Considerations on optimal design of hybrid power generation systems using whale and sine cosine optimization algorithms

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Abstract

Nowadays, the continuous increase of power demand leads to various challenges for distribution system operators (DSOs) such as power quality, system stability and reliability. Microgrids (MGs) and hybrid power generation systems (HPGSs) can play a significant role in solving these issues while improving the performance of electrical power systems. In this paper, an optimal multi-criteria design of a grid-connected HPGS is introduced, taking into consideration involvement of a natural gas distribution network (NGDN) in the proposed configuration, where the NGDN supplies natural gas to a gas turbine. The HPGS system consists of wind turbines (WT), photovoltaic (PV) arrays, battery banks (BBs), gas turbines (GTs), in addition to a utility grid (UG). Two different meta-heuristic optimization algorithms, namely whale, and sine cosine, are employed to find the optimal design of the system for minimizing the total annual cost and system emissions. A detailed comparative study of the results with results of the cuckoo search and firefly optimization algorithms is presented to show the robustness of the used techniques.

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