Ain Shams University
Faculty of Engineering
Electrical Power and Machines Department

TRANSMISSION LINE PROTECTION USING SYNCHRONIZED SAMPLING

A Thesis Submitted in the Partial Fulfillment of the
Master Degree
Electrical Engineering – Power and Machines

By
Eng. Hoda Farouk Mohamed Anis Eltarabishy
Teaching Assistant
Faculty of Engineering-Ain Shams University

Supervised by

Prof.Dr. Mohamed M. Mansour
Faculty of Engineering
Ain Shams University

Prof. Dr. Hossam El Din Abdallah Talaat
Faculty of Engineering
Ain Shams University

Prof. Dr. Ibrahim Al-Desouky Helal
Faculty of Engineering
Ain Shams University

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Approval Sheet

For the thesis

Transmission Line Protection Using Synchronized Sampling

Submitted By

Eng. Hoda Farouk Mohamed Anis Eltarabishy

Submitted in partial fulfillment of the requirements for the M.Sc. degree in Electrical Engineering

Approved By

Name	**Signature**
Prof. Dr. Hossam El-din Abdallah Talaat	
Prof. Dr. Ibrahim Al-Desouky Helal	

Date / /2014

Approval Sheet

Transmission Line Protection Using Synchronized Sampling

Presented By

Eng. Hoda Farouk Mohamed Anis Eltarabishy

Approved By

Name, Title, and Affiliation **Signature**

Prof. Dr. Mahdy Mohamed Mahdy El-Areiny
Electrical Engineering Dept.
Faculty of Engineering, Zagazig University

Prof. Dr. Metwaly Awad Al-Sharkawy
Electrical Power and Machines Dept.
Faculty of Engineering, Ain Shams University

Prof. Dr. Hossam El-din Abdallah Talaat
Electrical Power and Machines Dept.
Faculty of Engineering, Ain Shams University

Prof. Dr. Ibrahim Al-Desouky Helal
Electrical Power and Machines Dept.
Faculty of Engineering, Ain Shams University

Statement

This thesis is submitted to Ain Shams University in partial fulfillment of the requirements for M.Sc degree in Electrical Engineering.

The included work in this thesis has been carried out by the author at the Electrical Power and Machines Department, Ain Shams University. No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Name: Hoda Farouk Mohamed Anis Eltarabishy

Signature:

Date: 1/12/2013

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Abstract

This thesis introduces a complete transmission line protection scheme using synchronized sampling technique implemented with neural networks to precisely detect, classify and locate fault over along transmission line.

For fault detection and classification module, synchronized data of voltage and current signals from both ends of transmission line are processed using

a mathematical algorithm to generate the inputs to an Artificial Neural Network (ANN). The target of that ANN signifies the occurrence of a fault. The appearance of current featured modal components points out the type of fault. A data window of 0.25 cycle is used to ensure a fast process.

For the fault location, two approaches were adopted, both based on synchronized sampling time domain data:

Single stage Featured Fault currents fault locator: The first approach uses the featured fault modal components chosen according to fault type as an input to ANN. The ANN is trained on different system conditions (fault inception angle, system loading, fault resistance, fault type) while the ANN target points out the fault location with an acceptable margin.

Single Stage Current Traveling wave based fault locators: The second approach on a different mathematical formulation. The algorithm was used to calculate fault location using current traveling waves based on synchronized data (Single Stage).

Double Stage current Traveling wave based Fault Locators: in the third scheme, the results for fault location are further refined via a trained ANN to minimize the error in the previously determined location from the previous scheme.

The computer software of the studied power system was carried out on PSCAD and the proposed protection schemes were developed using MATLAB. The results of all approaches were tested and validated.

Comparisons among different techniques against same criteria were demonstrated.

Table of Contents

Chapter (1): Introduction

1.1 General 1

1.2 Problem Description 2

1.3 Thesis Objectives 2

1.4 Thesis Outline 3

Chapter (2): Transmission Line Fault Analysis: Literature Review 5

2.1. Introduction 5

2.2. Criteria of designing protection system 6

2.2.1. Reliability 6

2.2.2. Selectivity 6

2.2.3. Speed 7

2.2.4. Performance vs. Economics 7

2.2.5. Simplicity 8

2.3. Complexities of Transmission Line Protection 8

2.4. Transmission Line Protection Classification 8

2.5. Shortcomings with Traditional TL Relaying 10

2.6. Modern Transmission Line Protection 11

2.6.1. Modern TL Fault Detection and Classification Algorithms 12

2.6.1.1. The Phasor Approach 12

2.6.1.2. Fourier Transform Approach 14

2.6.1.3. Travelling Wave Based Approach 14

2.7. Transmission Line Protection Using Synchronized Sampling 15

2.8. Fault Locators 19

2.8.1. Fault Locatots versus Protective Relays 19

2.8.2. Recent Techniques used for Fault Location 20

2.9. Synchronized Sampling Based Fault Detectors 22

Chapter (3): Synchronized Sampling for Fault Analysis: Theory and Proposed Methodology 25

