This report attached here to entitled " Study Case Of Chaotic Electronic Circuit" prepared by Prabagaran a/l Periasamy in partial fulfillment for the Bachelor Degree Of Electronic Engineering (Industrial Electronic) is here by approved.

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STUDY OF CHAOTIC ELECTRONIC CIRCUIT

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor Degree Of Electronic Engineering (Industrial Electronic)

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March 2005

" I here by admit that the paper is my own work except some of the parts which have been cited accordingly."

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ACKNOWLEDGEMENT

This study could never have been completed without the help and support of many person. I wish to express my most sincere gratitude to all of the people who helped me to make this project possible. My supervisor, Pn Anis Suhaila, for providing the excellent guidance, concern and informative discussions regarding to my project.. My beloved family members for their unconditional love, support and patience and at last my friends who give me support and opinion to make my project success.

ABSTRACT

This project is all about a study of chaotic in electronic circuit. Chaotic is known as a robust phenomenon which appears in many aspects of modern science. It is defined as a deterministic dynamical system are those whose state change with time in deterministic way. It also can be mentioned as "noise" in electronic circuit.
The objective of this project is to study about a chaotic in electronic circuit. Here to study about a chaotic, we have to know how it appears in a electronic circuit and to whom it depend to help us find out whether the system is chaotic or not. Here we will discussed about synchronization and attractors which is depend to chaotic system also. In this report also, a few electronic circuit which is design specially for chaotic system also added and it is discussed with the result. At last, a few method is discussed to control the chaos that arise in electronic circuit.

ABSTRAK

Projek ini keseluruhannya adalah mengenai " study of chaotic in electronic circuit". "Chaotic" ataupun lebih dikenali sebagai sebagai hinggar atau herotan yang wujud dalam sesebuah litar elektronik. Herotan atau hinggar ini boleh dikesan melalui gelombang keluaran yang dihasilkan oleh sesebuah litar elektronik. Untuk berlaku "Chaotic" ini bergantung kepada beberapa sebab. Objektif projek ini adalah untuk mengkaji tentang kewujudan "Chaotic" dalam litar elektronik. Untuk mengkaji kewujudan "chaotic" kita harus mengetahui bagaimana ataupun ciri-cirinya untuk berlaku "chaotic" dalam sesebuah litar elektronik. Untuk itu kita akan membincangkan tentang "Synchronization" dan "Attractors" yang mana saling berkait antara satu sama lain untuk terhasil sistem "Chaotic".Dalam laporan ini juga turut disertakan beberapa litar elektronik yang direka khas untuk menghasilkan sistem "Chaotic" bersama dengan keputusannya. Akhirnya, beberapa langkah yang diambil untuk mengawal "Chaotic" ini dalam litar elektronik.

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LIST OF ABBREVIATIONS

MMCC	-	Mixed - Mode Chaotic Circuit
PWM	-	Pulse Width Modulation

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CHAPTER I

INTRODUCTION

1.1 INTORDUCTION

Chaos is both a very interesting and important field of study as is observed that chaotic phenomena arises everywhere around us. Most people tend to shy away when they hear the word chaos, not realizing the beauty and potential that exists in it to enrich their lives.

Chaos is not always so chaotic. In some sense it can be predictable. Two system that can be designed so that one exhibits exactly the same chaotic behavior as the other. In other words, the system would be synchronized. Such devices might be useful for encrypted communications. For example, one of the system could conceal a message within the chaotic signal. Only someone who possesses the second system would be able to decode the transmission by subtracting the chaotic signal and leaving behind the message.

Any chaotic system that can be described by a mathematical equation includes two kinds of variables, that is dynamic and static. Dynamic variables are the fundamental quantities that are changing all the time. For a chaotic mechanism, the dynamic variables might be the position of a moving part and its velocity. Static variables, which might also be called parameters, are set a some point but then are never changed. The static variable of a chaotic mechanism might be the length of some part or the speed of a motor.

1.2 OBJECTIVES OF THE PROJECT

a) Study about chaos that arise in electronic circuit.
b) Study about chaotic attractors.
c) Study about synchronization.

1.3 SCOPES OF THE PROJECT

a) Study about chaotic.
b) Study about attractors.
c) Study about synchronization.
d) Find electronic circuit that chaos arise and study about it.
e) Study how to control the chaos.

1.4 PROBLEM STATEMENT

a) The chaos that arise in electronic circuit.

b) Weak coupling to other circuits can destroy the chaotic behavior.

c) To measure the "chaotioness".

d) To find which attractors as a discrete to chaotic circuit

1.5 METHODOLOGY

a) Study about chaotic and attractors. Understand the concept of chaotic and attractors.

b) Internet surfing. Access the web pages to get the valuable information regarding to this research.

