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Analysis of AC transformer and DC machines by using labview / Muhammad Asyraf Masrohe.

ANALYSIS OF AC TRANSFORMER AND DC MACHINES BY USING LABVIEW

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Bachelor of Electrical Engineering

May 2010

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"I hereby declared that I have read through this report entitled Analysis of AC Transformer and DC machines by using LabVIEW and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)"

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ANALYSIS OF AC TRANSFORMER AND DC MACHINES BY USING LABVIEW

MUHAMMAD ASYRAF BIN MASROHE

A report submitted in partial fulfilment of the requirements for the degree of Electrical Engineering (Industrial Power)

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

May 2010

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I declare that this report entitled "*Analysis of AC Transformer and DC Machine by using LabVIEW*" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Muhammad Asyraf bin Masrohe

Date : 10/5/2010

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To my beloved mother and father

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ABSTRACT

An Electrical Machine subject is a compulsory subject for student of Faculty of Electrical Engineering at UTeM. Among the main topics in this subject are AC Transformer and DC Machine. This project has been designed and developed by using LabVIEW for developing the graphical user interface (GUI) of AC transformer and DC machines analysis. This GUI could be used in the form of simulation for an electrical software application in laboratory session. It is also can be used as e-learning of teaching and learning process in terms on how to analyse practically through the software. This project has presented a virtual instrument (VI) of AC transformer and DC machine by using LabVIEW which it is a user friendly programming language and easy to be learnt by new programmer. It practices the user-friendly application which the user just needs to give a desired data for processing stage and output performance result. The VI consisted of 4 sections which are single phase transformer, three phase transformer, autotransformer and DC machines. These analyses focused on the performance of the AC transformer and DC machines and other aspect such as phasor diagram and power flow diagram. The LabVIEW result have been verified and compared with manual calculation in order to ensure they are correct and reliable. These VI projects could be used as learning and teaching aid in classroom and laboratory session.

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ABSTRAK

Subjek Mesin Elektrik ialah subjek wajib untuk pelajar di Fakulti Kejuruteraan Elektrik, UTeM. Antara topik utama dalam subjek ini ialah Pengubah arus ulang alik dan Mesin arus terus. Projek ini telah merekabentuk dan membangunkan sebuah paparan pengguna bergrafik (GUI) untuk analisis Pengubah arus ulang alik dan mesin arus terus dengan menggunakan LabVIEW. GUI ini boleh dijadikan sebagai sebuah simulasi mengenai aplikasi perisian elektrik sewaktu sesi makmal. Ia sesuai dijadikan sebagai e-learning dalam proses pengajaran dan pembelajaran mengenai bagaimana untuk menganalisis secara praktikal melalui perisian computer. Projek ini telah mencipta sebuah peralatan maya (VI) pengubah arus ulang alik dan mesin arus terus dengan menggunakan perisian LabVIEW yang mempunyai bahasa program bergrafik sangat mesra pengguna dan amat mudah untuk difahami oleh pengaturcara baru. Ia mengamalkan aplikasi mesra pengguna yang mana pengguna hanya perlu memberi data yang diperlukan untuk peringkat pemprosesan dan keputusan hasil prestasi. VI ini terdiri dari 4 seksyen iaitu pengubah satu fasa, pengubah tiga fasa, pengubah auto dan mesin arus terus. Semua analisis ini memberi tumpuan kepada prestasi transformer arus ulang alik dan mesin arus terus dan beberapa aspek lain seperti gambarajah phasor dan gambarajah aliran kuasa. Hasil keputusan LabVIEW ini telah dibandingkan dengan analisis pengiraan manual dengan tujuan untuk memastikan hasil analisis itu tepat dan mapan. GUI ini boleh dijadikan sebagai alat bantuan mengajar di dalam subjek Mesin Elektrik di bilik kuliah atau sewaktu sesi makmal.

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LIST OF SYMBOL

V	-	Voltage
Ω	-	Ohm
Y	-	Admittance
R	-	Resistance
X	-	Reactance
I	-	Current
Z	-	Impedance
P	-	Power
S	-	Apparent Power
Pf	-	Power Factor
η_2	-	Speed
τ_1	-	Torque

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LIST OF ABBREVIATIONS

UTeM	-	Universiti Teknikal Malaysia Melaka
VI	-	Virtual Instrument
GUI	-	Graphical User Interface

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CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

In faculty of electrical engineering, UTeM, Electrical Machine subject is being a compulsory subject for students. Under Electrical Machine subject, there have three sections which are Transformer, AC machines and DC machines. This project is to develop a virtual instrument (VI) on two topics of Electrical Machine subject which are Transformer and DC Machine. The VI will be focused on equivalent circuit, power flow diagram, phasor diagram and performance analysis such as voltage regulation and efficiency. This project will use LabVIEW software as their main platform of VI because it can be used to handle data acquisition in easier way compared to text based programming language. This project also hopefully could be a teaching aid for electrical machine subject in UTeM.

