

National Institute of Science Education and Research

## Nonlinear dynamics experiments simulation



P441-P442

*Roll no:* 1811004

Abhishek Anil Deshmukh *2018-2023*

School of Physical Sciences

October 10, 2021

## Abstract

Chua's circuits have shown applications in random number generation leading to applications in cryptography due to the quantity of numbers it can produce based on just small variations in initial parameters and so they deserve a detailed study. Chua's circuit is a simple electronic network that well-known shows a selection of bifurcation phenomena and attractors. The circuit includes a couple of capacitors, an inductor, a linear resistor, and a nonlinear resistor. This report describes simulation techniques of such circuit and circuits in general.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>LT-Spice</b>	<b>2</b>
2.1	Simulation from a saved .net file . . . . .	2
2.2	Plots . . . . .	2
	<b>Appendices</b>	<b>4</b>
<b>A</b>	<b>Chua.net</b>	<b>5</b>
<b>B</b>	<b>Un second appendice</b>	<b>6</b>

# List of Figures

# List of Tables

# Chapter 1

## Introduction

Chua circuits are simple oscillator circuit which exhibits a variety of bifurcations and chaos. Chua's circuits. The circuit follows the following state equations

$$C_1 \frac{dv_{C_1}}{dt} = G(v_{C_2} - v_{C_1}) - g(v_{C_1})$$

$$C_2 \frac{dv_{C_2}}{dt} = G(v_{C_1} - v_{C_2}) + i_L$$

$$i_L \frac{di_L}{dt} = -v_{C_2}$$

Where,

$$g(v_R) = m_0 v_R + \frac{1}{2}(m_1 - m_0)[|v_R + B_p| - |v_R - B_p|]$$

## Chapter 2

# LT-Spice

Two simulation of Chua's Circuit which each utilization an alternate type of the nonlinear resistor are introduced beneath. The subsequent odd attractors that are delivered are comparative, yet somewhat unique. Regardless of whether you are new to utilizing LTspice, you will see it simple to do the simulations.

### 2.1 Simulation from a saved .net file

To assist the people who are new to LTspice, I will portray a method by which you can simulate Chua's Circuit utilizing circuit document (Appendix 1).

1. From the LTspice toolbar, select "File" and afterward "Open."
2. Go to the organizer containing the record .asc document and select it. The circuit outline should now be noticeable on your screen.
3. Select "Simulate" on the toolbar and afterward "Run."
4. Pick "V(v2)" and the voltage across C2 will show up as an element of time. (It resembles a lot of commotion.)
5. Put your cursor on the level pivot of the plot and left snap. A container will seem named "Horizontal Axis."
6. In that container is a line marked "Quantity Plotted." On that line "time" as of now shows up.
7. Change "time" to "V(v1)" and afterward click "OK." You currently should see your first bizarre attractor.

Recall that the factors for this framework are the voltage (v1) across C1, the voltage (v2) across C2, and the current I(L1) through the inductor. Any of these amounts plotted versus another gives an intriguing perspective on the peculiar attractor.

### 2.2 Plots



# Bibliography

# Appendices

Appendix A

Chua.net

## Appendix B

### Un second appendice

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.