Go, change the world

Workshop on

"Physics Lab experiential learning using Scilab-XCOS"

For Physics cycle students

Dr. RAJESH BM

Assistant Professor

Department of Physics

RV College of Engineering

rajeshbm@rvce.edu.in

Outline

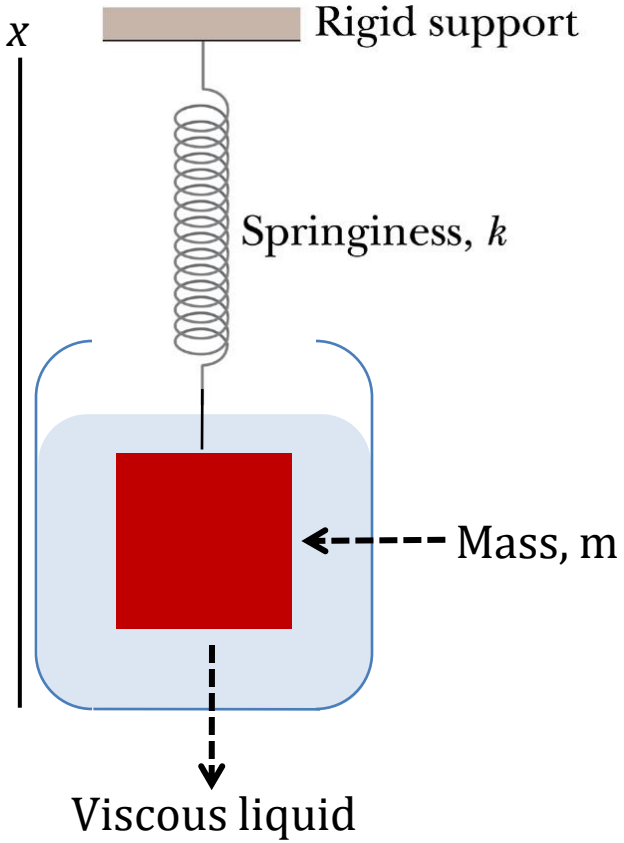
- Damped Harmonic Oscillation
- About Scilab-Xcos
- Simulation using Xcos
- Inference

