



CHAPTER I

INTRODUCTION

1.1 Computer Simulation

Simulation is a tool used for imitating a real physical problem in an equation or graphic form. For automobile, it may be used to show the characteristics of a proposed car model. In economics it can be used to predict what will happen in the world when some variables or parameters are changed.

In the past 30 years, both analog and digital computers have evolved as major tools in the art of simulation. In the last few years, we have seen the evolution of video games which simulate sports and star wars. These games use microprocessors, which have brought about a revolution in elementary education today. The scientific community has been using simulation for solving complex problems that yield differential or integral equations. In real life the majority of these equations are non-linear and, except in some simple cases, require numerical solutions. This leads to the use of analog or digital computers, which require that the engineer/scientist be familiar with programming digital computers. For analog computers the engineer must learn to set up the pots for amplifiers as well as learn to state the problem in the form of analog block diagrams. For a great number of engineers and scientists, the tedium of programming-finding syntax errors instead of solutions and waiting endlessly for the results from a data-processing shop - is not a very pleasant task.

The more common problems in engineering and technology also involve solutions of differential equations that require multiple trials either because of boundary conditions at two ends of the spectrum or approximate values of parameters obtained from the physical nature of the problem. Imagine having to wait for a batch of runs to find that the whole time was wasted because of a syntax error or the misplacement of a decimal point. This brings us to the use of interactive computing, which along with interactive digital simulation, became popular in recent years. We will concentrate on the use of interactive simulation with digital computers, especially personal computers, in the solution of complex engineering and scientific problems.

Simulation with digital and analog computers actually started in the late 50s and early 60s when the aerospace industry applied it to aircraft design and missile trajectory calculations. Computer simulation then became popular in control system design, a chief usage today. Some problems in the medical field and mechanical engineering design were also attacked with computer simulation, followed by its use in chemistry and chemical engineering design. Boundary value problems in fluid mechanics, which can be simplified to an ordinary differential equation format, also became amenable to the use of computer simulation.

Simulation is also used in economic forecasting and modeling, provided that proper means of describing the cause and effect relations between the variables being examined are available. Other simulations performed by programs like GPSS provide answers to problems such as how many tellers are to be used at a bank at lunch period with minimum customer wait time or how many terminals should be purchased for a computer system with bottlenecks in

a communication line. These simulations use the queuing theory and statistical assumptions in solving problems.

Computer-aided mechanical design also uses a form of simulation. Special purpose computers with colour graphic displays and electrical circuit board design are some of the application areas where these systems are popular. Simulation in this case consists of evaluating, for a given design, stress components in a mechanical part or heat dissipation in an electrical circuit board.

At present, There are many computer simulation of global warming programs in abroad, but it is little developed in Thailand.

The computer simulation has many advantages as follows:

- a) Simulation resembles scientific experimentation in that the user can evaluate proposed decisions by using mathematical models representing complex problems .
- b) Simulation can help determine what is likely to happen when certain decisions are made under particular conditions.
- c) Simulation is a trial-and-error problem-solving approach, since both decisions and conditions can be modified.
- d) Enable researchers to explore various potential solutions to the same problem in order to find an ideal or to eliminate them all.
- e) Microcomputers are proving especially useful here because they can be dedicated entirely to the experimental tasks at hand.
- f) It makes the user actively when using. Prior, a computer includes video screen, like a television, so it also provide interesting entertaining and informative visual images that help to keep users

'attention. The later, a computer requires action from the user before it can perform.

- g) The computer can provide fast and systematic feedback to the user.
- h) It does not get bored or frustrated with a slow users.
- i) The computer facilitates and sometimes even manage remediation.
- j) Using with computer simulation will give users a computer literacy as well.

1.2 The Significance of Climatic Temperature Change Research

In the chemical engineering aspect, the important factor affecting all the process, for example; a preparation of raw material; chemical reactions; reactor design and development; and separation and purification process, is a temperature. Therefore, the accuracy of temperature measurement of the system is considerable. Similar to these processes, the temperature change of the system (the globe) due to energy transfer was estimated in this research.

