

FINBARRS-EZEMA BERNARD

ASSIGNMENT 4

16/ENG03/027

CIVIL ENGINEERING

ENG382

Manually,

Finbarrs-Ezema Bernard
16/ENG03/027
Civil Engineering
Assignment 4

10/03/19

a) Using an initial guess vector of $m_0 = [0; 0; 0]$, determine the values of the variables in Equation (1) using Jacobi iterative method manually showing only three iterations.

b) Write a MATLAB m-file program to solve the problem in 1(a) and tabulate the results showing the number of iterations, the corresponding values of the variables and the error, which is calculated from the norms. Take the tolerance of the error to be $1E-15$.

$$\begin{cases} 10m_1 - 2m_2 + m_3 = 9 \\ -2m_1 + 10m_2 - 2m_3 = 12 \\ -2m_1 - 5m_2 + 10m_3 = 18 \end{cases}$$

Solution

$$m_1 = \frac{2m_2}{10} - \frac{m_3}{10} + \frac{9}{10} = 0.2m_2 - 0.1m_3 + 0.9$$
$$m_2 = \frac{2m_1}{10} + \frac{2m_3}{10} + \frac{12}{10} = 0.2m_1 + 0.2m_3 + 1.2$$
$$m_3 = \frac{2m_1}{10} + \frac{5m_2}{10} + \frac{18}{10} = 0.2m_1 + 0.5m_2 + 1.8$$

where initial $m_1, m_2, m_3 = 0$

$$\begin{aligned} m_1 &= 0.2(0) - 0.1(0) + 0.9 = 0.9 \\ m_2 &= 0.2(0) + 0.2(0) + 1.2 = 1.2 \\ m_3 &= 0.2(0) + 0.5(0) + 1.8 = 1.8 \end{aligned} \quad \left. \vphantom{\begin{aligned} m_1 \\ m_2 \\ m_3 \end{aligned}} \right\} \text{First Iteration}$$

$$\left. \begin{aligned} m_1 &= 0.2(1.2) - 0.1(1.8) + 0.9 = 0.96 \\ m_2 &= 0.2(0.9) + 0.2(1.8) + 1.2 = 1.74 \\ m_3 &= 0.2(0.9) + 0.5(1.2) + 1.8 = 2.53 \end{aligned} \right\} \begin{array}{l} \text{first} \\ \text{Second Iteration} \end{array}$$

$$\left. \begin{aligned} m_1 &= 0.2(1.74) - 0.1(2.53) + 0.9 = 0.99 \\ m_2 &= 0.2(0.96) + 0.2(2.53) + 1.2 = 1.908 \\ m_3 &= 0.2(0.96) + 0.5(1.74) + 1.8 = 2.862 \end{aligned} \right\} \text{Second Iteration}$$

$$\left. \begin{aligned} m_1 &= 0.2(1.908) - 0.1(2.862) + 0.9 = 0.9954 \\ m_2 &= 0.2(0.99) + 0.2(2.862) + 1.2 = 1.9704 \\ m_3 &= 0.2(0.99) + 0.5(1.908) + 1.8 = 2.952 \end{aligned} \right\} \text{Third Iteration}$$

Matlab,

The screenshot shows the MATLAB R2018a Editor window. The current folder is 'C:\Users\FINBARRS BERNARD\Desktop\3001 second\Maths assignment\Assignment 4'. The editor displays a function named 'bernard' with the following code:

```
1 function P = bernard(a,b,m0,tol)
2 A=[10 -2 1; -2 10 -2; -2 5 10];
3 b=[9 12 18]';
4 m0=[0 0 0]';
5 maxl=100;
6 tol=1E-15;
7 n=length(b);
8 for k=1:maxl
9     for i=1:n
10        iter(i+1)=1;
11        P(i)=(b(i)-A(i,[1:i-1,i+1:n])*m0([1:i-1,i+1:n]))/A(i,i)
12    end
13    err=abs(norm(P'-m0));
14    reterr=err/(norm(P));
15    m0=P';
16    if(err<tol)|(reterr<tol)
17        break
18    end
19 end
20 P=P'
21 table(iter', P', err')
```

The Command Window shows an error message: "Error in assignment4matlab (line 21) table(iter', P', err')".

The screenshot shows the MATLAB R2018a Command Window. The command 'assignment4matlab' has been executed, resulting in the following output:

```
>> assignment4matlab
P =
    0.9000
P =
    0.9000    1.2000
P =
    0.9000    1.2000    1.8000
P =
    0.9600    1.2000    1.8000
P =
    0.9600    1.7400    1.8000
```

MATLAB R2018a

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FILE NAVIGATE EDIT BREAKPOINTS RUN

Current Folder: C:\Users\FINBARRS BERNARD\Desktop\3001 second\Maths assignment\Assignment 4\assignment4matlab.m

Name: 16ENG03027.pdf, assignment2matlab.m, assignment2word.docx

Details

Workspace

Name	Value

Command Window

New to MATLAB? See resources for [Getting Started](#).

```

P =
    0.9600    1.7400    1.8000
P =
    0.9600    1.7400    1.3800
P =
    1.1100    1.7400    1.3800
P =
    1.1100    1.6680    1.3800
P =
    1.1100    1.6680    1.1220
P =

```

MATLAB R2018a

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FILE NAVIGATE EDIT BREAKPOINTS RUN

Current Folder: C:\Users\FINBARRS BERNARD\Desktop\3001 second\Maths assignment\Assignment 4\assignment4matlab.m

Name: 16ENG03027.pdf, assignment2matlab.m, assignment2word.docx

Details

Workspace

Name	Value

Command Window

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```

    1.1130    1.6610    1.1921
P =
    1.1130    1.6610    1.1921
P =
    1.1130    1.6610    1.1921
P =
    1.1130    1.6610    1.1921
P =
    1.1130    1.6610    1.1921
P =
    1.1130
    1.6610
    1.1921
Undefined function or variable 'tablo'.

```

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