5 (0.124) + 0.5 (0.6576) = 0.4158u$$

when $i = 4$ $u_{4,4} = 0.5 (u_{3,3}) + 0.5 (u_{5,3})$

$$= 0.5 (0.362) + 0.5 (1) = 0.681u$$

For $J=4$

when $i=1$ $u_{1,5} = 0.5(u_{0,4}) + 0.5(u_{2,4})$
$$= 0.5(0.2098) + 0.1099u$$

when $i=2$ $u_{2,5} = 0.5(u_{1,4}) + 0.5(u_{3,4})$
$$= 0.5(0.087) + 0.5(0.4158) = 0.2514u$$

when $i=3$ $u_{3,5} = 0.5(u_{2,4}) + 0.5(u_{9,4})$
$$= 0.5(0.2098) + 0.5(0.68) = 0.4454u$$

when $i=4$ $u_{4,5} = 0.5(u_{3,4}) + 0.5(u_{5,4})$
$$= 0.5(0.4158) + 0.5(1)$$
$$= 0.7094u$$

Δt	$\dfrac{J}{\text{Temp}(t)}$							
0.1	5	0	0.1049	0.2514	0.4454	0.7097	1
0.08	4	0	0.087	0.2098	0.4158	0.681	1
0.06	3	0	0.596	0.174	0.362	0.6524	1
0.04	2	0	0.328	0.1152	0.3152	0.6088	1
0.02	1	0	0.0128	0.0656	0.2196	0.5648	1
0	0	0	0.0016	0.028	0.1296	0.4094	1
Δx		0	0.2	0.4	0.6	0.8	1
	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