KUNDE SHARON SEDINEN
17/ENG03/032
ENG382
ASSIGNMENT 6
CIVIL ENGINEERING

$u_t = C u_{xx} = 0$

$du/dt - C\, d^2u/dx^2 = 0$

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

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

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

$u = u(x,0) = x^4 K$

$\Delta x = 0.2m$, $\Delta t = 0.02$ Day

for Liminal conditions

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

At $x = 0.2 \rightarrow 0.2^4 = 1.6\times10^{-3}$

At $x = 0.4 \rightarrow 0.4^4 = 0.0256$

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

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

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

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

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

When $i = 1, j = 0$

$u_{1,1} = 0.5u_{0,0} + 0.5u_{2,0}$

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

$u_{1,1} = 0.0128$

When $i = 2, j = 0$

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

$= 0.5(1.6\times10^{-3}) + 0.5(0.1296)$

$u_{2,1} = 0.0656$

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

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

$u_{3,1} = 0.2176$

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 $i = 1$; $u_{1,2} = 0.5(0,1) + 0.5(u_{2,1})$

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

$u_{1,2} = 0.0328$

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

~~0.5(0.0656) + 0.5(~~

$0.5(0.0128) + 0.5(0.2176)$

$u_{2,2} = 0.1152$

Where 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 $U_{4,2} = 0.5(U_{2,1}) + 0.5(U_{5,1})$

$= 0.5(0.2176) + 0.5(1)$

$U_{4,2} = 0.6088$

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

$= 0.5(0.0328) + 0.5(0.3152)$

$= 0.174$

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

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

$U_{4,3} = 0.6576$

For J=3

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

$= 0.5(0) + 0.5(0.174)$

$= 0.084$

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

$= 0.5(0) + 0.5(0.174)$

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

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

$= 0.2098$

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

$= 0.5(0.087) + 0.5(0.4158)$

$= 0.2514$

When i=3 $U_{3,4} = 0.5(U_{2,3}) + 0.5(U_{3,3})$

$= 0.5(0.362)$

$= 0.5(0.2098) + 0.5(0.681)$

$= 0.4454$

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	Temp(K)						
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	0.0576	0.174	0.362	0.6576	1
0.04	2	0	0.0328	0.1152	0.3152	0.6008	1
0.02	1	0	0.0128	0.0656	0.2176	0.5648	1
0	0	0	0.0016	0.028	0.1296	0.4096	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