Turkish Journal of Electrical Engineering & Computer Sciences

http://journals.tubitak.gov.tr/elektrik/

Research Article

Turk J Elec Eng & Comp Sci
(2013) 21: 825 – 850

doi:10.3906/elk-1108-62

Optimal sizing and siting distributed generation resources using a multiobjective algorithm

Seyed Amir HOSSEINI,[1] **Seyed Siavash Karimi MADAHI,**[2] **Farzad RAZAVI,**[1,*]
Mohsen KARAMI,[3] **Ali Asghar GHADIMI**[4]
[1]Department of Electrical Engineering, University of Tafresh, Tafresh, Iran
[2]Department of Power Engineering, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia
[3]Department of Electrical Engineering, Islamic Azad University, Ashtian Branch, Ashtian, Iran
[4]Department of Electrical Engineering, Faculty of Engineering, Arak University, Arak, Iran

Received: 20.08.2011 • **Accepted:** 15.03.2012 • **Published Online:** 03.05.2013 • **Printed:** 27.05.2013

Abstract: The restructuring of the electrical market, improvement in the technologies of energy production, and energy crisis have paved the way for increasing applications of distributed generation (DG) resources in recent years. Installing DG units in a distribution network may result in positive impacts, such as voltage profile improvement and loss reduction, and negative impacts, such as an increase in the short-circuit level. These impacts depend on the type, capacity, and place of these resources. Therefore, finding the optimal place and capacity of DG resources is of crucial importance.

Accordingly, this paper is aimed at finding the optimal place and capacity of DG resources, in order to improve the technical parameters of the network, including the power losses, voltage profile, and short-circuit level. The proposed formulation of this paper significantly increases the convergence and the speed of the finding the answers. Furthermore, to select the optimal weighting coefficients, an algorithm is proposed. The weighting coefficients are decided on according to the requirements of each network and deciding on them optimally prevents the arbitrarily selection of these resources. The genetic algorithm is used to minimize the objective function and to find the best answers during the investigation. Finally, the proposed algorithm is tested on the Zanjan Province distribution network in Iran and the simulation results are presented and discussed.

Key words: DG optimal location, DG optimal size, distributed generation, objective function, genetic algorithm

1. Introduction

Distributed generation (DG) is defined as electrical power resources that are directly connected to the network [1]. These resources include renewable and nonrenewable energies. Renewable energies that are applicable for DG include wind, solar, and biomass. On the other hand, nonrenewable energies include microturbines, gas turbines, and fuel cells [2,3]. Installing DG on distribution networks has many different impacts on the parameters of these networks. These impacts can be positive and negative. The positive impacts of installing DG resources includes increasing the power quality, improving the voltage profile, reducing the power loss, decreasing the requirements of installing new transmission lines, and deferring the necessity of improving the capacity of substations [4,5].

On the other hand, the main adverse impact of installing DG is the increase in the short-circuit level of the network [6].

*Correspondence: farzad.razavi@tafreshu.ac.ir