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Optimum Designing of Solar – wind hybrid battery system apart from the network with regard to lack of supplying load using Grasshopper Optimisation Algorithm

Ronak Jahanshahi Bavandpour * Hamid Ghadiri

1. Dept. of Electrical Engineering, Darolfonoon Higher Educ. Inst., Qazvin, Iran, lili66630@gmail.com
2. Dept. of Electrical, Biomedical and Mechatronics Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran, h.ghadiri@qiau.ac.ir

Abstract

Today, designing of energy hybrid systems are studying from two viewpoints of production price and supplying load demand. In this article, optimum designing of solar-wind hybrid system is presented with saving battery system for supplying a specific hourly load annually with the aim of minimizing annual system expenses and the probability of Loss of Power Supply Probability (LPSP) with the aid of new Grasshopper Optimisation Algorithm (GOA2) using Multi-objective weight coefficients. In this article, annual expenses of system including initial investment costs, maintenance cost, and cost of replacement costs are considered. Decision making variables including the number of solar panels, wind turbines, number of batteries, the height of wind tower and the angle of solar panel toward solar radiation are considered. In this study, some of the effective elements, such as inverter efficiency, changes in load demand, and also changes of maximum probability of Loss of Power Supply Probability on system designing are evaluated. The results indicate the superiority of GOA method toward particle swarm optimization (PSO3) in reaching better target function and less cost. Also, simulation results show that the efficiency reduction, load increase and reducing of Loss of Power Supply Probability lead to increase in annual energy costs of systems.

Key words: solar-wind hybrid system, battery, optimum designing, Loss of Power Supply Probability, Grasshopper Optimisation Algorithm

1. Introduction

Energy is the essential requirement of everyone's life in every places and every time. This subject is become more true in this new century; a century in which people seek for higher level of life quality. Among different kinds of energy, electricity is one of the most important energies that people need every day[1]. The concentration of electrical generators has been possible since the possibility of alternating electric voltage changes and as a results the increase of them along energy transmission lines and reduction of them at the end of lines using transformers are provided with science development. Nowadays, along with the various developments in the electrical industry, there is a discussion about massive transformation in energy production and transmission systems that "Distributed Generation (DG)" is heard frequently. Distributed generation is related to using small generation unit in strategic power system regions near load centers. The power plants with the small generation capacity (from some kilowatt to 10 megawatt) is called distributed generation power plant that installed in regions near consumers in order to generate electricity. Some of these power plants are wind