Editorial

Special Issue on Advanced Approaches, Business Models, and Novel Techniques for Management and Control of Smart Grids

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1. Introduction

The current power system should be renovated to fulfill social and industrial requests and economic advances. Hence, providing economic, green, and sustainable energy are key goals of advanced societies. In order to meet these goals, the latest features of smart grid technologies need to have the potential to improve reliability, flexibility, efficiency, and resiliency. This *Special Issue* aims to encourage researchers to address the mentioned challenges.

2. Advanced Smart Grids

Considering the aim of the special issue, ten papers have been published in the area of advanced approaches and novel techniques for the management and control of smart grids, from different standpoints. In reference [1], the classification of energy management systems has been carried out from a new viewpoint. Energy management systems have been classified into four categories based on the type of storage systems. Furthermore, energy management systems have been reviewed in terms of uncertainty modeling techniques, objective functions and constraints, optimization techniques, as well as simulation and experimental results. In order to perform dynamic optimizations in real-time, new solutions are required to consider data privacy and cybersecurity. In reference [2], a paradigm has been designed to meet these requirements based on a bottom-up method to lead to misinterpretations or wrong conclusions. Fractal analysis is also employed to identify unique and independent elements of smart grids required for the design of an architectural paradigm. The processes of demand response and conservation voltage reduction are also presented. In reference [3], the greedy smallest-cost-rate path first algorithm is presented to route power from sources to loads in a digital microgrid. In such a microgrid, one distributed energy resource may supply power to one or many loads, and one or many distributed energy resources may supply the power requested by a load. Reference [3] has addressed the high complexity by using heuristics to match sources and loads and to select the smallest-cost-rate paths in the digital microgrid. Reference [4] has studied the building energy and comfort management systems. These systems have a high potential to decrease energy consumption costs as well as to enhance the efficiency of resource exploitation, by implementing strategies and policies for resource control and demand side management. In order to prevent users' disaffection and the gradual abandonment of the system, reference [4] has developed a sensor-based system for the analysis of users' habits and the early detection and prediction of user activities.

Reference [5] has studied the phase synchronization of an islanded network with large-scale distributed generations in a non-homogeneous condition. The critical coupling strength formula is reduced for different weighting cases via the synchronization condition. On this basis, three cases of Gaussian distribution, power-law distribution, and frequency-weighted distribution have been

analyzed. In reference [6], an islanding detection algorithm for distributed generations has been proposed. This work presents a passive islanding detection algorithm for all types of distributed generations by combining the measured frequency, voltage, current, phase angle and the rate of changes at the point of common coupling. The proposed algorithm can detect the islanding situation, even with the exact zero power mismatches. In reference [7], a novel approach has been presented for earth fault location by using a negative sequence current. The developed method is proposed for locating single-phase earth faults on non-effectively earthed medium voltage distribution networks, and it requires only current measurements. The method is based on the analysis of negative sequence components of the currents measured at secondary substations along with medium voltage distribution feeders.

In reference [8], an augmented Prony method has been proposed for power system oscillation analysis using synchrophasor data obtained from a wide-area measurement system. Intrinsic mode functions provide an intuitive representation of the oscillatory modes, and they are mainly calculated by Hilbert–Huang transform methods. However, those methods suffer from the end effects, mode-mixing and Gibbs phenomena. To overcome the drawback, the augmented Prony method has been employed in [8] and tested on an online oscillation-monitoring framework. Another important issue for the operation of islanded microgrids is frequency stability. An inherent delay in the communication system or other parts such as sensor sampling rates may lead microgrids to have unstable operation states. Therefore, it is essential to use an optimization algorithm to determine the optimum parameters. In reference [9], the communication system delay and ultra-capacitor size along with the parameters of the secondary controller have been obtained by using a Non-dominated Sorting Genetic Algorithm II (NSGA-II). Reference [10] has proposed a black-box modeling method to identify the voltage and frequency response model of microgrids. The microgrid has been considered a two-input two-output black-box system and the simplicity of the modeling can be met by input and output ports, while the model parameters can be adjusted by the change of microgrid operating structure, which makes the model more adaptable.

3. Future Approaches, Models, and Techniques

Although the *Special Issue* has been closed, there is a need for new studies in advanced approaches, business models, and novel techniques for management and control of smart grids. The studies should address the complexity of customers' privacy, climate change, and the role of smart grids for building a greener planet.

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