**DECLARATION**

I hereby declare that I carried out the work reported in this thesis in the Department of Electrical and Information Engineering, School of Engineering and Technology, College of Science and Technology, Covenant University, Ota, Nigeria under the supervision of Prof. C.O.A. Awosope and Prof. J.C. Ekeh.

I also solemnly declare that no part of this report has been submitted here or elsewhere in a previous application for award of a degree. All sources of knowledge used have been duly acknowledged.

Engr. ADOGHE UWAKHONYE ANTHONY

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**CERTIFICATION**

This is to certify that this thesis is an original research work undertaken by **Anthony Uwakhonye ADOGHE** (CU05GP0125) and approved by:

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**DEDICATION**

This thesis is dedicated to God Almighty for his faithfulness and love towards me and to the service of Humanity.

**ACKNOWLEDGEMENTS**

I am grateful to almighty God, the Author and finisher of my faith, for granting me access to his ceaseless revelation, wisdom and favour that saw me through my doctoral studies.

My sincere appreciation goes to the Chancellor, Dr. David Oyedepo for the vision and mission of the University.

Also, special thanks to the Vice Chancelor, the Registrar, the Deans of Colleges, the Heads of Department for their commitment and drive for excellence and sound academic scholarship.

I also heartily appreciate and sincerely thank my supervisor, Prof. C.O.A. Awosope, whose encouragement, guidance and support enabled the successful completion of this thesis.

I owe my deepest gratitude to my co-supervisor who is also my Head of Department Prof. J.C. Ekeh, for his good counsel, ever-ready willingness to assist and motivate, and more importantly his critical review of the work and useful suggestion in ensuring the success and speedy completion of this work.

It is my pleasure to thank Prof. James Katende, the Dean of the College of Science and Technology (CST), for his support and encouragement all through the course of this work. Special thanks to the Dean of post Graduate School, Professor C.O. Awonuga and all my teachers at the postgraduate school. I thank all my friends and senior colleagues in the Department of Electrical and Information Engineering for their support and willingness to assist at very short notice during the course of this work. Engr. Gab I. Ezeokoli the Abule-Egba Business unit manager, Power Holding Company of Nigeria Plc is also highly appreciated for given me open access to their maintenance data used for this thesis. I also sincerely appreciate Dr.S.A. Daramola whose thesis provided useful guide for my writing.

Lastly, but deliberately Iwant to specialy appreciate my wife and my children for their understanding, support and contributions to the success of this endeavour, God keep you all for me.

**CONTENTS**

Title page …………………………………………………………… i

Declaration …………………………………………………………. ii

Certification ……………………………………………………………iii

Dedication …………………………………………………… iv

Acknowledgements ………………………………………………… v

Table of Contents ………………………………………………… vi

Lists of Symbols and Abbreviations ……………………………… x

List of Figures and Diagrams …………………………………........ xii

List of Tables ……………… ……………………………………… xv

Abstract ………………………………………………… … xvi

**Chapter one: Introduction**

1.1 Background information.....................................................................1

1.2 Research problem definition (statement of the problem)...................4

1.3 Aim and objectives of the study........................................................ 8

1.4 Research methodology...................................................................... 8

1.5 Significance of the study...................................................................9

1.6 Motivation of the study.....................................................................9

1.7 Expected contribution to knowledge ................................................11

1.8 Scope and limitation...........................................................................11

1.9 Thesis organization............................................................................12

**Chapter two: Literature Review**

2.1 Introduction..................................................................................... 14

2.2 Maintenance approaches............................................................... 16

2.3 The emergence of RCM............................................................... 17

2.4 Evolution of maintenance............................................................. 18

2.5 What is reliability? ................................................................. 26

2.6 Reliability centred maintenance.............................................. 28

2.7 Reliability engineering............................................................. 34

2.8 Reliability engineering process................................................ 35

2.9 Reliability evolution................................................................ 36

2.10 Limitation of RCM.................................................................. 39

2.11 Observations and Findings from the Literature Survey ..... 42

2.12 The proposal of reliability centred maintenance (RCM) for asset management in electric power distribution system............................. 42

