Optimal multi-criteria design of a new hybrid power generation system using ant lion and grey wolf optimizers

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Abstract

The importance of the hybrid power generation systems (HPGS) increased especially in the last few years. HPGS are used to distribute the load between many different energy sources (e.g. utility grid (UG), wind turbine (WT), photovoltaic (PV), fuel cell (FC), and storage battery (SB)). These power sources are combined together in different configurations to form the HPGS. There are two common operation modes for these hybrid power systems; the first one is called as a standalone mode, in which the distributed power sources are combined together to supply the power without any supporting from the utility grid. The other mode is known as the utility grid connect mode, where the combination of these power sources is paralleled connected to the utility grid. This paper introduces a new contributions on the design of the HPGS, where the proposed hybrid system includes for the first time another energy utility such as the natural gas piping network. All operations conditions of this network are considered through the design of the HPGS. Applying modern meta-heuristic optimization techniques for the first time in the sizing of the HPGS. The applied techniques are; the ant lion optimizer (ALO) and grey wolf optimizers (GWO). MATLAB software has been used to execute the optimization process using ALO and GWO, and a detailed comparison is occurred between the results of applying the above mentioned techniques and another two modern optimizations techniques; Cuckoo search algorithm (CSA) and flower pollination algorithm (FPA) to show the effectiveness of applying both of ALO and GWO.

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