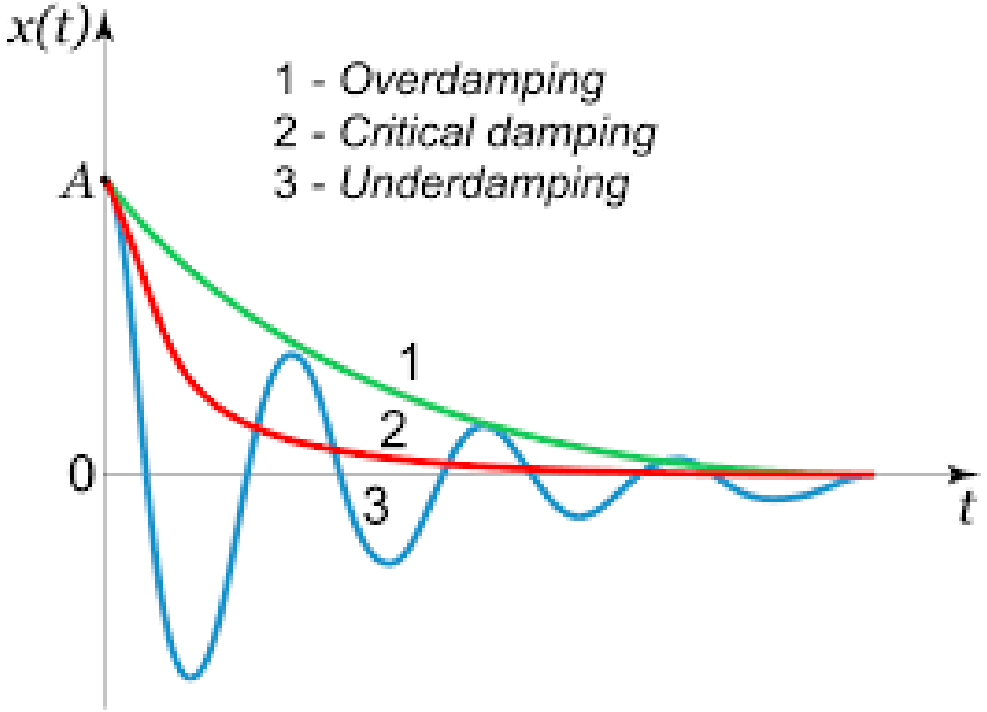
Damped harmonic motion

$$F_{damping} = -r\frac{dy}{dt}$$

Damping force

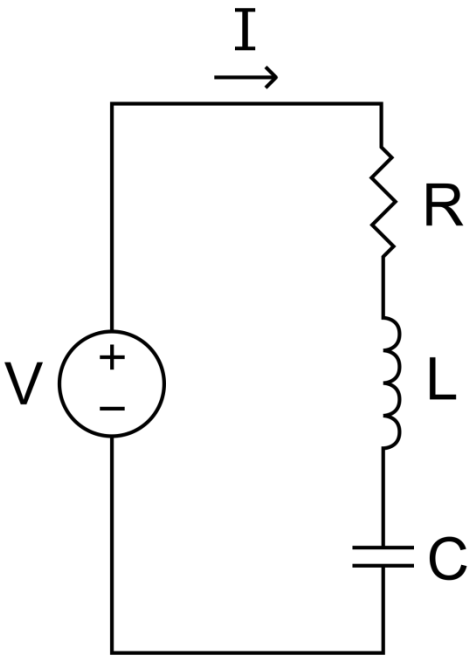
Damping constant





Electrical Damped harmonic oscillation

The circuit can be modeled by using second order linear differential equation for the electrical damped harmonic oscillator:



$$\frac{d^2V}{dt^2}+\left(\frac{R}{L}\right)\frac{dV}{dt}+\left(\frac{1}{LC}\right)V=0$$

The characteristic equation using the quadratic formula is

$$\alpha=\frac{-R\pm\sqrt{R^2-4L/C}}{2L}$$

By substituting the variables for b and ω, α *can be written as*

$$\alpha=-b\pm\sqrt{b^2-\omega^2}$$

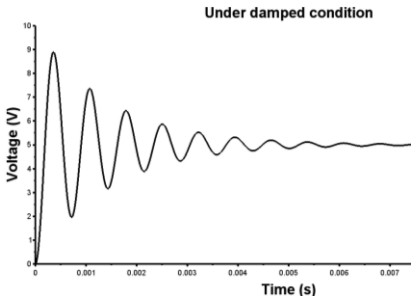
$$Where\ b=\frac{R}{2L}\ \ and\ \ \omega^2=\frac{1}{\sqrt{LC}}$$

The voltage across the capacitor is studied by varying R and keeping L and C is constant

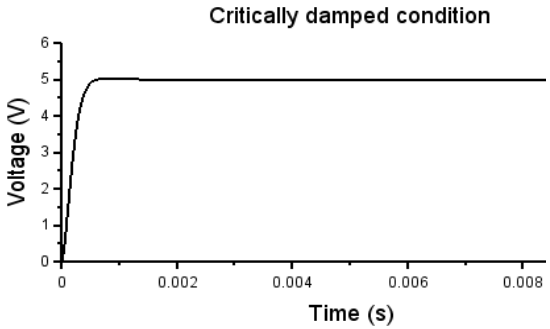
The natural frequency of a series RLC circuit is given by $\omega = \frac{1}{\sqrt{LC}}$

and damping factor $b = \frac{R}{2L}$

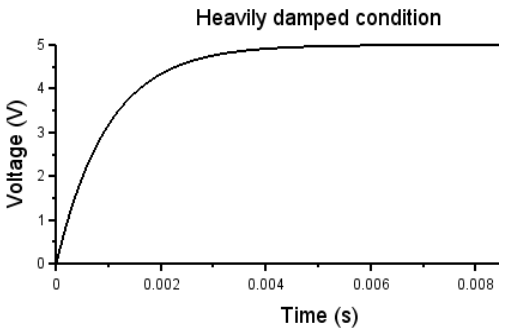
Depending upon the value of b and ω the response could be under-damped, critically-damped or over-damped



b < ω



b ≈ ω



b > ω

Scilab

•Numerical computations, data analysis and plotting, system modeling and simulation, graphical user interface.

