



# **ANALYSIS OF TRANSIENT OVERVOLTAGE IN MEDIUM VOLTAGE DISTRIBUTION NETWORK OF CEYLON ELECTRICITY BOARD**

A dissertation submitted to the  
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## Abstract

This thesis presents the analysis of transient overvoltages in medium voltage (33kV) network and the research is based on feeder lines in the Uva province. Parameters which influence lightning performance of overhead distribution lines such as line height, line length, type of structure, availability of shield wire and flash density in the area are discussed in details. More over, failures due to transient overvoltages and its impact on the reliability of the network are analyzed in this study.

Lightning may cause flashovers from direct strokes or induced voltage from nearby strokes. Direct lightning to power distribution lines causes insulation flashovers in great majority of the cases. Therefore the goal of this research is to estimate the lightning performance level of feeder lines and investigate improvements. Shielding effect from nearby trees, critical flashover voltages for different flashover paths and deterioration of insulation with aging are also discussed. Thus the analysis of lightning related incidents such as transformer failures, arrester failures and nuisance fuse blows are presented.

The study of transformer installation reveals that arrester lead length becomes critical during a lightning discharge since it generates high voltage stress in the winding which may fail the distribution transformer. Earth rod impulse resistance is also an important parameter which increases the voltage stress.

It is necessary to develop models, using electrical parameters for simulation of transient overvoltages. The PSCAD software is especially developed to study transient simulations of power systems. Variation of transient overvoltages due to strikes to phase wires, strikes to earth wire, and variation due to striking distance are discussed in this study. Further, simulation of surge arrester performance and nuisance fuse blows are also presented. Finally, the study presents applications to achieve zero lead length in substation, introduction of surge durable fuses and procedures which can be implemented to improve lightning performance in the MV network.

## DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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# CONTENTS

Declaration	i
Abstract	iv
Acknowledgement	v
List of Figures	vi
List of Tables	viii
List of Principal Symbols	ix
<b>1. Introduction</b>	<b>1</b>
1.1 Scope of Study	3
1.2 Literature Review	4
<b>2. Statement of Problem</b>	<b>6</b>
2.1 Identification of the Problem	6
2.2 Study of MV Network Configurations in the Uva Province	6
2.3 Bad Weather and Pattern of MV Feeder Failures	12
2.4 Transient Overvoltages Related Failures	14
<b>3. Lightning Performance of Distribution Feeder Lines</b>	<b>18</b>
3.1 Direct Lightning Strikes on Phase Conductors	22
3.2 Induced Voltage Flashovers	25
3.3 Total Number of Flashovers	29
3.4 Study of Shielding Effect from Nearby Trees	30
3.5 Determination of Critical Flashover Voltage (CFO) for Possible Flashover Paths.	33
3.6 Testing of Insulators to Check Deterioration of Insulation with Aging.	34
<b>4. Transient Overvoltage Stress in Distribution Substations</b>	<b>36</b>
4.1 Calculation of Impulse Resistance	36
4.2 Calculation of Arrester Lead Length	38

<b>5. Sensitivity Study of Transient Overvoltages using PSCAD Models</b>	<b>41</b>
5.1 Model for Lightning Surge (Wave Form)	41
5.2 Models to Study Transient Overvoltages in Tower line and Pole line	42
5.3 Sensitivity Study to Analyze Surge and Line Parameters	43
5.4 Analysis of Performance of Surge Arrestors	47
5.5 Analysis of Nuisance Fuse Blows	50
5.6 Surge Durability in Surge Arrester and DDLO Fuse Connection	50
<b>6. Proposals for Improvement of Surge Performances</b>	<b>52</b>
6.1 Zero Lead Length Application in Distribution Substation	52
6.2 Use of Surge Durable Fuse Links	53
6.3 Introduction of Lightning Proof Fuses	54
6.4 Use of Surge Arrester in Connection between Pole Line and Tower Line	54
6.5 Other Improvements	55
<b>7. Conclusions</b>	<b>56</b>
<b>References</b>	<b>59</b>
<b>Appendix A</b> Definitions	61
<b>Appendix B</b> PSCAD Models & Measured Data	62
B.1 Model 1- PSCAD Model for Tower Line	62
B.2 Model 2- PSCAD Model for Tower Line	63
B.3 Model3- PSCAD Model for Tower Line	64
B.4 Measured Data	65
B.5 Test values of flashover voltages	66

