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Editorial

Special Issue on "Application of Power Electronics Technologies in Power System"

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Over the years, all countries have agreed to alleviate the greenhouse effect and promote net zero carbon emissions. Due to the rapid improvement of semiconductor technology, the application of various power electronics not only dramatically improves the system efficiency of various equipment but also collects a large amount of clean, renewable energy, which is of obvious benefit to the improvement of ecology and the environment. This Special Issue contains 15 articles of great reference value, divided into four sections for readers to read and cite.

1. Inverter

In recent years, various renewable energy technologies have been continuously developed to alleviate the impact of the greenhouse effect in various countries around the world. Among them, the converter (DC/AC) is one of the most critical technologies, which can convert the DC voltage generated by renewable energy into AC voltage, in the same way as the AC grid. This Special Issue contains four papers in this area. The first paper addresses an optimal quick-response variable structure control with a single-phase sine-wave inverter application, which keeps harmonic distortion as low as possible under various loading conditions [1]. A reduced switching component step-up multilevel inverter (RSCS-MLI) with a low value of voltage stress without the requirement of an H-bridge is explored in the second paper [2]. The third paper addresses a single-stage differential boost inverter (SSDBI) applied in a single-stage battery energy storage system (BESS) topology that can supply power from a lower-voltage battery module to an alternating current (AC) load [3]. The compensation of voltage sags and swells using a dynamic voltage restorer (DVR) based on a bi-directional AC/AC converter presented for stabilizing single-phase AC line voltage is the focus of the fourth paper [4].

2. Converter

Developing high efficiency and multifunctional power converter technology and applications are also major focus areas of power electronics. This Special Issue contains four papers in this area. The first paper focuses on a bidirectional resonant converter for an electric vehicle battery charger/discharger system [5]. The second paper addresses a novel, high-efficiency, high-step-up DC–DC converter for photovoltaic (PV) systems [6]. An input-series output-parallel soft switching resonant circuit with balance input voltage and primary-side current is studied and implemented in the third paper for direct current (DC) microgrid system applications [7]. The fourth paper studies and implements a power converter with less current ripple output and wide voltage input operation [8].

3. Control Technique

All kinds of converters in power electronics need to adopt various control methods to meet the requirements of system characteristics, including improving system stability,

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system dynamic characteristics, or other specific purposes. The first paper provides a robust intelligent tracking-control technique that is subsequently applied to single-phase SPWM inverters [9]. The proposed technique mixes advanced sliding mode control (ASMC) with the Grey–Markov model (GMM). For the sake of improving the swing regulate steadiness and safety of EV, the second paper uses a particle swarm algorithm to optimize and improve the BP neural network PID and designs an EV steering regulator to regulate the transverse swing torque and slip rate of EV to improve the safety and steadiness of EV steering [10]. The third paper aims to introduce an effective control system that enhances the dynamics of a doubly fed induction generator (DFIG) operating at fixed and variable speeds [11]. The fourth paper in this area addresses the hybrid algorithm of the chaos synchronization detection method (CSDM) with a convolutional neural network (CNN) for studying PV module fault detection [12].

4. Others

In recent years, the applications of power electronics have become more widespread. The following topics are also important and representative. Numerous MPPT algorithms are available for solar power generation (SPG) systems and have been extensively investigated; the particle swarm optimization (PSO) algorithm is based on imitating the behavior of bird flocks and discovering the advantages of evolution in bird flocks [13]. Additionally, recent research has shown the viability of CPT in the kW power level-related approaches, as demonstrated in [14]. Several topologies of capacitive coupler configurations, such as bipolar along with row/column arranged plates, multi-plate structures with coupling, and parasitic capacitances, have also been well illustrated to make CPT much more efficient. In addition, the literature [15] presents an AC LED driving circuit that uses two active switches for LED dimming. This structure consists of two active switches, called a bidirectional switch, and an electromagnetic interference (EMI) filter used to eliminate high-frequency noise. Since the two switches' gates and sources are connected, it is possible to use one gate driving signal to drive the two switches simultaneously. Adjusting the switches on time changes the output voltage's average value, and therefore, LED dimming can be achieved.

Although the application range of power electronics is quite broad and diverse, the articles in this special issue cover complete theoretical analysis, model derivation, actual measurement, verification, etc., which are critical research directions and have very high reference values.

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