2.13 Summary ..................................................................................... 45

**Chapter three: Theory of Reliability Evaluation**

3.1 Introduction.................................................................................... 46

3.2 Definition and terminology .......................................................... 46

3.3 Applied reliability indices............................................................ 52

3.4 Maintenance Strategies.................................................................. 55

3.5 Choosing an appropriate distribution model ................................. 55

3.6 Modelling of life distribution function.......................................... 57

3.7 Exponentially distributed random variable................................... 59

3.8 Weibull-distributed random variable......................................... 59

3.9 Failure rate modelling for the RCM studies................................. 60

3.10 Method of reliability evaluation ............ 60

3.11 Ways for constructing the developed model.......................... 65

**Chapter four: Application of RCM model to PHCN network**

4.1 Introduction................................................................................. 80

4.2 The network topology description............................................... 81

4.3 Data collection and processing.................................................... 87

4.4 Modelling of failure and repair processes.................................... 100

**Chapter five: Transformer Inspection and Maintenance: Probabilistic Models**

5.1 Introduction.................................................................................... 104

5.2 Causes of transformer Failure............................................. 105

5.3 Transformer maintenance model....................................... 108

5.4 Equivalent mathematical models for transformer maintenance…..112

5.5 Sensitivity analysis of inspection rate on mean time to

first failure (MTTFF)………………………………………………. 115

5.6 Analysis of the mean time to first failure ………………….. 120

**Chapter six: Estimating the remaining life of the identified distribution transformer**

6.1 Introduction................................................................................... 122

6.2 Asset’s life cycle...................................................................... 123

6.3 Techniques for asset management of transformers............ 124

6.4 Performing maintenance plans............................................... 129

6.5 Determination of the transition parameters for predicting the remaining life of an asset (distribution transformer)........................................... 131

6.6 Determination of the steady - state probabilities.................... 133

6.7 Determination of the mean time to first failure...................... 135

6.8 Sensitivity analysis of failure rate on estimated remaining life of distribution transformer................................................................................... 139

6.9 Discussion and analysis of results......................................... 146

**Chapter seven: Conclusion and recommendations**

7.1 Summary ....................................................................... 148

7.2 Achievements ........... ……………… 149

7.3 Recommendation .......................................................... 150

Annexes ……………… 152

References ……………………………………….. 179

**LISTS OF SYMBOLS AND ABBREVIATIONS**

AENS Average energy not supplied per customer served

AI Artificial Intelligent

AM Asset Management

ANN Artificial Neural Network

ASAI Average Service Availability Index

CAIDI Customer Average Interruption Duration Index.

CAIFI Customer Average Interruption Frquency Index

CA Condition Assessment

CBM Condition Based Maintenance

CiGre International council on large electric systems

CM Corrective Maintenance

cm Condition Monitoring

CH4 Methane

C2H2 Acetylene

C2H4 Ethylene

C2H6 Ethane

CO Carbon monoxide

CO2 Carbon dioxide

DGA Dissolved gas analysis

DP Degree of polymerization

EPRI Electric Power Research Institute

FA Fura Analysis

FRA Frequency Response Analysis

HPP Homogeneous Poisson Process

HST Hot Spot temperature

HV High voltage

H2 Hydrogen

int. Interruption of voltage

LOE Average loss of energy

LTA Logic decision tree analysis

LV Low Voltage

MATLAB Matrix Laboratory

MC Monte Carlo

MM Maintenance Management

MTBF Mean Time Between Failures

MTTFF Mean Time To First Failure

MTTR Mean Time To Repair

MV Medium Voltage

NHPP Non – Homogeneous Poisson process.

PHCN Power Holding Company of Nigeria

PD Partial Discharge

PM Preventive Maintenance

RCM Reliability-Centered Maintenance

RMS Root mean Square value

SAIDI System Average Interruption Duration Index.

SAIFI System Average Interruption Frequency Index

UMIST: University of Manchester Institute of Science and Technology.

**LIST OF FIGURES AND DIAGRAMS**

Figure 1.1: Project scope definition ………………………… 12

Figure 2.1: Overview of maintenance approches ………… 16

Figure 2.2: Reactive maintenance model ……………………… 21

Figure 2.3: Proactive maintenance model ……………… 22

Figure 2.4: Composition of availability

and its controlling parameters …………………..… 35

Figure 2.5: Logic of relating component maintenance

System reliability with operating costs. …………… 44

Figure 3.1: Definitions of failures ……………………… 50

Figure 3.2: Total time for repair/replacement ………………… 51

Figure 3.3: Outage time sequence ………………………… 52

Figure 3.4: Discrete-parameter Markov Model for the determination of the remaining life ……………………………………………. 67

Figure 3.5: Continuous Parameter Markov Model ………………… 69

Figure 3.6: Function of the Mean Time to failure versus failure rate ……………………………………………………………….. 70

Figure 3.7: Markov Model with Continuous Parameter ……… 70

Figure 3.8: Diagram illustrating development of the mean transition time between states i and j ……… …………………………………. 71

