

**PERFORMANCE COMPARISON BETWEEN METAL OXIDE
VARISTOR AND GAS DISCHARGE TUBE AGAINST TRANSIENT
OVERVOLTAGE DUE TO LIGHTNING STRIKE**

This thesis is presented in partial fulfillment for the award of the

Bachelor of Engineering (Hons.) Electrical

FACULTY OF ELECTRICAL ENGINEERING

UNIVERSITI TEKNOLOGI MARA

MALAYSIA



LAWRENCE ANAK AJUT

2010756301

Faculty of Electrical Engineering

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM, SELANGOR DARUL EHSAN

ACKNOWLEDGEMENT

First of all, I want to praise to God for giving me the ability to complete my final year project. I am really proud with myself. Every hard and pain that I have gone through along the way to finish this project is a gift to me because it was really exciting when I realized that I have done something that very special in my life. The success and final outcome of this project required a lot of guidance and assistance from many peoples and I am extremely fortunate to have got this all the progresses of my project.

On this opportunity, I would like to express my deepest appreciation to my project supervisor Miss Dalina Johari for her guidance, encouragement and providing indispensable advice and information over the last two semesters since my final year project proposal. Thank you very much for putting your trust on me and giving me the chance to become a part of your career. I will never forget your word in telling me how to do a great job. Your support was essential to my success here.

I would like to thank Mdm. Nurzulaili for teaching me how to using PSCAD and her helps on different aspects of my project. I also would like to thank to Dr. Farid, Mr. Rijallul and members of Facility Management Office of UiTM Shah Alam for the data that given to me.

Last but not least, I would like to say thank to every persons who has involved either directly or indirectly in completing my final year project. I really appreciate your help and support. Only God can pay back what you have given to me. All this is meaningless without you. Thank you.

ABSTRACT

This project presents the comparison of the performance of transient overvoltage due to lightning strike. There were two protection devices compared in this project which is Metal Oxide Varistor (MOV) and Gas Discharge Tube (GDT). These two types of transient protector are commonly used to suppress transient in many applications such as industrial process measurement, control instrumentation, high-frequency communications and ac-medium power supply line. Their sharp breakdown characteristic enables them to provide transient suppression performance. Three models of MOV have been simulated in this project which is IEEE Group model, Picenti Giannettoni model and Fernandez Diaz model. The best among this three were compared to GDT. Where the model used to simulate the performance of GDT in this project is model proposed by Christophe Basso. The simulation has been done using the Power System Aided Design (PSCAD) software base on UiTM Shah Alam's distribution system. Results showed that Gas Discharge Tube is better than Metal Oxide Varistor in protecting our system against lightning strike.

TABLE OF CONTENTS

<u>DESCRIPTION</u>	<u>PAGE</u>
APPROVAL	II
DECLARATION	III
ACKNOWLEDGEMENT	IV
ABSTRACT	V
TABLE OF CONTENTS	VI
LIST OF FIGURES	IX
LIST OF TABLES	XI
LIST OF ABBREVIATIONS	XII
CHAPTER 1: INTRODUCTION	1
1.1 Introduction	1
1.2 Problem Statement	2
1.3 Objectives	2
1.4 Significant of Project	2
1.5 Scope of Project and Limitation	3
1.6 Thesis Organization	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Literature Review	5
2.2 Transient Overvoltage	6
2.3 Lightning Definition	8
2.4 Electrical Power System in Malaysia	10
2.5 Metal Oxide Varistor (MOV)	12
2.5.1 IEEE Group Model	14
2.5.2 Picenti Giannettoni Model	15
2.5.3 Fernandez Diaz Model	16
2.6 Gas Discharge Tube (GDT)	17
2.7 PSCAD Software	19

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Malaysia is one of the tropical countries that have most frequent lightning activities. The researches done by meteorological department found that flash density of lightning strike in Malaysia mostly equal to 20flash/km/year [1]. Most of the transient overvoltage occurrence on the line system is caused by return stroke of the lightning. The highest value of return stroke current recorded in Malaysia is 352kA [2]. Since the current industries used a lot of sensitive electronic technology for their control system purposes, communication and switching equipments, so the topics of lightning transient protection is important to discuss. The principle of lightning transient protection is knowledge of the mechanism of the lightning discharge enable an understanding of the way in which lightning detection and warning system operates [3]. As we know the transient overvoltage can cause extreme damage and explosion to our sensitive electronic devices such as personal computer, radio, television, telephone, refrigerator and many more. The young engineers nowadays should be more creative and come with a new design of mitigation technique against lightning transient overvoltage. Metal Oxide Varistor (MOV) and Gas Discharge Tube (GDT) are two of famous mitigation technique used by majority of the industries now.