1.2 PROBLEM STATEMENT

Student of Faculty of Electrical Engineering, UTeM, learnt about AC transformer and DC machines deeply especially in the aspect of basic knowledge about it. The students need to understand the concept, the operation and the analysis of those things before applying them in the real work. The lecturers teach the students on how to analyse through a manual calculation and build up the phasor diagram from that calculation. Some calculation may be different as certain condition is changed which student need to recalculate based on the new condition. However, this manual calculation process takes a longer time and it has a lot of formulas that the students need to apply during calculation. Sometimes errors also can be happen and the output result will be not accurate in the way it should be.

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In the aspect of knowledge understanding, students have problem to visualize the total flow of power in the machines and phasor diagram construction. The existence of voltage drop within machines is influenced by power factor that can be visualized in the form of phasor diagram. Some student may have problem to concentrate in class, thus, an alternative of teaching and learning style should be introduce to help them to study by themselves.

An efficiency teaching aid is a suitable teaching aid which help student for improving their knowledge and understanding in Electrical Machine subject. The good teaching aid must have the required aspect such as a machines model with the animation related to the performance analysis of transformer and machine which included in syllabus of that subject.

Therefore, a virtual instrument (VI) is developed to make student more clear about the analysis. However, this project only focuses on the analysis of AC transformer and DC machine by using LabVIEW. By development of Graphical User Interface (GUI), the analysing time for AC transformer and DC machine can be reduced and the result of analyzing can be prepared as soon as possible. Besides, the probability of error happen in calculation also can be avoided. It could be as an electronics learning module which can help in learning and teaching process through visualization of AC Transformer and DC machines analysis.

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1.2 PROJECT OBJECTIVE

The Graphical User Interface (GUI) is the main study in this project. The project began with the revision and designs of the GUI of analysis for AC transformer and DC machines. The manual calculation must be accurate and correct before programming stage can be started. Finally, this VI is developed to achieve the following objectives:

- To analyze the performance of AC transformer and DC machines in various conditions as introduced in Electrical Machine subject.

- To develop an effective teaching aid for lecturers in classroom and laboratory.

- To develop an interactive learning aid that can be used by students for studying Electrical Machine subject by themselves.

1.3 PROJECT SCOPE

This study focuses on development of Graphical User Interface (GUI) by using Virtual Instrument (VI). Through this project, LabVIEW is used as the main platform for VI. In order to make the development of GUI is carried on clearly, the analysis of AC transformer and DC machines need to be reviewed and identified.

In short the project scopes are listed as follow:

- To perform the analysis of single phase transformer, the suitable performance are focused more on circuit analysis in every parts, power flow analysis and power flow diagram depending on circuit and power flow condition.

- For the analysis of three phase transformer, the focus is more on the transformer connection type such as delta and wye connection in between primary and secondary windings.

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- About the analysis on autotransformer, the focus is stressed on the step up or step down connection type and both of those connection type are different either in primary and secondary winding condition.

- For the DC machine, the focus stressed on the torque-speed characteristic graphs.

1.5 PROJECT OUTLINE

This report on "Analysis of AC Transformer and DC machines by using LabVIEW" is divided into 7 chapters. Chapter 1 introduces the general background of this research, the problem statement, project objectives, as well as the project scope. Also, it offers an overall view of the project outline.

Chapter 2 is a compilation of required information and a basic knowledge of LabVIEW software. It included the information as a turnkey needed by this project.

Chapter 3 is a theory of electrical machine which related with this project. The topic chosen is AC Transformer and DC machine.

Chapter 4 is a literature review on past studies related to this project. Only simple background theory included.

Chapter 5 explains about the methodology used in this project from starting stage until ending stage. The detail explanation about the project milestones has been written clearly.

Chapter 6 presents the result and the analysis of the project. This chapter is also discussing on the approved VI analysis by manual calculation and the survey by personal which have used this VI.

Finally, Chapter 7 presents the conclusion of a LabVIEW as E-Learning for students and lecturers. It can be as teaching aid during in learning and teaching process.

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CHAPTER 2

LABVIEW

2.1 OVERVIEW OF LABVIEW

LabVIEW is short form for **Lab**oratory **V**irtual **I**nstrument **E**ngineering **W**orkbench. The concept of the **virtual instrument (VI)** practices a real application into the simulation. It is mention that 'the objective in virtual instrumentation is to use a general-purpose computer to mimic real instruments with their dedicated control and display, but with the added versatility that comes with software' [1].

Instead of buying a strip-chart decoder, an oscilloscope, and a spectrum analyser to build up a real duel display multimeter, only in purposing to get a output result, LabVIEW can simulate all of these instruments through build a custom of duel display multimeter by its VI efficiently and having only the necessary features as shown in Figure 2.1.

Figure 2.1: duel display multimeter

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