

CHAPTER I



INTRODUCTION

BACKGROUND

In tire manufacturing industry, vulcanization is the basic, final and most energy - intensive process. The product quality depends on this process. The optimum conditions for heat transfer of curing process is still a processing problem today.

The computational simulation of the heat transfer conditions is carried out in stages from pre-design preparation to calculations optimization. The simulation includes determining the dimensionality and type of mathematical model necessary and sufficient to give prediction results when solving a heat transfer of thermal conductivity problem. The steps include determining the geometrical region of tire curing process modelling, the thermophysical and vulcanization characteristics of the rubber compound, and the initial boundary conditions.

In addition, the study involves the investigation of real time temperature during curing process, and prediction of possible conditions of heat transfer on the process equipment.

The understanding of heat transfer mechanism during tire curing process is an important step in the optimization of tire curing process. Since the heat transfer mechanism is related to the quality control and the economics of the process.

This paper has presented principle of developing a mathematical model to explain the heat transfer process during the tire curing process. A typical mathematic modelling technique can be represented by the diagram in Fig 1.

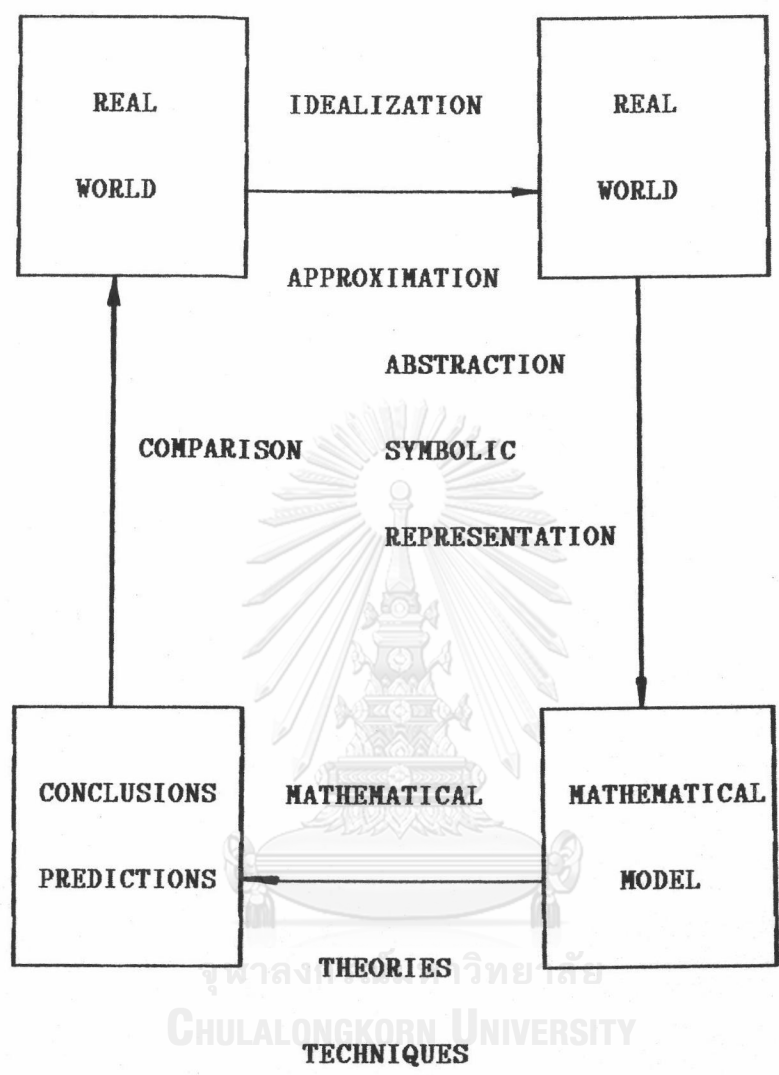


Figure 1.1 Typical Mathematical Modelling Technique.

(K.S. Haridas and S.Premkumar ,1994)

OBJECTIVES

The objectives of this work are :

1. To experimental study heat transfer phenomena of tire curing process by measuring the temperature distribution as a function of time.
2. To simulate the temperature distribution in the tire by mathematical model.
3. To predict the temperature profile versus time in the tire during vulcanization by simulation.

SCOPE OF WORK

1. Introduction of the tire vulcanization process.
2. Summarization of the basic knowledge of vulcanization and heat transfer process.
3. The experimental investigation of real time temperature distribution during curing prcess in different parts of the tire, i.e. at the crown and under tread , surface of bladder or diaphragm. The temperature distribution was obtained from direct measurement via thermocouple.

4. Identification of the geometrical region of the thermal axis by cylindrical symmetry and derivation heat transfer equation.
5. The simulation of temperature-time profile was based on finite difference approximation methods of computation.
6. Comparison of computer simulated results with experimental data.
7. Conclusions

BENEFITS EXPECTED

This work should provide ;

1. A suitable and simple heat transfer model for basic tire curing process.
2. The ability to use a computer to study or simulate the behavior of heat transfer when it needs to change curing condition or rubber compound formula.
3. The ability to simulate case study of tire curing process.
4. Information to support the rubber compound formulation which relates to heat transfer properties.