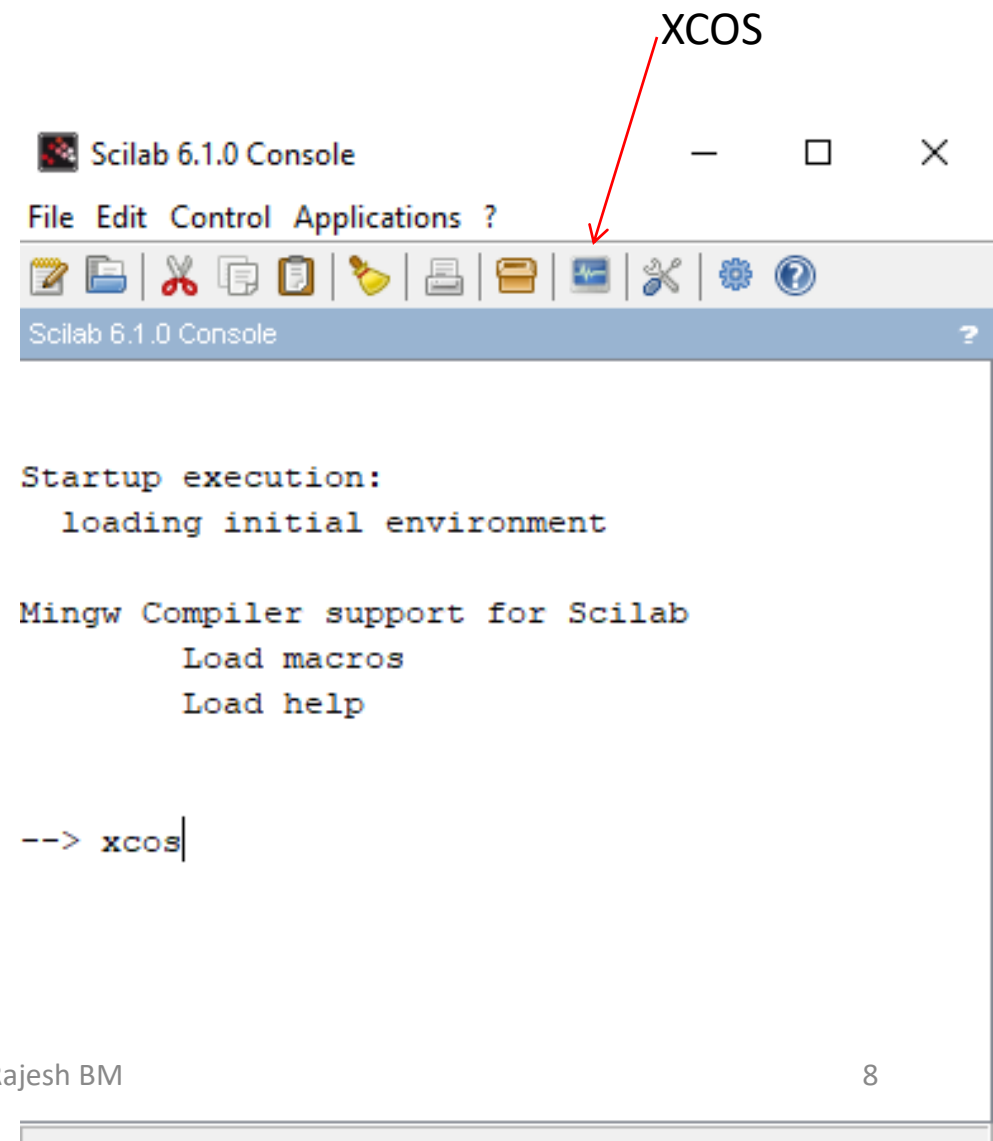
•Scilab is in use in every strategic domain of science, industry, and services including space, aeronautics, automobile etc.,

•**XCOS** is a tool in Scilab that is used to model and simulate dynamic systems.

•XCOS allows us to represent models in the form of blocks and block diagrams.

