Solving System of Linear Equations using Gauss Elimination and Gauss-Jordan Methods

Talk to a Teacher Project
http://spoken-tutorial.org
National Mission on Education through ICT
http://sakshat.ac.in

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Objectives

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- **Solve system of linear equations**
- **Develop Scilab code to solve linear equations**

System Requirements

- **OS: Ubuntu Linux 12.04**

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- **Scilab 5.3.3**

Prerequisites

- **Basic knowledge**

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  - **Scilab**
  - **Linear Equations**
- **Please refer to the relevant Scilab tutorials available on http://spoken-tutorial.org**

System of Linear Equations

- **Finite collection**

System of Linear Equations

- **Finite collection**
- **Linear equations**

System of Linear Equations

- **Finite collection**
- **Linear equations**
- **Same variable**

Gaussian Elimination Method

- **Given a system**

Gaussian Elimination Method

- **Given a system**
- $Ax = b$

Gaussian Elimination Method

- **Given a system**
- $Ax = b$
- m **equations**

Gaussian Elimination Method

- **Given a system**
- $Ax = b$
- m **equations**
- n **unknowns**

Gaussian Elimination Method

$$[\mathrm{A} \quad \mathrm{b}] = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} & b_1 \\ a_{21} & a_{22} & \dots & a_{2n} & b_2 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} & b_m \end{bmatrix}$$

Gaussian Elimination Method

$$\begin{bmatrix} c_{11} & c_{12} & \dots & c_{1n} & d_1 \\ 0 & c_{22} & \dots & c_{2n} & d_2 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \dots & c_{mn} & d_m \end{bmatrix}$$

Example

Solve using Gaussian Elimination Method

$$3.41x_1 + 1.23x_2 - 1.09x_3 = 4.72,$$
$$2.71x_1 + 2.14x_2 + 1.29x_3 = 3.10,$$
$$1.89x_1 - 1.91x_2 - 1.89x_3 = 2.91$$

Gauss-Jordan Method

- **Form the augmented matrix $[A|B]$**

Gauss-Jordan Method

- **Form the augmented matrix $[A|B]$**
- **Perform row operations**

Gauss-Jordan Method

- **Form the augmented matrix $[A|B]$**
- **Perform row operations**
- **Convert A to diagonal form**

Gauss-Jordan Method

- **Dividing the diagonal element and the right-hand-side element**

Gauss-Jordan Method

- **Dividing the diagonal element and the right-hand-side element**
- **By diagonal element**

Gauss-Jordan Method

- **Dividing the diagonal element and the right-hand-side element**
- **By diagonal element**
- **Diagonal element equal to one**

Example

Use Gauss-Jordan Method to solve

$$0.7x_1 + 1725x_2 = 1739,$$
$$0.4352x_1 - 5.433x_2 = 3.271$$

Summary

In this tutorial, we have learnt to:

- **Develop Scilab code for solving system of linear equations**
- **Find the value of the unknown variables of a system of linear equations**

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- **Watch the video available at http://spoken-tutorial.org /What_is_a_Spoken_Tutorial**
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- More information on this Mission is available at http://spoken-tutorial.org/NMEICT-Intro