

chapter : Solution of System of Linear Equations.

- Gauss elimination Method
- Gauss Jordan Method
- LU decomposition Method
- Matrix Inverse Method
- Jacobi iteration Method
- Gauss Seidel Method

Linear Equations are :

$$\rightarrow 4x + 7y = 15$$

$$\rightarrow -x - \frac{3}{4}y = 0$$

Non-Linear Equations are :

$$\rightarrow 2x - xy + y = 2$$

$$\rightarrow x^2 + y^2 = 25$$

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A system of n linear equations is represented generally as :

$$\left. \begin{array}{l} a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n = b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n = b_2 \\ \vdots \\ a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n = b_n \end{array} \right\} \text{--- ①}$$

In matrix notation, Eq. (1) can be expressed as,

$$Ax = b$$

where,

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}, \quad x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \text{ and } B = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix}$$

Methods for solving system of Linear algebraic equations :

fundamentally we have two different approaches.

- 1) Elimination approach / direct approach.
- 2) Iterative approach.

1) Elimination Approachs

It reduces the given system of equations to a form from which the solution can be obtained by simple substitution.

The solution of direct methods do not contain any truncation errors.

It may contain roundoff errors due to floating point operations.

We will discuss the following elimination method.

- a) Basic Gauss elimination method.
- b) Gauss elimination with pivoting
- c) Gauss-Jordan method
- d) LU decomposition method.
- e) Matrix inverse method.

2) Iterative Approachs

Direct approach poses some problems when the systems grow larger or when most of the co-efficients are zero.

They require prohibitively larger number of floating point operations and therefore, not only become time consuming but also severely affect the accuracy of the solution due to round off errors.

ill-conditioned systems can be solved by iterative methods without facing the problem of roundoff errors.

The following three iterative methods are :

- a) Jacobi iteration Method
- b) Gauss - Seidel iteration Method
- c) Successive over relaxation Method.