Figure 3.9: A simple maintenance model under deterioration failure. 73

Figure 4.1: Block diagram showing the origin of Ikeja

distribution zone …………………………………. 83

Figure 4.2: Line diagram showing 10 injection substations …….. 84

Figure 4.3: A section of the Abule-Egba distribution business unit …85

Figure 4.4: A typical customer feeder in Ojokoro Substation …… 86

Figure 4.5: Processed 2005 outage data for Abule-Egba business unit ……………89

Figure 4.6: Processed 2006 outage data for Abule-Egba business unit …………… …89

Figure 4.7: Processed 2007 outage data for Abule-Egba business unit ………………90

Figure 4.8: Processed 2008 outage data for Abule-Egba business unit ……………91

Figure 4.9: Processed outage data for Ijaye Ojokoro feeders for 2005.92

Figure 4.10: Processed outage data for Ijaye Ojokoro feeders for 2006.93

Figure 4.11: Processed outage data for Ijaye Ojokoro feeders for 2007. ………94

Figure 4.12: Processed outage data for Ijaye Ojokoro feeders for 2008

…………….95

Figure 4.13a: Processed failure data for critical feeder for 2005....... 98

Figure 4.13b: Processed failure data for critical feeder for 2006 ……99

Figure 4.13c: Processed failure data for critical feeder for 2007 ……99

Figure 4.13d: Processed failure for critical feeder for 2008 …………100

Figure 5.1: Transformer maintenance model …………109

Figure 5.2: Perfect Maintenance Model ……………………113

Figure 5.3: Imperfect Maintenance Model ………………………114

Figure 5.4: Inspection Model ……………………………114

Figure 5.5a-c: The relationship between inspection rate and MTTFF …………………… 118

Figure 5.6a-c: The relationship between inspection rate and MTTFF

When stage1 is represented by three subunits …… 119

Figure 6.1: Stages in the asset Management lifecycle. …… 123

Figure 6.2: Asset Management – asset life cycle with about 90% Maintenance stage … 124

Figure 6.3: Transformer asset Management activities ……… 125

Figure 6.4: Transformer condition Monitoring and assessment techniques …………… 126

Figure 6.5: Classification of Maintenance activities ……… 129

Figure 6.6: Function of mean time to failure versus failure rate ….. 132

Figure 6.7 Markov Model with Continuous Parameter ……… 132

Figure 6.8: Markov Model for generating intensity Matrix ……133

Figure 6.9: Estimated transformer life-span at varying failure rates. 142

Figure 6.10a-b: Sensitivity data fitted to 8th degree polynomial and its corresponding Norm residuals …………………………………… 142

Figure 6.11: Plot of the result of the sensitivity analysis when other variables are held constant except maintenance rate ……………… 145

Figure 6.12a-b: Sensitivity data fitted to 3rd degree polynomial and its corresponding Norm residuals ………………………………… … 145

**LIST OF TABLES**

Table 2.1 Changing maintenance techniques ………………….. 33

Table 4.1a: Statistical parameters from outage data set for 2004 ……96

Table 4.1b: Statistical parameters from outage dataset for 2005 ……96

Table 4.1c: Statistical parameters from outage dataset for 2006 ……96

Table4.1d: Statistical parameters from outage dataset for 2007 …… 97

Table 4.1e: Statistical parameters from outage dataset for 2008 …..97

Table 5.1: Number of failures for each cause of failure ……………105

Table 5.2: List of the distribution of transformer failure by age ….. 108

Table 5.3: Transformer maintenance tasks ………………………… 110

Table 5.4: Rated limit for values of transformer oil for voltage class 111

Table 5.5: List of model parameters and definitions ………………112

**REFERENCES**

**APPENDIX**

**ABSTRACT**

The purpose of Maintenance is to extend equipment life time or at least the mean time to the next failure.

Asset Maintenance, which is part of asset management, incurs expenditure but could result in very costly consequences if not performed or performed too little. It may not even be economical to perform it too frequently.

The decision therefore, to eliminate or minimize the risk of equipment failure must not be based on trial and error as it was done in the past.

In this thesis, an enhanced Reliability-Centered Maintenance (RCM) methodology that is based on a quantitative relationship between preventive maintenance (PM) performed at system component level and the overall system reliability was applied to identify the distribution components that are critical to system reliability.

Maintenance model relating probability of failure to maintenance activity was developed for maintainable distribution components. The Markov maintenance Model developed was then used to predict the remaining life of transformer insulation for a selected distribution system. This Model incorporates various levels of insulation deterioration and minor maintenance state. If current state of insulation ageing is assumed from diagnostic testing and inspection, the Model is capable of computing the average time before insulation failure occurs.

The results obtained from both Model simulation and the computer program of the mathematical formulation of the expected remaining life verified the mathematical analysis of the developed model in this thesis.

The conclusion from this study shows that it is beneficial to base asset management decisions on a model that is verified with processed, analysed and tested outage data such as the model developed in this thesis.