At the present, the world' s population is growing by about 90 million people each year (about 1.65 %). According to an increasing world population causing an increase in both human activities and atmospheric greenhouse gas concentration. Current increases in greenhouse gas have been estimated as follows: carbon dioxide, 0.4 % per year; methane, 1.3% per year; nitrous oxide, 0.2-0.3 % per year and chlorofluorocarbon, >5 % per year (World Resources, 1987).

If current trends still continue, the build-up of these gases is likely to cause significant warming of the global climate. Some warming may already be inevitable because of past emissions. The global climate change could

destabilise the natural and society systems upon which we have come to depend. The means for reducing the risk of global warming, for example, increasing the efficiency of energy production and use, switching from carbon-intensive fuels such as coal to hydrogen-intensive fuels such as natural gas, where possible, encouraging the rapid development and use of solar and other carbon-free energy sources, eliminating the production of most chlorofluorocarbon and developing the means to recapture those now in use, reducing the rate of deforestation will be possible. If we can know how the change occurs. One way to make spirit among human is to reveal the global warming crisis by developing simulation program for estimating the climatic temperature change. With this program, the user can estimate the sea-surface temperature change easily and effectively because it provide users with many Graphic User Interfaces (GUI).

1.3 The Featuring of Climatic Temperature Change and Its Detection Simulation Program

Climatic temperature change or sea-surface temperature change takes place by an increase in many atmospheric greenhouse gases. They can absorb and reemit the longer-wavelength radiation emitted from the Earth's surface. By trapping heat in this manner, greenhouse gases cause the lower part of the Earth's atmosphere (the troposphere) to become warmer.

The amount of temperature change depends on different factors e.g. time, concentration of greenhouse gases, heat capacity, density, specific heat, and thermal diffusivity of sea water, etc. Several computer programs are developed to estimate the amount of temperature change. However, at present we find that there utilisation does not reach the satisfactory level, and has a lot of limitations.

Most of such programs have to be imported from abroad then its utilisation is very limited. This work, therefore, will focus on developing a simulation program which is efficient and costs less than a program bought from abroad.

1.4 The Objective of this Thesis

The objectives of this research are:

- a) To study the phenomena of global warming caused by an increase in the concentration of many greenhouse gases.
- b) To develop simulation program for estimating sea-surface temperature at each time or greenhouse gas concentration.
- c) To calculate sea-surface temperature for each time or greenhouse gas by using the developed simulation program.
- d) To analyse the value obtained from the developed simulation program with results of the program based on the original model and the observed temperature record.

1.5 The Scope of this Thesis

This climatic temperature change simulation program developed in this work can provide both calculation section and theoretical section. The scope of each section is as follows:

Calculation Section

In this section, the author will show the both of numerical and graphical results after all correct data are inputted. This section used Visual Basic for Windows as a compiler. Detail of task carried out in this work is as follows:

- a) The determination of climatic temperature change (sea-surface temperature) by using computer simulation program which is written in Microsoft Visual Basic language and for the study of the following variables:
 - i) Time
 - ii) Atmospheric concentration of carbon dioxide
 - iii) Atmospheric concentration of methane
 - iv) Atmospheric concentration of nitrous oxide
 - v) Atmospheric concentration of chlorofluorocarbon
- b) Testing performance of this simulation program by comparing the value of sea-surface temperature estimated by the program with the observed sea-surface temperature obtained from many data sources.
- c) Develop of a database to support in the program calculation consists of:
 - i) Global Warming Potential
 - ii) Observed atmospheric concentration of carbon dioxide
 - iii) Observed sea-surface temperature

Theoretical Section

This section shows text and pictures that involve with a climatic temperature change in global warming phenomena. It is developed by using ForeHelp in creating keywords and applying hypertext technique to construct hot spots and related topic jumpings.