



Faculty of Engineering
Electrical Power and Machines Department

Enhancing the distribution system performance by network reconfiguration and dispersed generation allocation

M.Sc. Thesis

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

Electrical Engineering
(Electrical Power and Machines Department)

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STATEMENT

This Thesis is submitted to Ain Shams University in partial fulfillment of the requirements of Master of Science degree in Electrical Engineering.

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

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Abstract

The emergence of dispersed generation, smart grids and deregulated electricity markets has increased the focus on enhancing the performance of distribution systems. To achieve this objective, different aspects that can be considered in the planning and operation of distribution systems; including energy loss minimization, enhancing the voltage profile, and improving the system reliability.

Despite their advantages, renewable based Dispersed Generators (DGs) can pose some challenges in the planning and operation of the distribution system due to the intermittency in their output power. Accordingly, the actual output profile of these DGs should be considered to obtain realistic results.

The work in thesis proposes a method that can be used to enhance the performance of the distribution system by performing simultaneous Distribution System Reconfiguration (DSR) and DGs allocation. In addition, the intermittent nature of the renewable based DGs and the load profile are considered while performing the proposed method using a probabilistic model. The proposed method aims to present different annual plans for the optimal system configuration and DGs sizes and locations in order to achieve three objectives. The first objective focuses on performing simultaneous DSR and DGs allocation to minimize the annual energy loss of the distribution system under study. The second objective discusses the application of the proposed method to improve the distribution system reliability. Finally, in the third objective, the proposed method is used to minimize the combined cost of annual energy loss and annual energy not served which is related to the system reliability. The proposed method is implemented using Firefly Algorithm (FA) which is one of the modern Meta-Heuristic optimization techniques.

In this work, the solar irradiance and wind speed data are obtained from the National Renewable Energy Laboratory. In addition, the IEEE 33-bus distribution system is used, and FA is implemented in the MATLAB environment. In addition, Newton Raphson

power flow is used to check the constraints related to the voltages and currents ampacities.

Keywords: distribution system, dispersed generators, distribution system reconfiguration, optimal power flow, firefly algorithm.

Acknowledgement

First and foremost, I would like to thank God whose guidance lead me this far and for the knowledge he has blessed me with.

I would like to thank my supervisor **Prof Dr. Hossam E.A Talaat**, for his guidance, support, encouragement throughout my research study. He has made major influence in my academic life.

I would like to express my sincere gratitude to my supervisor **Dr. Walid Atef Omran** for his continuous guidance, and constructive suggestions during the research. I could not possibly list all that I have learned from him throughout the research period.

Finally, I am grateful for my parents, who helped me through all these. Special thanks to my wife who stood by me throughout the hard and good times.

Table of Contents

Abstract	i
Acknowledgement.....	iii
Table of Contents	iv
List of Figures	vii
List of Tables.....	ix
List of Abbreviations.....	x
List of Symbols	xi
Chapter 1 Introduction	1
1.1 General	1
1.2 Power system structure	1
1.3 Distribution system planning and operation aspects	2
1.4 Research objectives	2
1.5 Thesis organization.....	2
Chapter 2 Performance Enhancement of Distribution Systems	4
2.1 General	4
2.2 Distribution system performance enhancement methods	4
2.2.1 Distribution system reconfiguration.....	4
2.2.2 Optimal DGs allocation.....	5
2.2.3 Simultaneous distribution system reconfiguration and DGs allocation	5
2.3 The adopted strategy.....	6
2.4 Summary.....	7
Chapter 3 Modelling Methodology	8
3.1 General	8
3.2 Photovoltaic systems modelling	8
3.3 Wind turbines modelling	10
3.4 Load modelling.....	13
3.5 Summary.....	15
Chapter 4 Energy loss Reduction	16
4.1 General	16
4.2 Problem formulation.....	16