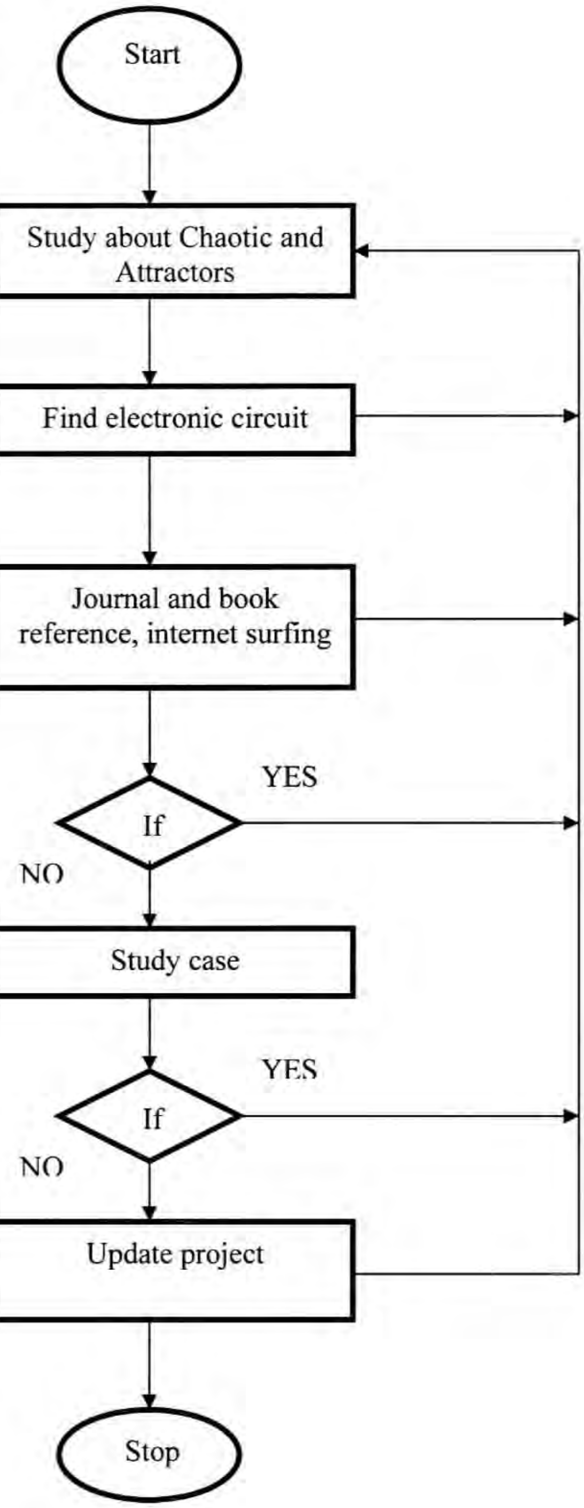
c) Books and Journals reference. Referring to the journals and books to get the information.

d) Compile all the important information. Collect all the information from various sources and compile it to make the study case.

e) Always communicate with supervisor to update project. Always communicate with supervisor regarding the problems and guideline to do the quality research.

f) Come out with the final report.

1.5.1 Flow Chart



1.6 HISTORY OF CHAOS

Chaos is robust phenomenon which appears in many aspects of modern science. While the study is still relatively young, many important results have been found which yield vast insight into the nature of complex nonlinear dynamical systems. The techniques developed from these findings offer many exciting applications into future technology such as communication and neural networking.

Until recently, chaos was considered more of a nuisance than a valid scientifically aspect. Whether it was turbulent fluid flow, fibrillation of the heart, the irregularity at which a tap dripped or the complexity of the weather, there was little attempt to come to terms with these phenomenon from scientific point of view.

This changed when meteorologist named Edward Lorenz noticed some very interesting behavior in some equations he derived in an attempt to model the weather in 1961. He observed that in this set of nonlinear equations, making very small changes of the parameters had a huge effect on their solutions. In addition, he found that a very interesting symmetry to the system, what called as butterfly attractor.

Louis M. Pecora of the U.S. Naval Research Laboratory came with the idea of synchronized chaotic system. He used a computer simulation to show that such a phenomenon can exist. The step that he has taken is demonstrate the idea using physical systems-specifically, electrical circuits, which are accessible and inexpensive.

To demonstrate synchronized chaos initially, Pecora created a computer simulation based on the chaotic Lorenz system, which is named after American meteorologist Edward N. Lorenz, who in 1963 discovered chaotic behavior in a computer study of weather. The Lorenz systems have three dynamic variables and consequently the state-space picture of such systems in three-dimensional. Plotting the trajectory of the Lorenz system in state space reveals what is known as the Lorenz chaotic attractor. Pecora started with the three dynamics variables of the Lorenz system and choas one of them as the driving signal. The subsystem consisting of the two remaining dynamic variables was then duplicated. Although the subsystem and its duplicate were initially set up to produce different outputs, it quickly converged and generating chaotic signals in synchrony.

