Faculty of Engineering
Electrical Power and Machines Department

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

M.Sc. Thesis
By

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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.

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