TECHNO-ECONOMIC FEASIBILITY STUDY ON LIGHTNING PROTECTION OF OVERHEAD TRANSMISSION LINE HAVING MULTI-CHAMBER INSULATOR ARRESTERS (MCIA). (CASE STUDY: MATHUGAMA-KUKULE, 132KV TRANSMISSION LINE)

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Dissertation submitted in partial fulfillment of the requirement for the degree Master of Science

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May 2016

DECLARATION OF THE CANDIDATE AND SUPERVISORS

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May 17, 2016

The above candidate has carried out research for the Masters dissertation under our supervision.

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May 17, 2016

ABSTRACT

Transmission lines are a key factor of the transmission network of a country which connects Grid Substations and the Power stations. Performance of transmission lines has a great impact on reliability aspects of a particular power supply system of a country. Unreliable transmission lines can lead to partial or even total power failures resulting with great financial losses. Radially connected power stations can be isolated from the transmission network by tripping the connected lines to the transmission system. The lightning back flashover effects are recognized as one of the major causes of transmission line outages.

Several types of solutions are presently available to address the issue of lightning back flashovers. Installing of Transmission Line Arresters (TLA) is of great popularity due to its good performance, with low cost compared to the other traditional solutions. However, latest technology called "Multi Chamber System (MCS)" are now being widely used worldwide to protect transmission lines as well as distribution lines from lightning surges including direct and indirect lightning surges. A novel technology, extension of MCS, Multi Chamber Insulator Arresters (MCIA) are the latest arrester technology which has great advantages over all the traditional surge mitigation techniques including installation of TLAs.

This report describes a case study which was carried out on one of a critical 132kV transmission line of the Sri Lankan transmission network, having several past records of lightning back flashover related outages resulting with partial system failures.

The study described in this report is mainly focuses on the way of analyzing the back flashover events by transient modeling and subsequent simulation of the selected transmission line in an electromagnetic transient computer program. The study uses the Power System CAD (PSCAD) software program as the software tool for the purpose of modeling and simulation of selected 132kV, Mathugama-Kukle transmission line.

Simulation of the created transmission line model is carried out with and without MCIA model to evaluate the improvements in lightning back flashover performance after installation of MCIAs in the selected transmission line.

The result of the simulations shows that the installation of 06 Nos. of MCIAs on all phases of a selected tower improves the back flashover mitigation performance on the same tower as well as the towers on the either sides of the selected tower. Thus, lightning performance of the selected transmission line is improved.

DEDICATION

To my loving Parents, Wife and Son

ACKNOWLEDGEMENT

I sincerely thank my supervisor, Dr. K.T.M.U. Hemapala for his great supervision and guidance offered for the successful completion of this study. I extent my sincere thanks to lecturers of Electrical Engineering Department, University of Moratuwa, who gave me the theoretical knowledge and the support during the study period to make the study practical and meaningful.

My special thanks go to Dr. U.N. Gnanarathna, University of Manitoba, Canada, who spent his valuable time to guide me and providing valuable information required for this study.

Further, my great gratitude goes to Mr. Matthieu ZINCK, Asia-Pacific Manager, Mr. Potcharamon KALAPONG, Regional Office Manager for their valuable support and the MCIA samples given free of charge to the University of Moratuwa. Also, my special thanks to the Supplies Unit of the University of Moratuwa, Sri Lanka for the support given for obtaining free samples from the Streamer Company.

I would like to express my sincere gratitude to Eng. W.W.R.Pitawala, Eng. W.N. Jayalath, Eng. K.S.S.Kumara, Eng. C.D. Wijeweera, Eng. M.Chanaka, Eng. D.L.P. Munasinghe, Eng. S.C.D. Kumarasinghe, Eng. R.C.P. Rajapakshe, Eng. A.D.G. Chandrasena Eng. L.A.A.N. Perera, Eng. W.M.O.M. Withanage working at Ceylon Electricity Board for their excellent support and the encouragement towards the success of this academic work.

Further, I would like to thank many individuals, friends and colleagues who have not been mentioned here personally in making this educational process a success.

Finally, I admire with great pleasure that I remember the encouragement and support extended by my parents and my wife. May be I could not have completed this research without their valuable support.

K.P.R.D.S.K. Dharmadasa
May 17, 2016

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LIST OF ABBREVIATIONS

BFR	Back Flashover Rate
CEB	Ceylon Electricity Board
CFO	Critical Flashover
CIGRE	Conseil International des Grands Réseaux Électriques
CPDL	Constant Parameter Distributed Line
EMTDC	Electromagnetic Transients including DC
EMTP	Electromagnetic Transients Program
GFD	Ground Flash Density
GSW	Galvanized Steel Wire
GUI	Graphical User Interface
GW	Ground Wire
IEEE	Institute of Electrical and Electronics Engineers
IKL	Isokaraunic Level
KMDL	Kukule Mathugama Double Circuit Line
MCIA	Multi Chamber Insulator Arrester
MCS	Multi Chamber System
OPGW	Optical Fiber Ground Wire
PSCAD	Power System Computer Aided Design
TLA	Transmission Line Arrester

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