

# Solving System of Linear Equations using Iterative Methods

**Talk to a Teacher Project**

<http://spoken-tutorial.org>

**National Mission on Education through ICT**

<http://sakshat.ac.in>

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- **Solve system of linear equations using iterative methods**
- **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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- **Basic knowledge**
  - Scilab
  - Linear Equations
- Please refer to the relevant Scilab tutorials available on <http://spoken-tutorial.org>



# Jacobi Method

$$x_i^{k+1} = \frac{b_i - \sum_{j=1, j \neq i}^n a_{ij} x_j^k}{a_{ii}} \quad i = 1, 2, \dots, n$$

- Assume values for  $x_j - (x_1, x_2, \dots, x_n)$



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- **Assume values for**  
 $x_i = (x_1, x_2, \dots, x_n)$
- **Substitute values of  $x_i$  in the equation**



# Jacobi Method

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- Assume values for  $x_i = (x_1, x_2, \dots, x_n)$
- Substitute values of  $x_i$  in the equation
- Iterate until solution converges



# Example

## Solve using Jacobi Method

$$2x_1 + x_2 = 11,$$

$$5x_1 + 7x_2 = 13,$$

using initial vector  $X^{(0)} = [1, 1]^T$



# Gauss Seidel Method

$$x_i = \frac{b_i - \sum_{j=1, j \neq i}^n a_{ij} x_j}{a_{ii}}, i = 1, 2, \dots, n$$



# Gauss-Seidel Method

- In Jacobi method, the computation of  $x_i^{(k+1)}$  requires each element in  $x_i^{(k)}$  except itself



# Gauss-Seidel Method

- In Jacobi method, the computation of  $x_i^{(k+1)}$  requires each element in  $x_i^{(k)}$  except itself
- In Gauss - Seidel Method, we overwrite  $x_i^{(k)}$  with  $x_i^{(k+1)}$



# Example

## Solve using Gauss-Seidel Method

$$2x_1 + x_2 = 11,$$

$$5x_1 + 7x_2 = 13,$$

using initial vector  $X^{(0)} = [1, 1]^T$



## Solve using Jacobi and Gauss-Seidel Method

$$4x_1 - 10x_2 + 5x_3 = 32,$$

$$5x_1 - 4x_2 + 10x_3 = 39,$$

$$10x_1 + 5x_2 - 4x_3 = 17$$

using initial vector  $X^{(0)} = [1, -1, 1]^T$



# 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**



# About the Spoken Tutorial Project

- Watch the video available at [http://spoken-tutorial.org/What\\_is\\_a\\_Spoken\\_Tutorial](http://spoken-tutorial.org/What_is_a_Spoken_Tutorial)
- It summarises the Spoken Tutorial project



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- If you do not have good bandwidth, you can download and watch it



# Spoken Tutorial Workshops

## The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to [contact@spoken-tutorial.org](mailto:contact@spoken-tutorial.org)



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- More information on this Mission is available at

<http://spoken-tutorial.org/NMEICT-Intro>

