Technical and Economic Impacts of Distributed Generationon Distribution Systems

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Education

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Lecture

Bachelor Degree in Electrical Engineering

- 1. Electric Power System Analysis
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Master Degree in Electrical Engineering

- 1. Computer Analysis in Power Systems
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- 3. Thesis

Professional Memberships

- Chair of Master degree program in the Electrical Engineering at Rajamangala University of Technology Phra Nakhon
- Committees of National and International Conferences, EECON, EENET and ICPSE 2014
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Abstract

Electric demand is substantially increasing as a result of economic and social growths, the construction of a large sized power plant is running into financial and technical difficulties because it is capital intensive and needs considerable amount of time. An ideal alternative on electric distributions to electric users is the installation of a small sized generator or commonly known as distributed generation (DG). DG is a small-scale active generating unit located on or near the site where it is to be used (i.e., in distribution systems). The primary energy resources of DG could be wind, solar, biomass, fuel cells and hydrogen, etc. The introduction of DG units, however, brings a number of technical issues to the system; important among them is the active power loss. It is therefore proposed in this research to investigate the impact of distributed generation on distribution system in the context of planning and operation, illustrated respectively by distributed generation placement and feeder reconfiguration with DG.

The distributed generation placement problem is twofold that need to be simultaneously determined- firstly, location and secondly, number and sizes. In this research, the objective function of the problem is to minimize the system active power loss while retaining the voltage magnitudes of all load points within prescribed allowable limits for different load levels. Mathematical models and a technique based on Tabu search is developed to solve for optimal placement and sizing of DGs. The effectiveness of the developed method is demonstrated by 28-bus Provincial Electricity Authority (PEA) distribution systems. The study results indicate that the method manages to give the optimal placement and sizing of generators that yield the lowest total cost over the planning horizon.

Feeder reconfiguration is accomplished by altering topological structures of the network by changing the statuses of tie and disconnecting switches. To give an appropriate connection for several reasons such as loss reduction, load balancing, and voltage improvement. A methodology based on fuzzy multiobjective and Tabu search is formulated to determine the optimal on/off patterns of tie and sectionalizing switches for feeder reconfiguration with DGs. Three main objectives taken into account in the feeder reconfiguration problem consist of power loss, feeder load balancing, and number of switching operations of the switches. The performance of the developed methodology is demonstrated by a 69-bus radial distribution system. On the basis of the simulation results obtained, the satisfaction level of one objective can be improved at the expense of that of the others. The decision maker can, therefore, flexibly prioritize his or her own objectives by adjusting some of the fuzzy parameters. In addition, in order to increase the advantages of the feeder reconfiguration, the dispatch of the distributed generators is assumed to be implemented, where its dispatch schedule that gives the minimum total cost of generation is solved by an optimal power flow.

Keyword: Distribution Planning and Operation, Distributed Generation, Feeder Reconfiguration, Optimization