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Application of 'Line Drop Compensation'
To improve voltage of 33 kV Distribution Network

A dissertation submitted to the
Department of Electrical Engineering,
University of Moratuwa

in partial fulfillment of the requirements for the
Degree of Master of Science
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By



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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
Index of Figures.....	vi
Index of Tables.....	vii
Abbreviations.....	viii
1. Introduction.....	1
1.1. Background.....	1
1.2. Problem Statement.....	2
1.3. Motivation.....	3
1.4. Objective of the study.....	4
1.5. Scope of Study.....	5
2. Methodology.....	6
2.1. Line Drop Compensation.....	6
2.2. Calculation of LDC Settings.....	8
2.3. The approach.....	11
2.4. Determination of LDC limits under planning criteria.....	12
3. Modeling and Analysis of MV Distribution Network.....	15
3.1. Existing Distribution Scheme of MV distribution network.....	15
3.2. Habarana Grid Substation.....	16
3.3. GSS transformers and On Load Tap Changers.....	17
3.4. GSS transformer and 33kV Feeder loading.....	19
3.5. Data Collection and modeling of MV Distribution Network.....	21
3.6. Analysis of Existing 33kV distribution network.....	24
4. MV Distribution Network with LDC.....	30
4.1. Application of LDC.....	30
4.2. Initial Calculation of LDC settings.....	30
4.3. Simulation of Automatic Tap adjustment of power transformer with LDC.....	32

4.4.	Performance of MV distribution system with LDC under normal conditions.....	34
4.5.	Performance of MV distribution system with LDC when feeder tripping	39
4.6.	Performance of MV distribution system with LDC when feeder extended.....	39
5.	Results, discussion and conclusion.....	40
5.1.	Results	40
5.2.	Implementation at Habarana GSS	40
5.3.	Considerations for further developments.....	41
5.4.	Conclusion.....	42
References.....		44

Appendix I - MV Distribution Feeders of Habarana Grid Substation

Appendix II - Snapshot of nameplate data of power transformers of Habarana GSS

Appendix III - Hourly Feeder Loads of Habarana GSS 1st October 2009 to 15th October 2009

Appendix IV - Load Profile of GSS for two weeks, 1st - 14th October, 2009

Appendix V - List of Heavy supply installations with load profile and sample load profiles

Appendix VI - Half-hourly Load readings of Feeders of Habarana GSS and Load profile of Feeders on 14th October, 2009

Appendix VII -Voltage profile of MV Feeders of Habarana GSS without LDC implementation, as at 14th October, 2009

Appendix VIII - Voltage profile of MV Feeders of Habarana GSS with LDC implementation, as at 14th October, 2009

Abstract

Lengthy Medium Voltage lines are typical in Rural Electrification implementations. The voltage of ends of such lines varies drastically from the time of peak loading to mid-night owing to drastic difference in line loading in Sri Lanka. Therefore consumers at end of long feeders experience very low voltages during peak loading times. Although distribution transformers come with off-load tap adjustments to buck / boost LV voltage, effective use of the full range of this tap setting is restricted due to high variation of voltage drop during the day and night. Hence these off-load tap adjustment may not fully resolve the low voltage problem of some consumers. However, if voltage at the Grid Substation Medium Voltage bus is dynamically adjusted such that voltage at some mid location of the line is maintained constant irrespective of the line load, deviation of voltage along the line can be minimized. The 'Line Drop Compensation' feature available in MK20 Voltage Regulator provides this feature.

Voltage of MV lines of Polonnaruwa and suburbs are badly affected due to long distance from Habarana Grid Substation. As a remedy, implementation of LDC in Habarana GSS has been studied. The MV network was modeled and load flow study was carried out with and without LDC for peak and off-peak times.. The voltage profiles so obtained were used for selection of optimum off-load tap of distribution transformers. The study indicates that the line end voltage is greatly improved, particularly in Polonnaruwa and suburbs, with the implementation of LDC. Hence LV terminal voltage of distribution transformers can be improved to provide customers with better voltage. Therefore, the study recommends suitable parameters of LDC for implementation at Habarana GSS.

The study also established a methodology for determining LDC parameters and verifying LDC implementation in a GSS having more than one distribution feeder.

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Index of Figures

Fig. 1.1: Coverage of Medium Voltage distribution network of Sri Lanka	1
Fig. 2.1: Principle of LDC.....	6
Fig. 2.2: Band width and Time delay of LDC relay.....	7
Fig. 2.3: Block diagram of LDC scheme implementation.....	8
Fig. 2.4: Front panel view and controls of MK20.....	10
Fig. 2.5: Typical MV distribution feeder	12
Fig. 3.1: MV lines fed off Habarana GSS	16
Fig. 3.2: Schematic diagram of Habarana GSS	17
Fig. 3.3: Load profile of Habarana GSS from 01/10/2009 to 07/10/2009, one week period ..	19
Fig. 3.4: Load profile of 33 kV feeders of Habarana GSS on 14 th Oct 2009, Wednesday.....	20
Fig. 3.5: Voltage profile of 33 kV bus at Habarana GSS on 14 th Oct 2009, Wednesday.....	21
Fig. 3.6: Voltage profile of MV Distribution system at 0230 hrs.....	25
Fig. 3.7: Voltage profile of MV Distribution system at 0600 hrs.....	25
Fig. 3.8: Voltage profile of MV Distribution system at 1130 hrs.....	26
Fig. 3.9: Voltage profile of MV Distribution system at 1930 hrs.....	26
Fig. 4.1: Voltage profile of MV distribution network with LDC at 0230 hrs	34
Fig. 4.2: Voltage profile of MV distribution network with LDC at 0600 hrs	35
Fig. 4.3: Voltage profile of MV distribution network with LDC at 1130 hrs	35
Fig. 4.4: Voltage profile of MV distribution network with LDC at 1900 hrs	36

Index of Tables

Table 2.1: Different voltage ratings of distribution transformers.....	12
Table 2.2: Voltage at consumer points with different distribution transformers.....	13
Table 2.3: Voltage at consumer points with LDC and without LDC	14
Table 3.1: Distribution feeders of Habarana GSS	15
Table 3.2: Name plate data of Power transformer at Habarana GSS	18
Table 3.3: Technical data of MK20 VR relay at Habarana GSS.....	18
Table 3.4: Feeder Demands of Habarana GSS on 14 th Oct, 2009	23
Table 3.5: Voltage levels of selected few locations in MV Distribution system.....	27
Table 3.6: Voltage at LV terminals of 33kV/415V dist. trf. at selected locations in MV network.....	28
Table 4.1: GSS 33kV bus voltage with LDC	33
Table 4.2: Voltage levels of selected locations in MV Distribution network with LDC.....	37
Table 4.3: Voltage at LV terminals of 33kV/415V dist. trf. in MV network with LDC	38
Table 5.1: Proposed LDC settings of Habarana GSS	43



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Abbreviations

AVR	Automatic Voltage Regulator
CEB	Ceylon Electricity Board
Dist.	Distribution
GSS	Grid Substation
HS	Heavy Supply
km	Killo meters
LDC	Line Drop Compensation
LECO	Lanka Electricity Company Limited
LTL	Lanka Transformers Limited
LV	Low Voltage
MR	Maschinenfabrik Reinhausen
MV	Medium Voltage
Nos.	Numbers
OLTC	On Load Tap Changer
PSS	Primary Substation
RE	Rural Electrification
Ref.	Reference
Trf.	Transformer
TX	Transmission
VR	Voltage Regulator