

# Solving ODEs using Scilab *ode* Function

**Talk to a Teacher Project**

**<http://spoken-tutorial.org>**

**National Mission on Education through ICT**

**<http://sakshat.ac.in>**

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- Plot the solution



# Objectives

**The typical examples:**



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**The typical examples:**

- **Motion of Simple Pendulum**



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- Van der Pol Equation



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- Motion of Simple Pendulum
- Van der Pol Equation
- Lorenz System



# System Requirements

- OS: Ubuntu Linux 12.04



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- **Scilab 5.3.3**



# Prerequisites

- **Basic knowledge of Scilab**



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- **Know to solve ODEs**



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- **Basic knowledge of Scilab**
- **Know to solve ODEs**
- **Please refer to the relevant Scilab tutorials available on <http://spoken-tutorial.org>**



# ode Function

- **Ordinary Differential Equation Solver**



# ode Function

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- $y = \text{ode}(y_0, t_0, t, f)$



# ode Function

- **Ordinary Differential Equation Solver**
- $y = \text{ode}(y_0, t_0, t, f)$
- $y_0$ - Initial conditions
- $t_0$ - Initial time
- $t$ - Time Range
- $f$ - Function



# Motion of Simple Pendulum

**Consider the motion of simple pendulum.**

**Let  $\theta(t)$  be the angle made with the vertical at time  $t$ .**

**Initially  $\theta(0) = \pi/4$  and  $\theta'(0) = 0$**



# Motion of Simple Pendulum

The subsequent position is described by

$$\theta''(t) - \frac{g}{l} \sin(\theta(t)) = 0$$

$g = 9.8m/sec^2$  - acceleration due to gravity

$l = 0.5m$  - length of the pendulum



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# Motion of Simple Pendulum

- Solve for  $0 \leq t \leq 5$  by using Scilab *ode* function



# Motion of Simple Pendulum

- **Solve for  $0 \leq t \leq 5$  by using Scilab *ode* function**
- **Plot the solution**



# Van der Pol Equation

The following equation describes the voltage across the trode circuit:

$$v''(t) + \epsilon(v(t)^2 - 1)v'(t) + v(t) = 0$$
$$v(2) = 1, v'(2) = 0, \epsilon = 0.897$$

Compute within  $2 \leq t \leq 10$

Plot the solution



# Lorenz System

**Lorenz system of equations:**

$$x_1' = \sigma(x_2 - x_1)$$

$$x_2' = ((1 + r) - x_3)x_1 - x_2$$

$$x_3' = x_1x_2 - bx_3$$

$$x_1(0) = -10, x_2(0) = 10, x_3(0) = 25$$



# Lorenz System

**Let**  $\sigma = 10$ ,  $r = 28$ ,  $b = 8/3$

**Compute within**  $0 \leq t \leq 50$

**Plot the solution**



# Summary

In this tutorial, we have learnt to:

- **Develop Scilab code to solve an ODE**
- **Use *ode* function**
- **Plot the ODE solution**



# 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>

