VALVE CONDITION MONITORING BY USING ACOUSTIC EMISSION TECHNIQUE

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MOHD KHAIRUL NAJMIE BIN MOHD NOR

Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Mechanical Engineering

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NOVEMBER 2009

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurrently submitted for award of other degree.

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LIST OF SYMBOLS

V	Voltage
μ	Water viscosity
C	Crest factor
$( )$	Probability density function of the instantaneous amplitude
	Amplitude
	Time
dB	Decibels
N	Counts
k	Kurtosis
σ	Standard deviation
$\bar{}$	Mean value

LIST OF ABBREVIATIONS

AE	Acoustic Emission
AED	Acoustic Emission Detector
AET	Acoustic Emission Testing
ANN	Artificial Neural Network
B.C	Before Christ
FFT	Fast Fourier Transform
NPP	Nuclear power plant
PAR	Peak-to-average ratio
RDC	Ring down counts
RMS	Root mean square
T & P	Temperature and pressure

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ABSTRACT

This study was carried out to monitor valve condition monitoring by using acoustic emission technique. Two conditions were considered in this study which are good condition valve and leak valve. There are two objective of the study which is to detect acoustic emission parameter and to develop a classification method to monitor valve condition by using acoustic emission technique. The study is accomplished by analyzing the parameter hits and average rms. A hydraulic bench was used to provide water to the test rig. The first experiment is to monitor good valve condition. It is done by analyze the hits and rms collected for every rotation of the wheel handle. Then, the graph of hits plotted is compared between the graphs plotted by Hafizi (2008) to see the different characteristic of different valve. The second experiment is to monitor the leak valve. Two different valves were used in the second experiment which are gate valve and check valve. Sand and then screw was put in the valve as to make the valve leak. Then, the parameter hits and rms is measured to analyze the different between good condition valve and leak valve. The results show that there is acoustic emission activity occur when there is leak in the valve and the activity can be detected by using the acoustic emission sensor. It is also prove that the different leak will emit different acoustic emission energy.

ABSTRAK

Kajian ini dijalankan untuk menyelia injap yang dalam berkeadaan baik dengan menggunakan teknik pancaran akustik. Dua keadaan injap di guna di dalam kajian ini iaitu injap dalam keadaan baik dan injap bocor. Kajian ini mempunyai dua objektif iaitu yang pertamanya untuk mengesan parameter pancaran akustik dan membangunkan teknik klasifikasi untuk mengkaji keadaan valve menggunakan teknik pancaran akustik. Dua parameter yang di kaji ialah hit dan juga rms. Bangku hidraulik digunakan untuk membekalkan air ke peralatan kajian. Ekperimen pertama adalah untuk mengukur parameter pancaran akusitik pada injap berkeadaan baik. Hit dan juga rms dikumpul bagi setiap pusingan injap. Kemudian, graf hit diplotkan dan dibandingkan dengan graf yang telah diplotkan oleh Hafizi (2008) untuk melihat perbandingan di antara dua graf tersebut. Eksperimen kedua dijalankan untuk mengkaji injap yang bocor. Pasir dan kemudiannya skru di letakkan di dalam injap untuk mewujudkan kebocoran di dalam injap. Hasil menunjukkan aktiviti pancaran akustik muncul apabila injap bocor. Hal ini menunjukkan kebocoran injap dapat di kesan menggunakan pengesan pancaran akustik. Ini juga membuktikan berlainan kebocoran akan mengeluarkan tenaga pancaran akustik yng berbeza.

CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

Observing defects in components help to reduce failures and improving product quality. Many researches were done in order to detect defect in component by using non-destructive method. Still, ineffective selection of non-destructive testing can be disastrous in such in industries as nuclear, chemical and petrochemical where quality demands are very stringent (Baldev Raj, 2002). In piping system, reduce component failure is important to improve the fluid flow. The reduction of component failure can be done by monitoring the component condition by non-destructive method. One of the most important components in the piping system is valve. Valve is commonly used in piping systems to control the flow rates by simply altering the head loss until the desired flow rate is achieved (Report 170, Valve). In power plant (especially in nuclear power plant), the valve failure can cause catastrophic failure despite of causing damage to another components (Zohari M.H, 2008).

The selection the right choice of non-destructive method to monitor the condition of valve is important. In other industries, rejection of acceptable component due to ineffective non-destructive testing can lead to financial losses (Baldev Raj, 2002). Acceptance of rejected component results in damage to reputation of the company due to supply of products where do not meet the quality requirement. Therefore, it is needless to say that the importance of right choice of the appropriate non-destructive method depends to the

component to be inspected, the types of defect and the sustainability of the technique from access point of view.

In this project, the acoustic emission (AE) technique will be used to monitor the valve condition. This study will focus on the analysis and understanding of the capability of acoustic emission technique to provide diagnostic information on different valve condition. Compared to other non-destructive technique such as ultrasonic and radiography, acoustic emission is a relatively new entry in case of monitoring the valve condition. Acoustic emission technique can provide on-line monitoring of valve condition that will gives many advantages such as totally non-invasive testing, simple and intrinsically safe operation, and cost reduction of maintenance and plant operations (Report 170, Valve).

1.2 PROBLEM STATEMENT

This study is to monitor valve condition by using acoustic emission technique. Currently, there are very few studies have been done for such a function. One of the problem occur in the piping system is about valve leak. The different between good condition valve and the leak valve should be determined. There are many acoustic emission parameters appearing in signal and the choice of precise parameter is important to detect leak in valve.

1.3 OBJECTIVE

For this project, two main objectives are listed:

1) To detect acoustic emission parameter from two valve condition which is good condition and leak
2) To study a classification method to monitor valve condition by using acoustic emission technique

1.4 SCOPE OF STUDY

The definition of scope is important to make sure the research is done towards the right direction. For this case, the project will use the acoustic emission technique to monitor valve condition. This study is completed by doing two experiments which are the first experiment is to measure acoustic emission parameter in good condition valve. Gate valve will be used in the first experiment. The second experiment is to measure acoustic emission parameter in leak valve. Gate valve and check valve is used for second experiment. Parameters of acoustic emission to be considered in the study are total hits and average rms.

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