3.1 Introduction 25

3.2 Synchronized Sampling Algorithm: Mathematical Model 26

3.3 Complete Fault Analysis for Long Transmission Line 28

3.3.1 Single Phase Transmission Line System 28

3.3.2 Three Phase Transmission Line System 33

3.4 Technologies used in the Design of Synchronized Sampling Transmission Line Protection System 35

3.4.1 The Global Positioning System 35

3.4.2 Intelligent Electronic Devices 37

3.5 System Understudy 39

3.5.1 System (A) Data 39

3.5.2 System (B) Data 40

3.6 PSCAD Models of Study Systems 40

3.7 Correlation between Fault Featured Current Model Components and Fault Current 41

3.7.1 The Impact of Fault Location 42

3.7.2 The Impact of Fault Inception Angle 43

3.7.3 Comment on the Study 43

3.8 Fault Detection and Classification 44

3.8.1 Theory 44

3.8.2 Simulation of Study System under Different fault Types 45

3.8.3 Proposed Scheme for Fault Detection and Classification 48

3.9 Fault Locations Schemes 50

3.9.1 Scheme1: Single Stage Fault Location Estimation (ANN) 52

3.9.2 Scheme2: Single Stage Current Travelling Wave based Fault Locator 53

3.9.2.1 Fault Location Index 55

3.9.3 Scheme3: Double Stage Current Travelling Wave based Fault Locator 59

Chapter (4): Performance and Results of the Proposed Schemes 62

4.1. Introduction 62

4.2. Fault Detection and Classification ANN Scheme 62

4.2.1. ANN Design 62

4.2.2. ANN Training 64

4.2.3. ANN Testing 65

4.2.4. Results and conclusion 66

4.3. Scheme 1:Single Stage ANN-based Fault Location Estimation 67

4.3.1. 3-phase to ground fault ANN 67

4.3.2. Phase to phase (A-B) Fault ANN 70

4.3.3. A-G fault ANN 72

4.3.4. Comments on Results 75

4.4. The Impact of Synchronized Sampling on Fault Locator Performance 76

4.4.1. Case 1: ANN Fault Locator using Synchronized Sampling and GPS for data transfer 76

4.4.2. Case 2: ANN Fault Locator using Synchronized Sampling and Hollow Fiber Optics 76

4.4.3. Case 3: ANN Fault Locator and non-unit Protection (Data used from one end) 77

4.4.4. Comparison between three Cases of Fault Location Estimations ANNs 77

4.5. Scheme 2: Single Stage Current Travelling Wave Based (CTWB) Fault Locator 80

4.6. Scheme 3: Double Stage CTWB Fault Locator

4.7. The Proposed Algorithm for merging Scheme 2 and Scheme 3 86

Chapter (5): Conclusions **88**

5.1. Research Findings **88**

5.2. Recommendations for Future Work **90**

List of Figures

1. Figure (2.1) Classification of Transmission Line protection 10
2. Figure (2.2) PMU arrangement 13
3. Figure (2.3) Travelling wave base relay 14
4. Figure (2.4) Flowchart of Fault Classification 18
5. Figure (2.5) Major blocks constituting the fault detector and locators 21
6. Figure (2.6) A faulted Transmission Line 22
7. Figure (3.1) A hypothetical three Phase Transmission Line 26
8. Figure (3.2) Homogenous T.L where no fault occurs 30
9. Figure (3.3) A faulted transmission line 31
10. Figure (3.4) GPS System consisting of 24 satellites around Earth orbit 36
11. Figure (3.5) Single line Diagram of System A and System B 39
12. Figure (3.6) Simulated Model of Study Systems (A) and (B) 40
13. Figure (3.7) The fault featured current on 19 different locations under same system conditions 42
14. Figure (3.8) The fault featured current under same loading conditions and same location with different fault inception angles 43
15. Figure (3.9) Seven calculated modal components of sending end featured fault current for no fault case 46
16. Figure (3.10) Seven calculated modal components of sending end featured fault current for no A-B fault 46
17. Figure (3.11)) Seven calculated modal components of sending end featured fault current for no A-G fault 47
18. Figure (3.12) Proposed Scheme for fault Detection and Classification 49
19. Figure (3.13) Proposed Scheme for Fault Locators 50
20. Figure (3.14) Architectural of the proposed fault location scheme 52
21. Figure (3.15) Generation of training set for ANN 60
22. Figure (3.16) Training of ANN scheme 3 60
23. Figure (3.17) Block Diagram of Double Stage CTWB line to ground (A-G) Fault locator 61
24. Figure (4.1) ANN for Fault Detection and Classification 62
25. Figure (4.2) Regression between inputs and outputs in training, validation and testing of ANN 64

