CHAPTER 1

INTRODUCTION

This chapter will describe background study, problem statement, objectives and scope of this project. This project also is related to the study of fracture mechanics and more specifically in determining the stress intensity factor for compact tension specimen by using numerical method and empirical calculation.

1.1 Background study

All engineering components and structures contain geometrical discontinuities or crack such as at threaded connections, keyways in shaft, teeth of gear wheel, etc. Stress intensity factor is important since it determines the strength and can predict life time of the structure. Investigation of stress intensity factor is the effective tool to improve safety, reliability and reasonable precaution of the structure that containing cracks.

A number of methods have been used for determination of stress intensity factor such as numerical method, empirical calculation and experimental method. Recently, the use of numerical method, particularly Finite Element Analysis (FEA) has vastly broadened the range of problems that can be solved by computational approaches instead of experimental method. FEA software has the ability to simulate almost actual stress intensity factor at the crack tip and at the specimen. While empirical calculation is a method that generally forms based on theory.

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1.2 Problem statement

Determination of stress intensity factor has proven to be an effective tool for crack growth analysis at crack tip. Initial propagation of crack is always happen at the crack tip because it endure highest amount of stress. The area around the crack tip is called singularity area is very crucial to investigate stress intensity factor at compact tension specimen. The most accurate method is experimental method but stress intensity Factor cannot be measured directly in experiment. Further investigation will cause human error, limited laboratory condition and can enable appreciation danger.

The convenient methods to find stress intensity factor are by using empirical calculation and numerical method. Unfortunately, both are complex and consuming time if the load and dimension varies. Variables that considered are crack size, component geometry, applied load and the material property called fracture toughness to evaluate the ability of a component containing a flaw to resist fracture. The objectives of this project are to solve this problem by design new method to find stress intensity factor from both methods for various dimension and load apply.

1.3 Objectives

There are three main objectives of this project study which are:

1. To model, analyze and determine stress intensity factor for compact tension specimen by using empirical calculation and numerical method (ANSYS)
2. To compare stress intensity factor values obtain by empirical calculation and numerical method
3. To plot graphs that can be use to interpret value of stress intensity factor for different dimension of thickness, width and crack length and load applied for both methods

1.4 Scope of study

This project was based on Fracture Mechanics and Linear Elastic Fracture Mechanic (LEFM) approach to determine stress intensity factor. Fracture Mode I involved and compact tension specimen choose as the testing specimen. The dimension, configuration and testing procedure is based on ASTM E399-90 (Approved 1997): Standard Test Method for Plane – Strain Fracture Toughness of Metallic Material. As stated in ASTM E399-90, plane strain condition must be satisfied to fulfill the requirement. To investigate the specimen, two methods will be uses which are empirical calculation and numerical method (ANSYS). Both of these methods only valid depend on limit of validity and at singularity area only. While material that will be use is Aluminum 7075-T6 and is assume isotropic.