Chapter 1

Preliminary

1.1 Background

One of the main equipment of cement production processes is kiln that has function to burn the raw mix into semi-finished cement. Inside the kiln, the burning process reach the highest temperature is about 1400-1500 ^{o}C, this range of temperature is purposed to complete the clinkerization process [1]. Due to the working temperature is very high, then the kiln shell that is made of steel is coated with refractory lining made of the firebrick. Practically, there are so many problems that occur during the kiln operation, both in terms of process, mechanical or even the electrical damage.

One of the mechanical damage is the dislodging/cracking of the firebrick from its location. The dislodged firebrick can occur as a result of shifting structure due to excessively high temperatures or even the rotation of the kiln itself. The void in the firebrick lining will cause direct contact between the hot gas flowing inside the kiln with kiln shell, and known as hot spot. This hot spot can cause ovality or cracks due to excessive thermal stress.

In order to avoid the crack, it is necessary to study the behavior of temperature and thermal stress of the hot spot. Because of the thermal stress mainly caused by temperature of the hot gas flowing inside the kiln, in this research the effect of temperature of the hot gas on the thermal stress is studied numerically.

1.2 Purposes

The purpose of this study is:

1. To obtain temperature distribution of hot spot area of the kiln shell.
2. To obtain thermal stress distribution of hot spot area of the kiln shell.
3. To know the effect of the obtained thermal stress to the kiln condition.

1.3 Benefits

The results of this final project are expected to add convenience to field implementers including engineers to guide in paying attention to the distribution of temperature and stress in hot spots, so that treatment can be determined suitable for the hot spot.

1.4 Scope of Problems

The problem limits discussed in this study are:

1. When performing calculations and modeling, the raw mix that enters the kiln is ignored.
2. Simulation is proceed in most thinner shell area.
3. The hot gas in the kiln is assumed to be laminar.
4. Modeling and numerical calculations are analyzed using computing programs.

1.5 Writing Systematics

The systematics of writing this research report starts from the making of CHAPTER I which explains the background of the problem, objectives, benefits, scope of problems and assumptions and the systematic writing of the report. CHAPTER II explains the basic theories about the rotary kiln, the nature of the shell kiln material, the hot spot on the shell of the kiln, the displacement of the kiln, and conduction in solid objects in an unsteady state which is the reference for writing later reports from the basic theory. about research flow diagrams, equipment used, research parameters and work details of the research procedures to be carried out. CHAPTER IV which describes and explains the data and test results obtained and

analyzes the equations and data in the form of graphs obtained from the results of the research conducted. And ended in CHAPTER V, explaining the final conclusions of the research and recommendations recommended based on experience in the field to improve the process of further testing.