Optimal Energy Management and Environmental Index Optimization of a Microgrid Operating by Renewable and Sustainable Generation Systems

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Abstract : The economic operation of electric energy generating systems is one of the predominant problems in energy systems. Due to the need for better reliability, high energy quality, lower losses, lower cost and a clean environment, the application of renewable and sustainable energy sources, such as wind energy, solar energy, etc., in recent years has become more widespread. In this work, one of a bio-inspired meta-heuristic algorithm inspired by the flashing behavior of fireflies at night called the Firefly Algorithm (FFA) is applied to solve the Optimal Energy Management (OEM) and the environmental index (EI) problems of a micro-grid (MG) operating by Renewable and Sustainable Generation Systems (RSGS). Our main goal is to minimize the nonlinear objective function of an electrical microgrid, taking into account equality and inequality constraints. The FFA approach was examined and tested on a standard MG system composed of different types of RSGS, such as wind turbines (WT), photovoltaic systems (PV), and non-renewable energy, such as fuel cells (FC), micro turbine (MT), diesel generator (DEG) and loads with energy storage systems (ESS). The results are promising and show the effectiveness and robustness of the proposed approach to solve the OEM and the EI problems. The results of the proposed method have been compared and validated with those known references published recently.

Keywords : renewable energy sources, energy management, distributed generator, micro-grids, firefly algorithm

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