UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON

YAP ZHI XIN
B071710685
971211-12-5922

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Electrical and Electronic Engineering Technology

INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON

Yap Zhi Xin
B071710685
971211-12-5922

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2020

INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON

YAP ZHI XIN
B071710685
971211-12-5922

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON

This report submitted in accordance with the requirement of the

Universiti Teknikal Malaysia Melaka (UTeM) for the

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

By

YAP ZHI XIN

B071710685

971211-12-5922

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2020

4

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON

Sesi Pengajian: 2020

Saya **YAP ZHI XIN** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar, Disahkan oleh penyelia:

叶芷欣

....

YAP ZHI XIN TS DR. ZIKRI ABADI BIN BAHARUDDIN

Alamat Tetap: Cop Rasmi Penyelia:

T10, LORONG 3, TAMAN ANGGERIK

JALAN SIBUGA, 90000, SANDAKAN

SABAH

TS. DR. ZIKRI ABADI BIN BAHARUDDIN
PENSYARAH
FAKULTI KEJURUTERAAN ELEKTRIK & ELEKTRONIK
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Tarikh: 23/2/2021 Tarikh: 23/2/2021

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled INVESTIGATION OF NARROW BIPOLAR PULSE LIGHTNING UNDER INFLUENCE OF SOUTHWEST MONSOON SEASON is the results of my own research except as cited in references.

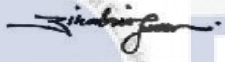
Signature : 叶芷欣

Name : Yap Zhi Xin

Date : 23/2/2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UteM) as a partial fulfilment of the requirement for the degree of Bachelor of Electrical Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

Signature : 

Supervisor Name : Dr. Zikri Abadi Bin Baharuddin

Date : 23/2/2021

ABSTRAK

Projek tahun akhir ini bertujuan untuk mengkaji salah satu jenis kilat unik di dalam awan yang dikenali sebagai nadi bipolar sempit. Sebahagian besarnya, berdasarkan laporan oleh banyak penyiasat kilat mendapati bahawa ciri aktiviti kilat itu berkaitan dengan perubahan keadaan meteorologi yang mungkin disebabkan oleh garis lintang, musim, wilayah gepgrapikal dan jenis badai. Bagaimanapun, kebanyakan laporan itu adalah spekulasi tanpa mencuba ciri-ciri ilmiah yang sebenarnya. Sehingga baru-baru ini, tidak ada laporan mengenai aktiviti kilat di Malaysia yang berkaitan dengan perubahan fizikal. Oleh itu, dalam projek tahun akhir ini, penulis berusaha untuk mengkaji hubungan denyut bipolar yang sempit dengan musim monsson kerana diperhatikan bahawa perubahan iklim berkaitan dengan aktiviti ribut petir di Malaysia kebanyakannya dipengaruhi oleh musim tengkujuh. Projek ini hanya memfokuskan pada musim monsun barat daya dan tempoh peralihan ke EWS. Projek ini melaksanakan wavestudio di bawah Lecroy Product. Kilat nadi bipolsr direkam menggunakan LeCroy 4160 kemudian diikuti dengan kerja analisis menggunakan wavestudio. Terangkan secara ringkas jumlah data, bilangan NBP terpencil, bilangan NBP yang berkaitan dengan kilat awan ke tanah dengan parameter durasi, amplitud puncak, masa melintasi sifar, masa meningkat 0-100%, masa kenaikan 10% -90%, gerakan separuh lebar penuh, tembakan berlebihan dan nisbah. Berdasarkan hasil analisis, didapati bahawa amplitud puncak rata-rata adalah -0.48V, jangka masa rata-rata adalah 27.29ms, purata masa melintasi sifar 5.32ms, waktu kenaikan rata-rata 0-100% adalah 2.62ms, waktu kenaikan rata-rata 10% -90% ialah 1.56ms, rata-rata separuh gerakan lebar penuh ialah 0.14ms, overhoot purata 2.13V dan nisbah purata 5.50.

ABSTRACT

This final year project is aimed to investigate one of unique type of lightning inside the cloud which is known as narrow bipolar pulse. Mostly, based on the reports by many lightning investigators found that the characteristic of the lightning activity was related to the changes of meteorology condition which can be due to latitude, season, gepgrapical region and type of the storm. However most of the reports were speculation without attempting the real scientific features. Until recently, there is no report of lightning activity in Malaysia to relate with physical changes. Therefore, in this final year project, the author put an effort to study the relationship of narrow bipolar pulse with monsson season since it was noticed that the climate change with regard to the thunderstorm activity in Malaysia mostly under influence to monsoon season. This project only focusing on southwest monsoon season and transition period to EWS. This project implementing wavestudio under Lecroy Product. The narow bipolsr pulse lightning are recorded using LeCroy 4160 then followed by the analysis work using the wavestudio.Briefly explain the number of total data, number of isolated NBP, number of NBP associated with cloud to ground flash with parameter of duration, peak amplitude, zero crossing time, rising time 0-100%, rising time 10%-90%, full width half motion, overshoot and ratio. Based on analysis result, it was found that the average peak amplitude is -0.48V, average duration is 27.29ms, average zero crossing time 5.32ms, average rising time 0-100% is 2.62ms, average rising time 10%-90% is 1.56ms, average full width half motion is 0.14ms, average overshoot is 2.13V and average ratio is 5.50.

