

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>

Script & Narration: Shamika & Ashwini

IIT Bombay

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Objectives

At the end of this tutorial, you will learn how to:



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- Use *ode* function in Scilab



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- **Use *ode* function in Scilab**
- **Solve typical examples of ODEs**



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At the end of this tutorial, you will learn how to:

- **Use *ode* function in Scilab**
- **Solve typical examples of ODEs**
- **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



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- OS: Ubuntu Linux 12.04



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- **OS: Ubuntu Linux 12.04**
- **Scilab 5.3.3**



Prerequisites

- **Basic knowledge of Scilab**



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- **Know to solve ODEs**



Prerequisites

- 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



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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



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

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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



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- More information on this Mission is available at

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

