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Editorial

Special Issue on Power Converter of Electric Machines, Renewable Energy Systems, and Transportation

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1. Introduction

Nowadays, energy is becoming more electrical in each field of engineering application, thus power converters have assumed an increasingly relevant role for electrical machines, renewable energy and transportation systems. The converters' design and control are critical, as they are evolving into an essential component to interface and integrate different power systems. In this evolution, power converters' topology and technology play an enabling role in the advancement of electric machine performance, renewable energy integration and emerging transport applications. The use of reliable and efficient electric machines is crucial in allowing the higher penetration of renewable energy in electrical systems, as well as in the ever-changing transport sector. Moreover, energy storage systems could be the way towards higher system flexibility and reliability. Consequently, each specific application requires developing dedicated innovative systems to properly meet the aforementioned goals. Indeed, in recent years, research has been very active in working to improve each electric subsystem, to achieve advantages in terms of system performances, robustness, easy installation, and maintenance. It is necessary to continue on this path in order to obtain significant technological advances.

2. Power Converter of Electric Machines, Renewable Energy Systems, and Transportation

In light of the above, this special issue was launched to address the present challenging issues with design and control techniques for power converters and electric machines, in the field of transportation, renewables and energy storage. After the rigorous peer review process, 10 papers were accepted. In particular, nine research papers and one review article. The published papers cover several topics, mainly on photovoltaic and wind power technologies, performance analysis of induction machines, and energy storage, thus showing that the addressed issues are still very relevant.

Four papers focused on PV systems. The first, a review article, authored by A. A. Estévez-Bén, A. Alvarez-Diazcomas, and J. Rodríguez-Reséndiz, presents a comparison between three voltage-source multilevel inverter topologies [1], while also showing several inverter topologies for PV application. The second paper, by M. Shadoul, H. Yousef, R. Al Abri and A. Al-Hinai, discusses an adaptive fuzzy control technique for a grid-connected PV inverter [2]. The third paper is authored by M. Nicola, and C.-I. Nicola, and it presents the control of a grid-connected PV system, using fractional-order sliding mode control and fractional-order synergetic controllers [3]. The fourth [4], authored by M. Coppola, P. Guerriero, A. Dannier, S. Daliento, D. Lauria and A. Del Pizzo, discusses the control of a fault-tolerant photovoltaic energy converter, by introducing a fast islanding detection method, based on the Hilbert transform of the voltage of the point of common coupling.

Three papers are devoted to wind power systems. The paper authored by Philippe Enrici, Ivan Meny and Daniel Matt, studied a low-power wind system based on a perma-

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nent magnet Vernier machine, in association with a PWM rectifier, with a diode bridge rectifier [5]. The second paper [6], authored by Ronglin Ma, Yaozhen Han and Weigang Pan, proposes a novel adaptive super-twisting sliding mode subsynchronous control interaction mitigation method, for series-compensated doubly fed induction generatorbased wind power systems. The last paper, authored by Gianluca Brando, Adolfo Dannier and Ivan Spina, analyzes the performance of a full order sensorless control adaptive observer, for a doubly fed induction generator, in the grid-connected operation of a turbine-based wind generation system [7].

The monitoring and fault prediction of electrical machines is addressed in the paper authored by Sami Bouzid, Philippe Viarouge and Jérôme Cros, where a real-time digital twin of a wound rotor induction machine, using a precomputed finite element model fed with online measurements, is proposed [8].

The last two papers deal with the integration of energy storage in power systems. The paper "Hybrid Multimodule DC-DC Converters for Ultrafast Electric Vehicle Chargers", authored by Mena ElMenshawy and Ahmed Massoud, introduces a hybrid converter configuration, based on multimodule dual-active bridge topology for the ultrafast charging of electric vehicles [9]. Finally, the paper authored by Gianluca Brando, Efstratios Chatzinikolaou, Dan Rogers and Ivan Spina, focuses on an analytical investigation of electrochemical cell power losses in modular multilevel converters and their dependence on the injected common mode voltage. The development of an optimal common mode voltage injection law allows us to minimize cell power losses under balanced operating conditions [10].

3. Future Works

Despite the closure of this special issue, a thorough investigation on the issues related to design and control of power converters of electric machines, renewable energy systems, and transportation is expected in the near future. In fact, the achievement of a more electrical energy-based world poses ongoing challenges to the research community.

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