HIGH RESOLUTION IMPULSE ANALYSING SYSTEM-HARDWARE AND SOFTWARE IMPLEMENTATION

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Special dedicated

to my supervisor and family who encouraged

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ABSTRACT

This research project objective is to develop an impulse analysing system consisting of data acquisition, analysis, reporting and storage. The main contribution of this research project is a cheaper alternative to the commercially available system such as HiAS743 and DiAS733 manufactured by Haefely This system is made up of digital oscilloscope (PicoSope) and personal computer with installed LabVIEW software. LabVIEW codes for the system operation were written. Other equipment used in the experimental work are an impulse voltage generator, impulse divider, attenuator, and transmission cable. The measuring and analysing system was successfully tested and calibrated. The system is ready to be used for high voltage impulse measurements as alternative and back-up to the current systems used in UTM.

ABSTRAK

Objektif kajian projek ini adalah untuk menghasilkan sistem alatan pengukuran impuls yang mempunyai keupayaan boleh mengumpul ,menganalisa, membuat laporan dan menyimpan data. Sumbangan utama dalam projek kajian ini adalah alternatif murah berbanding komersial yang sedia ada seperti HiAS743 dan DiAS733 dikeluarkan oleh Haefely. Sistem ini dibuat dengan menggunakan osiloskop digital (PicoScope) dan computer peribadi dengan memasang perisian LabVIEW. Kod LabVIEW untuk system operasi ditulis. Alatan lain yang digunakan dalam kerja eksperimen adalah penjana voltan impuls, pembahagi voltan,pengecil dan system kabel penghantaran.. Sistem pengukuran dan analisis berjaya di uji dan ditentuukurkan. Sistem ini sedia digunakan untuk pengukuran voltan tinggi impuls seperti alternatif dan sokongan kepada sistem yang sedia ada dalam UTM.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

HRIAS	-	High Resolution Impulse Analysing System
T1	-	Front Time/Rise Time
T2	-	Tail Time/ Time to Half Value
LI	-	Lightning Impulse
SI	-	Switching Impulse
OLI	-	Oscillating lightning Impulse
LICF	-	Lightning chopped Front
LICT	-	Lightning chopped Tail
IEC	-	International Electrotechnical Commission
RSG	-	Recurrent Surge Generator
K	-	Ratio
AC	-	Alternating Current
DC	-	Direct current
HV	-	High voltage
VI	-	Virtual Instrument
API	-	Application Programming Interface
PC	-	Personal Computer
VISA	-	Virtual Instrument Software Architecture
IVAT	-	Institute of High Voltage and High Current

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Project Background

High voltage testing or insulation testing is essential for electrical engineers and researchers to ensure the electrical equipment to be capable of withstanding overvoltage, which meets the requirement of its service. In electrical field engineering, the testing of voltages are divided into three, namely the direct voltages (DC), power frequency alternating voltages (AC) and impulse voltage. This research thesis study focuses on impulse voltage area knowledge, which then is used to develop a high resolution impulse measurement system. High impulse voltage is required for the testing purpose to simulate overvoltage in transmission lines and electrical apparatus that are stressed by two transient overvoltage conditions, which are lighting strike and switching operation.

In order to standardize the high voltage testing, international or national standard such as Electrotechnical Commission (IEC) specification is a necessity to follow and satisfy. This specification outlines the detail of testing technique, requirement for equipment, acceptable limit and procedure that meet the requirement of users and manufactures. The standard requirement reference for developing measuring impulse voltages is IEC 61083-1 that is required for instrument used for measuring the high voltage and IEC 61083-2, an evaluation software that uses determination impulse voltage parameter. IEC 60060-1 is a high voltage test technique which testing the requirement with general definition and IEC 60060 -2 is

a high voltage test technique measuring system requirement that need to be fulfilled. With this IEC standard given, it is important to distinguish between the equipment and software that is used in the design of high resolution impulse measurement system.

UTM High Resolution Impulse Analyzing System (UTM HRIAS 2015) is developed in UTM, which function is to measure the impulse. It has features to do, analyze and record an impulse.

1.2 Project Problem Statement

In commercial industry, there are several products that are related to the impulse measurement system, such as Hias 743 and Dias 733; manufactured by Haefely. However, the cost for the current facilities of impulse voltage is expensive. There are also some difficulties issues in HV impulse acquisition and analysis regarding the digital recorder. This is because, due to digitizing, the information about the measured signal is lost between neighboring sampling point. The digital recorder with lowest amplitude resolution always gets inaccurate and worse data analysis. A lower sampling rate digital recorder affects the evaluation of impulse parameter and has a possibility for superposed oscillation impulse. Besides, users always spending time to calculate and define the impulse parameter manually, since there is no automatic function cursor on the digital recorder. Furthermore, the users also have difficulties to use some old version digital recorders that are not user friendly in terms of data saving, due to capacity storage and data analysis report. The other issue is to verify compliance with the IEC standard for IEC 61083-1 and IEC 61083-2 that are required for the instrument and software. Moreover, standard IEC 60060 relate impulse high voltage testing technique needs to be verified, too.

1.3 Project Objective

The objectives for this research are stated as follows:

i. To develop a new impulse analysing system consisting both hardware and software implementation following international standard requirement;
ii. To test and calibrate the developed system;
iii. To compare the system performance against standard and commercial system.

1.4 Project Scope

This project focuses on utilizing the facilities related to impulse system in UTM IVAT laboratory. A study and testing equipment related to impulse system is done. Simulation and measurement testing are done using LabVIEW. Once the study and testing are completed, the hardware and software are integrated, to complete the full testing, analyzing and recording the impulse parameter. Hence, the UTM HRIAS system implemented in UTM is for researchers and students to analyze and study.

1.5 Project Contribution

The significant contribution for this project is a cheaper alternative system made for analyzing impulse. This system has some features, which are capable for data reading, analysis and data storage according to standard. This system is used as a backup to the current system used in UTM.

1.6 Project Report Outline

This thesis report consists of five chapters. Chapter 1 is an introduction of the research project. It covers the background, problem statement, objectives, contribution and scopes of the research study.

Chapter 2 is a literature review. It provides the detail of theories and standard of previous works related to impulse measurement system.

Chapter 3 is a research methodology that consists of the research methodology, the flow chart of the research. It describes the hardware and software approaches in experiment.

Chapter 4 analyzes the results and discussion from experiment done in IVAT laboratory for this research. The UTM HRIAS LabVIEW software modification and comparison with previous research will be discussed in this chapter

The last chapter, which is Chapter 5 will explains the conclusion and the suggestion for future work.

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