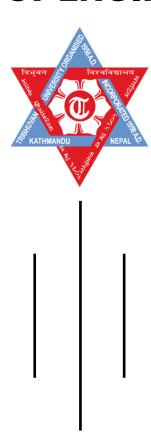
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING



PURWANCHAL CAMPUS

Dharan-8

A Lab Report On: To Solve The System Of Linear Algebraic Equation Using Gauss Elimination Method

Submitted By

Name: Dhiraj KC

Roll No. : PUR077BEI014

Faculty: Electronics, Communication

and Information

Group: A

Submitted To

Department Of Electronics and

Computer Engineering Checked By: Pukar Karki

TITLE: TO SOLVE THE SYSTEM OF LINEAR ALGEBRAIC EQUATION USING GAUSS ELIMINATION METHOD

THEORY

In Gauss Elimination Method, the unknown values are eliminated successfully and the system is reduced to a triangular system from which these unknown values are determined using substitution. It can be done by using two methods.

1. Forward Elimination

Given system is reduced to upper triangular matrix.

$$\begin{pmatrix} a_1 & b_1 & c_1 & : & d_1 \\ 0 & b_2' & c_2' & : & d_2' \\ 0 & 0 & c_3'' & : & d_3'' \end{pmatrix}$$

2. Backward Elimination

Given system is reduced to lower triangular matrix.

$$\begin{pmatrix} a_1'' & 0 & 0 & : & d_1'' \\ a_2' & b_2' & 0 & : & d_2' \\ a_3 & b_3 & c_3 & : & d_3 \end{pmatrix}$$

Consider a system of linear equation,

$$a_1x + b_1y + c_1z = d_1$$

 $a_2x + b_2y + c_2z = d_2$
 $a_3x + b_3y + c_3z = d_3$

Step 1: The Argument Matrix is

$$\begin{pmatrix} a_1 & b_1 & c_1 & : & d_1 \\ a_2 & b_2 & c_2 & : & d_2 \\ a_3 & b_3 & c_3 & : & d_3 \end{pmatrix}$$

Step 2: Elimination of 'x' from second and third row, applying $R_2 \to R_2 - \frac{a_2}{a_1} R_1$, $R_3 \to R_3 - \frac{a_3}{a_1} R_1$

$$\begin{pmatrix} a_1 & b_1 & c_1 & : & d_1 \\ 0 & b_2' & c_2' & : & d_2' \\ 0 & b_3' & c_3' & : & d_3'' \end{pmatrix}$$

Step 3: Elimination of 'y' from third row. $R_3 \rightarrow R_3 - \frac{b_3'}{b_2'}R_2$

$$\begin{pmatrix} a_1 & b_1 & c_1 & : & d_1 \\ 0 & b_2' & c_2' & : & d_2' \\ 0 & 0 & c_3'' & : & d_3'' \end{pmatrix}$$

Step 4: Evaluate the unknown values using backward substitution.

$$c'_{3}z = d''_{3}$$

$$z = \frac{d''_{3}}{c''_{3}}$$

$$b'_{2}y + c'_{2}z = d'_{2}$$

$$y = \frac{d'_{2} - c'_{2}z}{b'_{2}}$$

$$a_{1}x + b_{1}y + c_{1}z = d_{1}$$

$$x = \frac{d_{1} - b_{1}y - a_{1}z}{a_{1}}$$

ALGORITHM

- 1. Start
- 2. Read number of unknowns: n
- 3. Read argument matrix A of n by n+1 size
- 4. Transform argument matrix A to upper triangle matrix by row operation.
- 5. Obtain solution by Back Substitution
- 6. Display Result
- 7. Stop

PROGRAM

```
import numpy as np
a = np.array([[3, -2, 5, 0],
       [4, 5, 8, 1],
       [1, 1, 2, 1],
       [2, 7, 6, 5]], float)
b = np.array([2, 4, 5, 7], float)
n = len(b)
x = np.zeros(n, float)
# Elimination Stage
for i in range(n-1):
 for j in range(i+1, n):
  if a[j][i] == 0:
   continue
  factor = a[i][i]/a[j][i]
  for k in range(i, n):
   a[j][k] = a[i][k] - a[j][k]*factor
  b[j] = b[i] - b[j] * factor
# Back Substitution
x[n-1] = b[n-1] / a[n-1][n-1]
for i in range(n-2, -1, -1):
 sum = 0
 for j in range(i+1, n):
  sum += a[i][j]*x[j]
 x[i] = (b[i] - sum)/a[i][i]
print("The solution is ", x)
```

OUTPUT

The solution is [28.77777778 2.166666667 -16. 6.05555556]