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## List of Figures

Figure	Page
2.1 Geographical illustration of the Namunukula feeder	9
2.2 Variation of soil resistivity with the feeder elevation	9
2.3 Tower and pole line lengths of the Namunukula feeder	10
2.4 Spur line lengths of the Namunukula feeder	10
2.5 Tower and pole line connection	11
2.6 Rainfall data in Bandarawela area, Year 2008	12
2.7 Earth Fault and Over Current trippings	13
2.8 Monthly MV failures in the Uva province	14
2.9 Analysis of MV failures in the Uva province	15
2.10 Damaged insulators by flashovers or by unknown reasons	15
2.11 HT fuse usage for sub stations and spur lines	16
2.12 HT fuse usage and number of sub stations	17
2.13 Lightning related failures in the Uva province	17
3.1 Geometry of lightning leader and transmission line	19
3.2 Effect of grounding resistance on shield wire performance	23
3.3 Comparison of direct flashover rate for tower and pole line	24
3.4 Number of induced flashovers versus distribution line insulation level	25
3.5 Total flashovers (Lightning Performance) of feeders	29
3.6 Number of damaged insulator sets changed in the year 2008	30
3.7 Shielding effect from nearby trees	31
3.8 Shielding factors due to nearby objects	31
3.9 Age analysis of feeder lines	35
3.10 Insulator covered with moss	35
4.1 Common practices in substation construction	39

4.2	Variation of transformer surge voltage stress with surge current	40
5.1	TOV variation with magnitude of peak current (Strike on phase wire)	44
5.2	TOV variation with magnitude of peak current (Strike on earth wire)	45
5.3	TOV variation with EW grounding resistance	46
5.4	TOV variation with increase of soil resistivity	46
5.5	TOV variation with striking distance	47
5.6	IEEE surge arrester model	48
5.7	Arrester performance with the magnitude of surge current	49
5.8	Arrester performance with earth rod resistance	49
5.9	Wave forms obtained from simulation of fuse blowing	51
6.1	Transformer Combi Unit of Live Line Technology	53
6.2	Time Current Characteristic (TCC) curves and $I^2t$ values of fuses	53
6.3	Lightning Proof Fuse	55



## List of Tables

Table	Page
2.1 Break up of existing distribution network of the Uva province	7
2.2 Details of 33kV feeder lines	8
3.1 Thunder Days and GFD in Uva province	20
3.2 Probabilistic distribution of current peak values	21
3.3 Number of direct flashes per 100 km length	23
3.4 Number of direct stokes per year	24
3.5 Induced flashovers per 100 km	26
3.6 Number of Induced flashes per year	26
3.7 Distances for nearby trees	32
3.8 Estimated values of CFO for possible flashover paths	33
4.1 Impulse resistance variation with lightning current	38
4.2 Voltage stress at transformer HT bushing	40
5.1 Data obtained from simulation of fuse blowing	51

## List of principal symbols

<b>CEB:</b>	Ceylon Electricity Board
<b>CSC:</b>	Consumer Service Center
<b>CFO:</b>	Critical Flashover
<b>DDLO:</b>	HT fuse link
<b>E/F:</b>	Earth Fault
<b>GFD:</b>	Ground Flash Density
<b>HT:</b>	High tension
<b>HV:</b>	High Voltage
<b>LA:</b>	Lightning Arrester
<b>LT:</b>	Low Tension
<b>LV:</b>	Low Voltage
<b>MV:</b>	Medium Voltage
<b>MSL:</b>	Mean Sea Level
<b>O/C:</b>	Over Current
<b>PQ:</b>	Power Quality
<b>PSCAD:</b>	Power System Computer Aided Design
<b>T/F:</b>	Transformer
<b>TOV:</b>	Transient Overvoltage