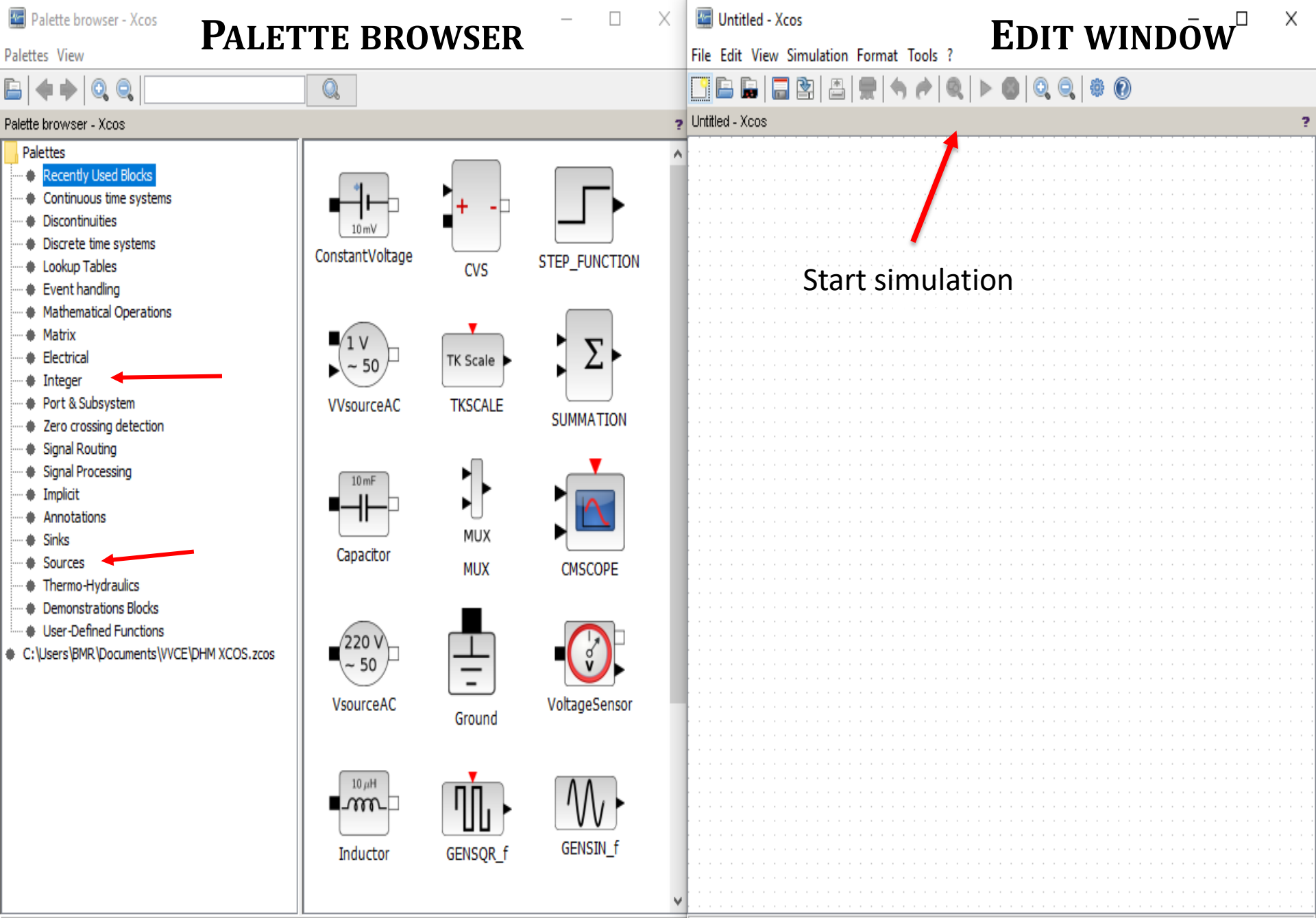
- Scilab includes hundreds of mathematical functions.
  - **Maths & Simulation**
  - **2-D & 3-D Visualization**
  - **Statistics**
  - **Signal Processing**
  - **Xcos - Dynamic systems modelling**

