Zabol University
M. Sc. Thesis
on Power Engineering

Subject
Dissertation for Master's Degree in Electrical Engineering
Power orientation

Title
Improving the performance of microgrids in balanced load distribution based on adaptive gray wolf meta-heuristic algorithm

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abstract

In recent years, issues such as the unsustainability of power systems, the increase in energy transmission costs, system reliability, system losses, the reduction of fossil resources and environmental pollution caused by the tendency of societies to use Renewable resources. Renewable resources do not have many challenges of fossil resources and are available. In order to use renewable resources to produce electrical energy, distribution networks were formed, which are capable of producing and controlling their own networks, similar to large power networks (traditional networks). These networks were called microgrids in the literature of power systems. A microgrid refers to a group of loads and small power sources that can act as a controllable system and produce electric power and heat at the same time. Several researches have been presented in the use and optimization of microgrids. However, production costs in these networks have not been minimized. In order to minimize the costs of electric energy production, optimization methods based on heuristic algorithms are useful. The main goal of this thesis is to model and optimize the appropriate model for the optimal use of scattered production combinations, based on the gray wolf optimization algorithm for providing power to remote areas. In the proposed micro-grid, there are production sources including: solar panels, diesel generator, battery set, as well as a two-way AC to DC converter. In order to reduce fuel costs, maintenance and repair costs of these production resources and the cost of not supplying microgrid load, a multivariable objective function has been considered. This function is considered as the objective function of the gray wolf optimization algorithm. It has been considered to optimize the parameters of the diesel generator so that the production costs for power companies and consumers reach the lowest level. Real data collected in the city of Rise have been used to simulate the proposed microgrid with the proposed optimization algorithm. The implementation period of the proposed plan is 25 years. The simulation results in the desired range show the reduction of maintenance and repair costs of the microgrid compared to the particle swarm optimization algorithm. This superiority in cost reduction is 2.5% in general.

Keywords: power systems, distribution network, microgrid, operation, optimization, gray wolf algorithm