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CIVIL ENG

17/ENG03/051

ENG 382: ENGINEERING MATHS II

ASSIGNMENT 12

$$U_t - C U_{xx} = 0$$

$$\frac{dy}{dt} - C \frac{d^2 y}{dx^2} = 0$$

$$\frac{dy}{dt} = C \frac{d^2 y}{dx^2}$$

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

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

$$U[x_0] = x^4 K.$$

$$\Delta x = 0.2 \text{ m}, \Delta t = 0.02 \text{ day}$$

for initial conditions

$$\text{At } x = 0 \rightarrow x^4 = 0$$

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

$$\text{At } x = 0.4 \rightarrow 0.4^4 = 0.0256$$

$$\text{At } x = 0.6 \rightarrow 0.6^4 = 0.1296$$

$$\text{At } x = 0.8 \rightarrow 0.8^4 = 0.4096$$

$$\text{at } x = 1 \rightarrow 1^4 = 1$$

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

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

when $i=1, j=0$

$$U_{1,1} = 0.5 U_{0,0} + 0.9 U_{1,0}$$

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

1

$$U_{11} = 0.0128$$

when $i=2, j=0$

$$U_{21} = 0.5(U_{110}) + 0.5(U_{010})$$
$$= 0.5(1.6 \times 10^{-3})$$

$$U_{21} = 0.0656$$

when $i=3, j=0$

$$U_{31} = 0.5(U_{210}) + 0.5(U_{110})$$
$$= 0.5(0.0256) + 0.5(0.4096)$$

$$U_{31} = 0.2176$$

when $i=f, j=0$

$$U_{41} = 0.5(U_{310}) + 0.5(U_{210})$$
$$= 0.5(0.0256) + 0.5(0.4096)$$

$$U_{41} = 0.5648$$

for $j=1$

when $i=1$

$$U_{112} = 0.5(U_{011}) + 0.5(U_{211})$$
$$= 0.5 U_{012} + 0.5 U_{211} = 0 + 0.5(0.0656)$$

$$U_{112} = 0.0328$$

when $i=2$

$$U_{212} = 0.5(U_{111}) + 0.5(U_{311})$$
$$= 0.5(0.0128) + 0.5(0.2176)$$

$$U_{212} = 0.1152$$

when $i=3$

$$U_{312} = 0.5(U_{211}) + 0.5(U_{411})$$
$$= 0.5(0.0656) + 0.5(0.5648)$$

$$U_{312} = 0.3152$$

when $i = 4$

$$\begin{aligned}U_{412} &= 0.5(U_{211}) + 0.5(U_{511}) \\ &= 0.5(0.2476) + 0.5(1)\end{aligned}$$

$$U_{412} = 0.6088$$

for $j = 2$

when $i = 1$

$$\begin{aligned}U_{113} &= 0.5(U_{011}) + 0.5(U_{212}) \\ &= 0 + 0.5(0.1152)\end{aligned}$$

$$U_{113} = 0.0576$$

when $i = 2$

$$\begin{aligned}U_{213} &= 0.5(U_{112}) + 0.5(U_{312}) \\ &= 0.5(0.0328) + 0.5(0.3152)\end{aligned}$$

$$U_{213} = 0.174$$

when $i = 3$

$$\begin{aligned}U_{313} &= 0.5(U_{212}) + 0.5(U_{412}) \\ &= 0.5(0.1152) + 0.5(0.6088)\end{aligned}$$

$$U_{313} = 0.362$$

when $i = 4$

$$\begin{aligned}U_{413} &= 0.5(U_{312}) + 0.5(U_{512}) \\ &= 0.5(0.3152) + 0.5(1)\end{aligned}$$

$$U_{413} = 0.6576$$

for $j = 3$

when $i = 1$

$$U_{114} = 0.5(U_{013}) + 0.5(U_{213})$$

(3)

$$\Rightarrow 0.5(0) + 0.5(0.174)$$

$$U_{11} = 0.087$$

when $i=2$

$$U_{21} = 0.5(U_{11}) + 0.5(U_{31})$$
$$= 0.5(0.087) + 0.5(0.362)$$

$$U_{21} = 0.2098$$

when $i=3$

$$U_{31} = 0.5(U_{21}) + 0.5(U_{41})$$
$$= 0.5(0.174) + 0.5(0.6576)$$

$$U_{31} = 0.4158$$

when $i=4$

$$U_{41} = 0.5(U_{31}) + 0.5(U_{51})$$
$$= 0.5(0.362) + 0.5(1)$$
$$= 0.687$$

for $J=4$

when $i=1$

$$U_{12} = 0.5(U_{02}) + 0.5(U_{22})$$
$$= 0.5(0.2098)$$
$$= 0.1049$$

when $i=2$

$$U_{22} = 0.5(U_{12}) + 0.5(U_{32})$$
$$= 0.5(0.087) + 0.5(0.4158)$$
$$= 0.2514$$

when $i=3$

$$U_{32} = 0.5(U_{22}) + 0.5(U_{42})$$

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

$$= 0.4454$$

when $i = 4$

$$u_{4is} = 0.5(u_{B14}) + 0.5(u_{S14})$$

$$= 0.5(0.4158) + 0.5(1)$$

$$= 0.7079$$

Δt	$\frac{s}{\text{trajektor}}$						
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	0.5576	1
0.04	2	0	0.0328	0.1152	0.3152	0.6008	1
0.02	1	0	0.0128	0.0658	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	

0.1	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

0.5