In 1989 Caroll built the first synchronized chaos circuit. By duplicating part of a circuit that exhibited chaotic behavior, he created circuit in which the subsystem and its duplicate were driven by the same chaotic signal. These two subsystems generated voltages that fluctuated in a truly chaotic fashion but were always in step with each other.

These results paved the way for a rigorous mathematical study of chaos. While there is no formal definition of the term, chaos can be most simply defined as the observable pattern of making a small change in a complex, nonlinear system which produces a huge change in the behavior of the system. This is often called a sensitive dependence upon initial conditions.

Over the past 15 years, scientists have seen the values of these studies as many subtle behaviors of physical systems have been shown stem from a chaotic origin. As a result, there has been a tremendous increase of interest in chaotic origin. As a result, there has been a tremendous increase of interest in chaotic behavior in such diverse fields as nuclear physics, biology, socioeconomic, electrical engineering and solid state physics.

1.7 CHAOTIC

In Mathematics is commonly defined as the study of patterns of structure, change, and space; more informally, one might say it is the study of "figures and numbers". In the formalist view, it is the investigation of axiomatically defined abstract structures using symbolic logic and mathematical notation; other views are described in Philosophy of mathematics. Mathematics might be seen as a simple extension of spoken and written languages, with an extremely precisely defined vocabulary and grammar, for the purpose of describing and exploring physical and conceptual relationships.

Physics is the study of energy and its interaction with matter. Because of the primacy of energy in the history of the universe, because all matter must interact with energy to express its properties and engage in transformations, and because energy is the key player when matter is decomposed into its most basic parts, physics is often considered to be the fundamental science.

Chaos theory deals with the behavior of certain nonlinear dynamical systems. Chaotic is deterministic dynamical systems are those whose states change with time in deterministic way. In engineering and mathematics, a dynamical system is a deterministic process in which a function's value changes over time according to a rule that is defined in terms of the function's current value.

1.8 DESCRIPTION OF THE THEORY

A non-linear dynamical system can in general exhibit one or more of the following types of behavior:

a) Forever at rest.

b) Forever expanding (only for unbounded systems. In the theory of dynamical systems, an unbounded system is a system that has no bound; example one that can expand forever, with no limit.).

c) Periodic motion. In mathematics, a periodic function is a function that repeats its values, after adding some definite period to the variable. Everyday examples are seen when the variable is time; for instance the hands of a clock or the phases of the moon show periodic behavior. Periodic motion is motion in which the position(s) of the system are expressible as periodic functions, all with the same period.

d) Quasi-periodic motion.

e) Chaotic motion.

1.8.1 Chaotic Motion

The most famous type of behavior is chaotic motion, a non-periodic complex motion which has given name to the theory. In order to classify the behavior of a system as chaotic, the system must be:

a) Bounded.

b) Sensitive on the initial conditions.

c) Transitive.

d) The periodic orbits must be dense.

1.9 CHAOS DIAGNOSTICS

Not all complex system are chaotic. Here, I shall make an attempt to summarize how one might proceed in looking for existence of deterministic chaos. The diagnosis of chaos is not a simple task, because a number of different determinations are necessary. There is no one measurement or calculation that can establish the existence or absence of chaos. For a system to be technically chaotic, certain specific conditions must prevail. These include:

a) The system must be nonlinear and its time series should be irregular.
b) Random components must exist.
c) The behavior of the system must be sensitive to initial conditions.
d) The system should have strange attractors, which generally means that it will have fractal dimension.

e) In dissipative system the 'Kolmogorov' entropy should be positive.

f) Perhaps the most terse way of pronouncing a system to be chaotic is to determine that there are positive 'Lyapunov' coefficients.

By definition, deterministic chaos means integral presence of randomness, which is a stochastic issue. In stochastic processes the parameters of the system evolve with time, not deterministically, but probabilistically. This leads to uncertainty in making predictions. Accordingly, any model must include probability distributions and various other statistical factors. Until chaos theory came along, modelers resorted to either deterministic models or stochastic models, usually the former to solve physical problems, and the later to solve social problems. With the advent of chaos theory, the coexistence of the two approaches had to be reconciled.

There are two other matters that must be considered, that is the system dissipative or conservative. If it is the former, various aspects of entropy may have to be considered because dissipative systems can lead to self-organization. It was said previously that very large systems, such as astrophysical configurations, can be treated quite adequately as conservative systems. Recent developments in cosmology that treat astrophysics in a holistic manner cast doubt on this.

The other issue that is of great importance in practical problems is whether the stochastic component is the randomness inherent in chaos or whether it is noise, or whether it is a combination of both.