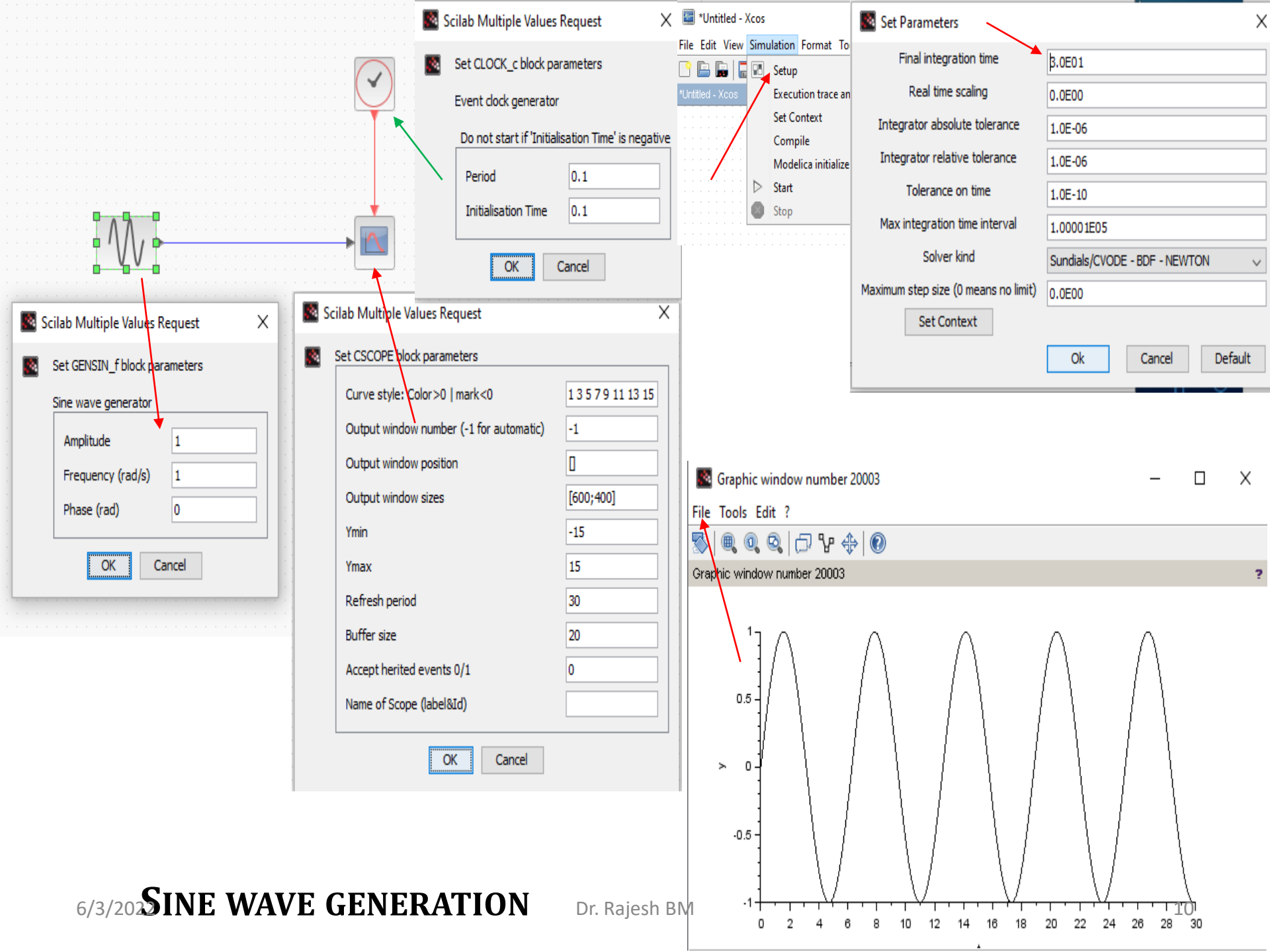
- Xcos is a graphical editor to design hybrid dynamical systems models.
- Standard Palettes & Blocks
- Model building & edition
- Simulation



