Optimal Operation of Droop Control in Microgrids Using Different Techniques Optimization: Review

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Abstract: Microgrids are small power systems and can operate in two modes: island mode and grid-connected. Switching between these two modes may cause a change in the load, which causes disturbances that affect the operation of the microgrid (MG), as the load change leads to a change in the voltage and frequency of the system so the operating control problem main issue for the microgrids that is need addressed during operation. A control system is required for accurate synchronization, system protection, and load reduction in an imbalance scenario, as well as to achieve system stability while supplying robust and efficient electricity to the microgrids. Droop control is one of the common methods used in the microgrid (MG) to adjust the real power and reactive power and control the system voltage and frequency. However, the traditional droop control suffers from problems in the accuracy of load distribution, line impedance mismatch, and slow dynamic response, as a result, parameter values must be carefully chosen. To address these issues, many techniques have been used, one of which is the optimization techniques. This paper reviews five different optimization techniques based on metaheuristic optimization algorithms applied to microgrids that address some of the drawbacks of droop control by optimizing droop control parameters for optimal flexible microgrid (MG) operation. These techniques include Particle Swarm Optimization (PSO), Genetic Algorithm (GA), Grey Wolf Optimization (GWO), Grasshopper Optimization Algorithm (GOA), and Salp Swarm Algorithm (SSA).

Keywords: Microgrid; Droop Control; Optimization Algorithms; Load Change; Voltage and Frequency Stability.

1. Introduction

A microgrid (MG) is a small-scale distribution network that is low voltage consisting of various distributed generation (DG) units whether it is renewable (wind turbines, microturbines, fuel cells, photovoltaic, etc.) conventional (gas microturbines, biomass boilers, etc.), or a combination of the two, and electrical loads that are either connected to the utility grid at the point of common coupling (PCC) or separated so Interconnecting power systems is important for maintaining an efficient power flow supply and improving the system's reliability. where renewable energy has become a significant source of power systems replacing conventional sources[1][2][3]. In recent decades, the use of distributed generation (DG) has increased dramatically, and the demand for electrical energy has risen as it has become a profitable supplementary service in our lifestyle[4]. DG units provide the following advantages over conventional centralized power generation: higher energy efficiency, less pollution, lower power transmission losses, and a more flexible installation site[5]. A microgrid can operate in two modes grid-connected mode and islanded mode. In the grid-connected mode, a controller's primary function is to manage energy. The microgrid connects to the utility grid via a bus bar known as the Point

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