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16/ENG06/006

MECHANICAL

ENG 382 ASSIGNMENT 4

SOLUTION

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$$\begin{bmatrix} 10M_1 - 2M_2 + M_3 = 9 \\ -2M_1 + 10M_2 - 2M_3 = 12 \\ -2M_1 - 5M_2 + 10M_3 = 18 \end{bmatrix} \quad \text{using jacobi}$$

Solution

from eqn (1)
$$M_1 = \frac{2M_2 - M_3 + 9}{10}$$

$$M_2 = \frac{2M_1 + 2M_3 + 12}{10} \quad \text{--- from eqn (2)}$$


$$M_3 = \frac{2M_1 + 5M_2 + 18}{10} \quad \text{--- from eqn (3)}$$

Iteration 0, $M_1 = 0, M_2 = 0, M_3 = 0$

1st Iteration,

$$M_1 = \frac{2(0) - 0 + 9}{10} = \frac{9}{10} = 0.9$$
$$M_2 = \frac{2(0) + 2(0) + 12}{10} = \frac{12}{10} = 1.2$$
$$M_3 = \frac{2(0) + 5(0) + 18}{10} = \frac{18}{10} = 1.8$$

2nd iteration,

$$M_1 = \frac{2(1.2) - 1.8 + 9}{10} = 0.96$$
$$M_2 = \frac{2(0.9) + 2(1.8) + 12}{10} = 1.74$$
$$M_3 = \frac{2(0.9) + 5(1.2) + 18}{10} = 2.58$$


2nd iteration

$$m_1 = \frac{2(1.74) - 2.58 + 9}{10} = 0.96$$

$$m_2 = \frac{2(0.96) + 2(5.8) + 2}{10} = 1.908$$

$$m_3 = \frac{2(0.96) + 5(1.74) + 18}{10} = 2.562$$

```
commandwindow
clear
clc
format short g
syms M1 M2 M3
A= [10 -2 1;-2 10 -2;-2 -5 10 ]
x=[M1;M2;M3]
```

```

B=[9;12;18]
C= [0 -A(1,2)/A(1,1) -A(1,3)/A(1,1)
    -A(2,1)/A(2,2) 0 -A(2,3)/A(2,2)
    -A(3,1)/A(3,3) -A(3,2)/A(3,3) 0 ]
D=[B(1,1)/A(1,1);B(2,1)/A(2,2);B(3,1)/A(3,3)]
x=[0;0;0]
for i=1:inf
    normB=norm(x)
    x=(C*x)+D
    normA=norm(x)
    error=abs(normA-normB)
    if error<=1E-15
        break
    end
end
i'
x'
error'
tableau=[i',x',error']

```

COMMAND WINDOW

A =

```

10 -2 1
-2 10 -2
-2 -5 10

```

x =

M1

M2

M3

B =

12

18

C =

| | | |
|-----|-----|------|
| 0 | 0.2 | -0.1 |
| 0.2 | 0 | 0.2 |
| 0.2 | 0.5 | 0 |

D =

0.9
1.2
1.8

x =

0
0
0

Warning: Too many FOR loop iterations. Stopping after 9223372036854775806 iterations.

> In mathsjacobiassignment (line 14)

normB =

0

x =

0.9

1.2

1.8

normA =

2.3431

error =

2.3431

normB =

2.3431

x =

0.96

1.74

2.58

normA =

3.2566

error =

0.91355

normB =

3.2566

x =

0.99

1.908

2.862

normA =

3.5793

error =

0.32271

normB =

3.5793

x =

0.9954

1.9704

2.952

normA =

3.6861

error =

0.10681

normB =

3.6861

x =

0.99888

1.9895

2.9843

normA =

3.7231

error =

0.036997

normB =

3.7231

x =

0.99947

1.9966

2.9945

normA =

3.7353

error =

0.012185

normB =

3.7353

x =

0.99987

1.9988

2.9982

normA =

3.7395

error =

0.0042271

normB =

3.7395

x =

0.99994

1.9996

2.9994

normA =

3.7409

error =

0.0013884

normB =

3.7409

x =

0.99999

1.9999

2.9998

normA =

3.7414

error =

0.0004829

normB =

3.7414

x =

0.99999

2

2.9999

normA =

3.7416

error =

0.00015816

normB =

3.7416

x =

1

2

3

normA =

3.7416

error =

5.5172e-05

normB =

3.7416

x =

1

2

3

normA =

3.7416

error =

1.8013e-05

normB =

3.7416

x =

1

2

3

normA =

3.7417

error =

6.3043e-06

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

2.0512e-06

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

7.2049e-07

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

2.3354e-07

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

8.2356e-08

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

2.6584e-08

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

9.4157e-09

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

3.0253e-09

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

1.0767e-09

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

3.4421e-10

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

1.2315e-10

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

3.9152e-11

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

1.409e-11

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

4.4516e-12

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

1.6125e-12

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

5.0626e-13

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

1.843e-13

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

5.7732e-14

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

2.1316e-14

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

6.2172e-15

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

2.6645e-15

normB =

3.7417

x =

1

2

3

normA =

3.7417

error =

8.8818e-16

ans =

34

ans =

1

2

3

ans =

8.8818e-16

tableau =

| | | | | |
|----|---|---|---|------------|
| 34 | 1 | 2 | 3 | 8.8818e-16 |
|----|---|---|---|------------|

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