PALETTE BROWSER

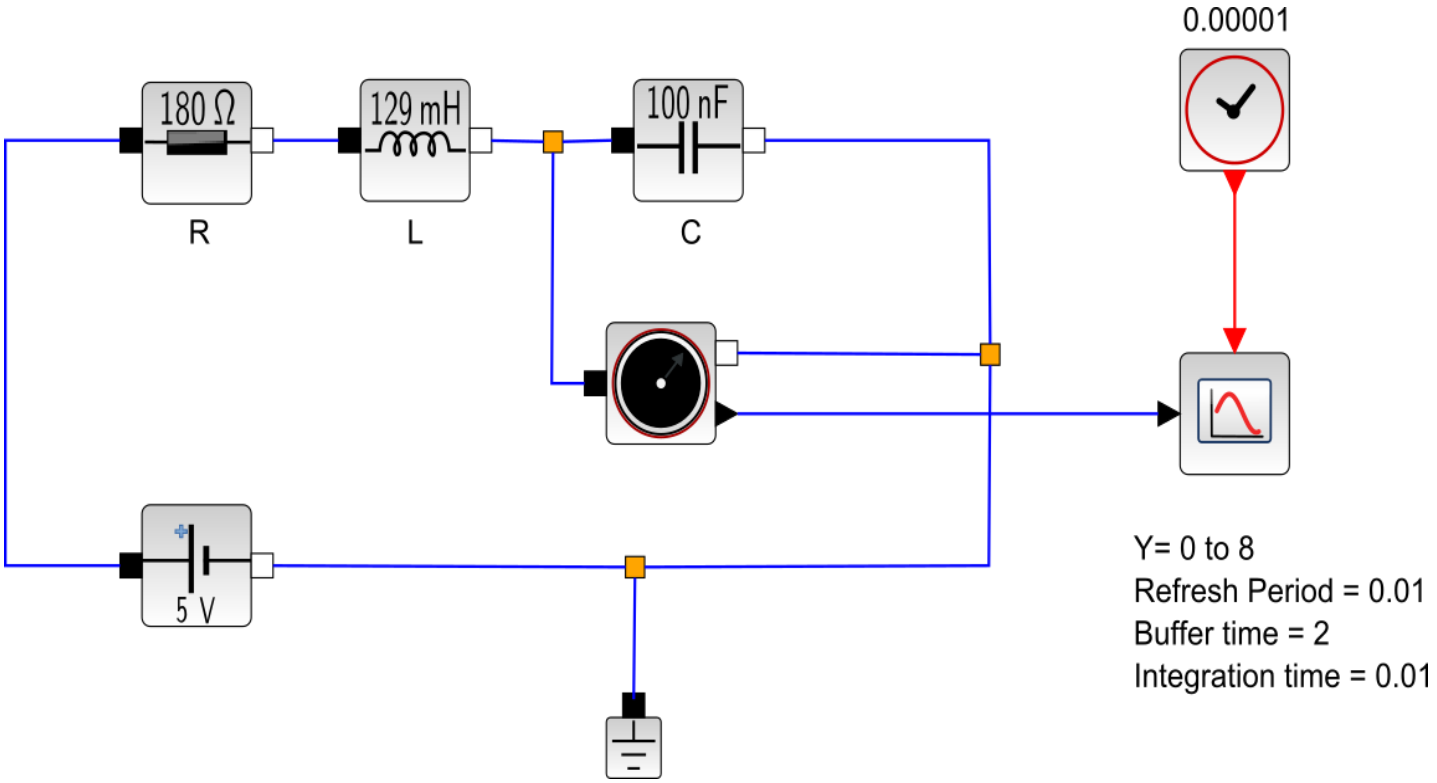
EDIT WINDOW





SINE WAVE GENERATION

RLC circuit using XCOS



Inference

- Understanding of damped harmonic oscillations concept

- Identification of different cases of damped harmonic oscillations based on RLC value

    - Under damped
    - Critically damped
    - Heavy damped

Report writing

- Aim/Objective of the experiment
- Theory of electrical damped oscillation
- Circuit diagram using XCOS
- Tabular column for three different cases of Damped harmonic oscillation
- Output graph
- Analysis of the graph

THANK YOU