DEDICATION

It is my real grateful and mildness regard that I dedicated this work to my beloved parent, my family, my respectful supervisor and co supervisor, my precious lecturers and my fellow friends. Many thanks for the support and facilitate given to me on finishing this thesis.

ACKNOWLEDGEMENT

First, most blessed for finalzing this report. I might prefer to import my folks and family for giving me full support, understanding and patience.

I would prefer to express my feeling and appreciation to any or all people who had gave me chance to finish this report. I categorical my deep sense of feeling to my supervisor, Dr. Zikri Abadi bin Baharudin for his steering and inspiration relating to the project of "Investigation of Narrow Bipolar Pulse Lightning under Influence of Southwest Monsoon Season" for completing project smoothly.

I am deeply indebted to all my lecturers and my fellow friends who have contributed to the preparation of this project report and support me by giving me some moral for me to complete the report on time.

I will be always indebted to them. Whithout their support, I might not be able to finish and complete my research project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICS

LIST OF SYMBOLS

A	-	Ampere
V	-	Volt
KM	-	Kilometer
NBP	-	Narrow Bipolar Pulse
RS	-	Return Stroke
ZCT	-	Zero Crossing Time
CG	-	Cloud to Ground

CHAPTER 1

INTRODUCTION

1.0 Background

Lightning is the one of the most unpredictable forces of nature. Any lightning strike is initializing with the polarization of positive and negative charges within a storm cloud (Jaroslav Patuc, 2018). The polarization generates electric field surrounding the cloud. Broadband electric field analysis of lightning has known pulses of very narrow nature with strong radio frequency radiation. Narrow bipolar pulse (NBP) and Compact Intra Cloud Discharges (CID) are identified associated with lightning activity that occurs inside thunderclouds. NBP have been known as two types of polarity which are positive narrow bipolar pulse and negative narrow bipolar pulse. Their classifications of polarity are based on the sign of convention used. NBP that have the similar initial polarity as the electric field change which shown downward negative charges are identified as positive while it shown upward positive charges are identified as negative. NBP were characterized by a short duration of bipolar spheric waveform which accompanied by strong radio frequency radiation. Their fast electric field changes are stronger than pulses which produced by high current cloud to ground flash, but not preceded by detectable breakdown. NBP occur rarely in storms but due to substantial length of their spheric, they are readily observed out to hundreds of km distance. Electric field changes are dominated by radiation component, but it remains strong and even at a close distance because of their speed and development.

1.1 Problem Statement

Malaysia is among the top three countries with approximately 180-260 recorded. The thunderstorm lightning that occurred in Malaysia, its location is on the equator. A lightning detection system in Malaysia primarily managed by Malaysia Meteorology Science (MMS) and Tenaga Nasional Berhad (TNB). The lightning data is observed by MMS and TNB are typically shown in term of value such as current lightning, voltage lightning, and distance without knowing the exactly real profile of each lightning even. Furthermore, most of the main parameters of the principle technique data being record are confidential which causes the difficulty to know the real things in the lightning detection systems. In this project, the author tries to investigate the narrow bipolar pulse lightning under influence of southwest monsoon season. The heart of this project mainly based on wavestudio - Lecroy. Wavestudio – Lecroy is used to analyse the lightning data that recorded in binary format. The suitable solution for analysing the information or parameter of the lightning data is saved in excel format. Then the saving data will be analysed. The extraction information of the data will be used to form histogram.

1.2 Objective of Project

There are some significant objective that has been made for this project which are:

1. To classify the characteristics of the isolated narrow bipolar pulse lightning and narrow bipolar pulse lightning associated with ground flash under influence of southwest monsoon season.
2. To analyse the lightning duration, peak amplitude, zero crossing time rising time 0-100%, rising time 10%-90%, full width half motion, overshoot and ratio of isolated narrow bipolar pulse and narrow bipolar pulse associated with ground flash.
3. To compare the difference between isolated narrow bipolar pulse and narrow bipolar pulse associated with ground flash under influence southwest monsoon season.