4.2.1	Objective function	16
4.2.2	Problem constraints	17
4.3	Firefly Optimization Algorithm.....	18
4.4	Application of the firefly algorithm.....	20
4.5	Case Studies.....	22
4.5.1	Case1 (Peak conditions)	23
4.5.2	Case 2	26
4.5.3	Case 3	29
4.6	Summary.....	36
Chapter 5 Reliability Improvement of The Distribution System		37
5.1	General	37
5.2	Distribution system reliability	37
5.3	Distribution system reliability indices	38
5.3.1	System average interruption frequency index (SAIFI)	38
5.3.2	System average interruption duration index (SAIDI)	38
5.3.3	Energy not served index (ENS).....	39
5.4	Modified reliability indices	39
5.4.1	Modified system average interruption frequency index (MSAIFI)	40
5.4.2	Modified system average interruption duration index (MSAIDI)	40
5.4.3	Modified energy not served index (MENS)	41
5.5	Problem formulation.....	41
5.5.1	Objective function	41
5.5.2	Problem constraints	42
5.6	Application of Firefly Algorithm on the objective function.....	43
5.7	Simulation results	45
5.7.1	Best values for the modified reliability indices based on season ...	46
5.7.2	Annual plans for reliability enhancement.....	49
5.8	Summary.....	55
Chapter 6 Distribution System Cost Reduction		56
6.1	General	56
6.2	Introduction	56
6.3	Problem formulation.....	56
6.3.1	Objective function	56

6.3.2	Problem constraints	58
6.4	Application of firefly on the objective function	59
6.5	Simulation results	61
6.5.1	Different annual plans for the combined cost minimization	61
6.5.2	The effect of the objective function on the overall system performance.....	65
6.6	Summary.....	67
Chapter 7 Conclusions and Future Work		68
7.1	Conclusions	68
7.2	Recommendations for future work.....	69
Appendix A Solar irradiance data for the four seasons during the whole studied period		70
Appendix B Probability matrices of the solar irradiance for the four seasons.....		72
Appendix C Wind speed data for the different seasons during the whole study period		76
Appendix D Wind speed probability matrices for the four seasons.....		78
Appendix E IEEE 33-Bus system data.....		82
Appendix F Example illustrates the method that used to calculate the reliability indices		85
Appendix G The failure rates of the system under study		87
List of References		89

List of Figures

Figure 1-1 Centralized power system [1].....	1
Figure 3-1 Solar irradiance for winter.....	10
Figure 3-2 Wind speed during winter season.....	11
Figure 3-3 Wind turbine output power curve [28]	13
Figure 3-4 Per unit load data [25]	13
Figure 4-1 Pseudo code of the FA	19
Figure 4-2 Flow Chart for the application of the FA	21
Figure 4-3 IEEE 33-bus system	23
Figure 4-4 Convergence of FA for Scenario V of Case 2.....	26
Figure 4-5 System configuration and DGs sizes/locations for winter in plan III...	32
Figure 4-6 System configuration and DGs sizes/locations for spring in plan III...	33
Figure 4-7 System configuration and DGs sizes/locations for summer in plan III	34
Figure 4-8 System configuration and DGs sizes/locations for fall in plan III	35
Figure 5-1 The application of FA for reliability enhancement	44
Figure 5-2 Modified system average interruption frequency index improvement.	46
Figure 5-3 Modified system average interruption duration index improvement ...	46
Figure 5-4 Modified energy not served improvement	47
Figure 5-5 MSAIFI for the different annual plans	53
Figure 5-6 MSAIDI for the different annual plans	53
Figure 5-7 MENS for the different annual plans	54
Figure 6-1 The application of the proposed method on the cost minimization.....	60
Figure 6-2 Typical cost function of energy not served [12].....	61
Figure 6-3 % improvements of the annual energy loss and annual energy not served	66
Figure A-1 Solar irradiance during winter.....	70
Figure A-2 Solar irradiance during spring	70
Figure A-3 Solar irradiance during summer	71
Figure A-3 Solar irradiance during fall.....	72

Figure C-1 Wind speed during winter.....	76
Figure C-2 Wind speed during spring.....	76
Figure C-3 Wind speed during summer	77
Figure C-4 Wind speed during fall.....	77
Figure F-1 Simple distribution system.....	85