26. Figure (4.3) Error Histogram during testing of ANN Fault detection and classification and classification…….. 65
27. Figure (4.4) Single Stage Fault Estimation ABCG ANN..... 67
28. Figure (4.5) Error vs. Fault Location testing of Single Stage Fault Location Estimation ABCG ANN 69
29. Figure (4.6) Single Stage Fault Location Estimation AB ANN 70
30. Figure (4.7) Error vs. Fault Location testing of Single Stage Fault location Estimation AB ANN…….. 71
31. Figure (4.8) Single Stage Fault Estimation AG ANN..... 73
32. Figure (4.9) Error vs. Fault Location testing of Single Stage Fault location Estimation AG ANN..... 74
33. Figure (4.10) comparison of Error (%) vs. Fault Location Estimation AG ANN between the three approaches..... 78
34. Figure (4.11) Comparison between the performances values of the three approaches 79
35. Figure (4.12) Error (%) in fault location in Single Stage CTWB FL using different data windows 81
36. Figure (4.13) comparing the performance of Single Stage CTWB FL using different data windows 81
37. Figure (4.14) Flow Chart of designing Double Stage CTWB Fault Locator ... 82
38. Figure (4.15) ANN for Double Stage CTWB Fault Locator..... 83
39. Figure (4.16) Comparison between Single Stage and Double Stage Fault Locator 84
40. Figure (4.17) Comparison between Different proposed fault locators 85
41. Figure (4.18) Comparison between Scheme 2 and Scheme 3 in different Fault Locations 86
42. Figure (4.19) Flowchart for the Proposed Fault Location Algorithm..... 87

LIST OF TABLES

1. Table (2.1) Error (%) For Location 10%, Time Variable Resistance Rf..... 17
2. Table (3.1) System (A) General data 39
3. Table (3.2) System (A) per unit length Transmission Line Parameters..... 39
4. Table (3.3) System (B) General data 40
5. Table (3.4) System (A) Per unit length Transmission Line Parameters..... 40
6. Table (3.5) Capability of different modal components to detect the different fault type..... 44
7. Table (3.6) Featured sending end fault current model components used for each fault type to calculate fault location..... 53
8. Table (3.7) Start and end of the summation of equation (3.37) in the first 50% of Transmission Line 56
9. Table (3.8) Start and end of the summation of equation (3.37) in the last 50% of Transmission Line 56
10. Table (3.9) The summation limits of equation (3.37) at different locations... 57
11. Table (4.1) Inputs and Targets of Fault detection and classification ANN..... 63
12. Table (4.2) Training and testing patterns of Fault detection and classification ANN..... 64
13. Table (4.3) Testing Outputs of Fault detection and classification ANN..... 66
14. Table (4.4) Testing Results of Fault detection and classification ANN..... 67
15. Table (4.5) Inputs and Targets of Single Stage Fault Location Estimation ABCG ANN..... 68
16. Table (4.6) Training and testing patterns of Single Stage Fault Location Estimation ABCG ANN..... 68
17. Table (4.7) Testing Results of Single Stage Fault Location Estimation ABCG ANN ... 69
18. Table (4.8) Inputs and Targets of Single Stage Fault Location Estimation AB ANN... 70
19. Table (4.9) Training and Testing Patterns of Single Stage Fault Location Estimation AB ANN 71
20. Table (4.10) Testing Results of Single Stage Fault Location Estimation AB ANN ... 72
21. Table (4.11) Inputs and Targets of Single Stage Fault Location Estimation AG ANN 73
22. Table (4.12) Training and Testing Patterns of Single Stage Fault Location Estimation AG ANN..... 73
23. Table (4.13) Testing Results of Single Stage Fault Location Estimation AG ANN..... 74
24. Table (4.14) Training and Testing Patterns for ANN for Double Stage CTWB Fault Locator..... 84