DEVELOPMENT OF A GENARALIZED METHODOLOGY FOR BLACKOUT RESTORATION: A CASE STUDY OF SRI LANKAN POWER SYSTEM

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Degree of Master of Science

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature: Date:

The above candidate has carried out research for the Master thesis under my supervision.

Signature of the supervisor:

Dr. W. D. Prasad **Eng. Rienzie Fernando** Date:

DEDICATION

This work is dedicated to my beloved parents, Sanath Sirisena and Menaka Sirisena and my darling wife, Dimuthu Wasana.

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Abstract

Blackouts are been reported throughout the history worldwide and nowadays, a moment without electricity causes a greater loss of lives and economy. On the other hand, restoration of a blacked-out power system requires expertise of experienced engineers which is not completely reliable under certain system complexities. Generally, it turns out to be a trial and error approach under the guidance of experts. This paper proposes a generalized aiding methodology for solving the restoration problem by assessing the next system state for a given decisions of the system operator. With adequate system information (pre-outage data, equipment availability etc.), this proposed decision support methodology could mitigate unexpected cascaded tripping events which occur owing to lack of confidence in next state during restoration. The case study considers restoring of a crucial subsystem of Sri Lankan power system, Colombo – Kelanitissa system along with Laxapana System. Successful attempts shall fulfil load flow while maintaining system parameters and stability during switching operations. The results compare and depict the success in solving the restoration problem with proposed real-time, offline methodology against trial and error approach. Further it suggests the requirement of parallel computer based simulations on restoration of other sub systems and synchronizing events during actual implementation.

Keywords: Blackout Restoration, Decision Support, Steady State, Transient Stability, Sri Lankan Power System

Table of Contents

DECLARATION i
DEDICATION ii
ACKNOWLEDGMENT iii
Abstract iv
Table of Contents v
List of Figures vii
List of Tables vii
List of Abbreviations viii
1 INTRODUCTION 1
1.1 Power System (PS) Blackouts 1
1.2 Sri Lankan Power System 5
1.3 Objectives of the study 5
1.4 Thesis outline 6
2 LITERATURE REVIEW 7
2.1 Blackout causes 7
2.2 Problems associated with restoration 8
2.3 Restoration planning 10
2.4 Requirements of expert systems 10
3 PROPOSED METHODOLOGY FOR BLACKOUT RESTORATION 14
4 CASE STUDY ON RESTORING SRI LANKAN POWER SYSTEM 21
4.1 Restoration Attempt 1 24
4.2 Restoration Attempt 2 24
4.3 Restoration Attempt 3 25
4.4 Restoration Attempt 4 26
5 RESULTS AND ANALYSIS 27
5.1 Attempt 1 27
5.2 Attempt 2 29
5.3 Attempt 3 31
5.4 Attempt 4 32
6 CONCLUSIONS AND FUTURE DIRECTIONS 38

6.1 Conclusions 38
6.2 Future Directions 39
6.2.1 Blackout Restoration in Sri Lanka 39
6.2.2 Impact of future Renewable Energy penetration on restoration 39
7 REFERENCES 41

List of Figures

Page

Figure 1 – States of Power System [1] 2
Figure 2 - Typical restoration stages [11] 11
Figure 3 - Proposed approach for Blackout Restoration 14
Figure 4 - Proposed Decision Support Methodology 15
Figure 5 - Reactive Capability Curve (D-Curve) of a generator [23] 17
Figure 6 - Mathematical interpretation of Generator Reactive Capability Curve 18
Figure 7 - Power Angle Curve 19
Figure 8 - Restoration problem: Colombo-Kelanitissa and Laxapana subsystems of Sri Lankan PS (PSSE model for year 2017 – Night Hydro Peak) 23
Figure 9 - BARGE (2222) performance during Attempt 1 28
Figure 10 – KCCP GT (4301) performance during Attempt 1 28
Figure 11 - BARGE (2222) performance during Attempt 2 30
Figure 12 - KCCP GT (4301) performance during Attempt 2 30
Figure 13 - BARGE (2222) performance during Attempt 3 32
Figure 14 - Old Laxapana (4100) performance during Attempt 4 34
Figure 15 – Bus voltage behaviour during interconnection of Col. and Lax. Sub-systems 34
Figure 16 - Load Angle variation of Bus 1550 [Kolonnawa 132 kV] 35
Figure 17 – Load Angle variation of Bus 1500 [Kosgama 132 kV] 35
Figure 18 - Frequency variation of synchronizing buses 36
Figure 19 - Rate of Change of Frequency variation during Attempt 4 36

List of Tables

Page

Table 1 - Extract of blackouts in history [8] 7
Table 2 - Restoration Problems encountered in 1979-1983 8
Table 3 - Associated Loads and Generators from Colombo Kelanitissa System 21
Table 4 - Associated Loads and Generators from Laxapana System 22
Table 5 - List of decisions in Attempt 1 24
Table 6 - List of decisions in Attempt 2 25
Table 7 - List of decisions in Attempt 3 25
Table 8- Summary of Restoration Attempts 26
Table 9 - Bus voltages during Attempt 1 27
Table 10 - Bus voltages during Attempt 2 29
Table 11 - Bus voltages during Attempt 3 31
Table 12 - Sequence of operations during Attempt 4 32
Table 13 - Bus voltages during Attempt 4 33

List of Abbreviations

Abbreviation	Description
BS	Black-start
CEB	Ceylon Electricity Board
DG	Diesel Generator
EG	Embedded Generation
EHV	Extra High Voltage
HV	High Voltage
GT	Gas Turbine
NBS	Non Black-start
PS	Power System
PV	Photovoltaic
RE	Renewable Energy
RoCoF	Rate of Change of Frequency
SCADA	Supervisory control and data acquisition
SCC	System Control Centre
ST	Steam Turbine