

UNIVERSITI TEKNOLOGI MARA

**FATIGUE STUDIES ON CARBON
STEEL PIPING WELDED
MATERIALS AND ITS
CONNECTIONS**

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ABSTRACT

In this study, the fatigue characteristics in pipe is investigated to increase the knowledge of the fatigue crack growth in pipe. The material used in this study is carbon steel. This study does a simulation of the fatigue crack growth on a created model. This simulation uses a software called ABAQUS, this software uses extended finite element analysis as a platform to simulate the changes happen to the model when in different condition. This simulation require the construction of a 2-D model that will be experiencing fatigue crack growth. This means the model will be subjected to the force of tensile and compression to imitate what happen during the life of a pipe. The model will undergoes several steps before result can be obtained. For example, the mechanical properties data must be inputted in the software before running the software. The steps also included other steps such as load assignation and meshing. The obtained result comes in form of images of the crack opening after the condition applied. It shows the different results based on the condition that the model have gone through.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

In oil and gas industry, the usage of pipes and piping system is very basic. There are various processes in oil and gas industry which the application of piping system is very crucial such as crude oil drilling, production, processing, storage and transportation of crude oil. It is very important for the pipes and all its components to function properly in order to achieve maximum efficiency in any processes involve piping system. Pipes comes in different size and compositions. Examples of pipes used in oil and gas industry are stainless steel and carbon steel. Each type of steel have their own size and characteristics depending on the condition of the site. The selection of pipes is also depends on the type of materials to be transported by the pipeline.

During the handling of the pipes, it is frequently exposed to stress and strain that lead to fatigue loading. Continuous exposure of excessive stress to the pipe will lead to fatigue crack growth which will cause mechanical failure or crack. Under normal operating condition, the failure of piping component can happen even though the stress is well below the allowable stress limit. The failure shows that the conventional stress analysis cannot guarantee the integrity of the components under operational condition.

Fatigue is a mechanism that is frequently found in the piping system. The presence of fatigue may cause disadvantages to the integrity of the piping system and its components. Fatigue also can cause crack initiation in the pipe. This is because the some regions may experience high stress or area with the presence of undetected flaws occur to the weld or the components. It is important to make sure that crack initiation will not occur during the service life of the pipe and the equipment. In order to achieve that, the behavior of crack initiation under cyclic loading need to be understand. It will help the prediction of the life of the components.