

**COMBINATION OF ULTRASONIC SIGNAL WITH
WAVELET ANALYSIS FOR DETECTION OF CABLE
DEGRADATION**

This thesis is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Hons.)

UNIVERSITI TEKNOLOGI MARA



MOHAMMED SUHAIMI WASI BIN ZAINAL ARIFFIN
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM

ACKNOWLEDGEMENT

First and foremost, my humble gratitude and appreciation to Almighty ALLAH, Most Gracious and Most Merciful, Whose help and guidance has sustained me to bring this dissertation to completion.

I would like to thank my Project Supervisor, En. Muhammad Farid bin Abdul Khalid for the guidance and support he has provided throughout the course of this final project. His knowledge, energy, openness and encouraging me to perform to the best of my capabilities.

I wish to acknowledge my debt of gratitude for all my families and friends who help me during my Bachelor studies. To my friend Ahmad Azizul Azwan bin Yaacob, thank you for always kept accompany me.

May ALLAH reward all our efforts and good intentions.

AMIN....

ABSTRACT

This paper proposes a technique for identification of insulator's degradation for high voltage cable using ultrasonic technique. The ultrasonic technique signal of the cable was captured using the listening device (Voltage range at 5kV, 10kV and 12.5kV). Then, the sample of ultrasonic signal is transferred to personal computer (PC) using the microphone. These signals are stored in MATLAB workspace for further analysis. The application of Discrete Wavelet Transform (DWT) is used to extract the feature of the ultrasonic signal. From the DWT application, the difference between the normal insulator and degraded insulator of cable could be identified.

TABLE OF CONTENTS

CHAPTER		PAGE
1	INTRODUCTION	
1.1	Introduction	1
1.2	Objective	2
1.3	Scope of Thesis	3
1.4	Organization of Thesis	4
2	LITERATURE REVIEW	
2.1	Application of cables	5
2.2	Partial Discharge (PD)	6
2.2.1	Classification	7
2.2.2	Terminology	8
2.3	Wavelet Transform Theory	9
2.3.1	Wavelet Transform Technique	11
2.3.2	Fourier Transform (FT)	11
2.3.3	Multiresolution and Wavelets	14
2.3.4	The Continuous Wavelet Transform (CWT)	15
2.3.5	Sampling and the Discrete Wavelet Series	18
2.3.6	Discrete Wavelet Transform (DWT) and Subsignal Encoding	19
2.3.7	Conservation and Compaction of Energy	21
2.3.8	Wavelet Packet Analysis	22
2.3.9	An Introduction to the Wavelet Families	24
2.3.10	Haar	25
2.3.11	Daubechies	25
2.4	Introduction to Ultrasonic	26
2.4.1	Ultrasonic Technique	27

CHAPTER 1

INTRODUCTION

1.1 Introduction

Cables used in power plants are selected on the basis of qualification test which provides a sufficient degree of confidence in the ability of the cables to maintain operational readiness for well-defined “life” duration.

Partial discharge (PD) is an important phenomenon in high voltage equipment. Partial discharges will occur along the entire length of a cable when voltages greater than the partial discharge inception voltage are applied. The magnitude of such discharges is usually small, but they can cause progressive deterioration and may lead to ultimate failure. It is therefore essential to detect their presence in a non-destructive control test [1]. The partial discharge cables can be detected when the ultra probe device was directed to the cables.

With the help of the ultra probe device, the ultrasonic signal of cable was recorded and the signal will be transferred to PC using the microphone. The output signal can be analyzed efficiently in wavelet analysis.

The wavelet transform is a new analyzing method in signal processing. The wavelet analysis can analyze in detail the signals for both time and frequency domains. The wavelet analysis result could be used because the result was clear to degradation diagnosis of insulator.