applied sciences

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Editorial

10th Anniversary of Applied Sciences: Invited Papers in Electrical, Electronics and Communications Engineering Section

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Applied Sciences has reached a remarkable milestone by publishing its 10th volume in 2020. This milestone is therefore being celebrated by the Electrical, Electronics, and Communications Engineering section with a dedicated Special Issue that consists of 13 original research papers featuring important and recent developments or achievements around relevant topics in the section, with a special emphasis on emerging techniques or applications.

Four of the papers featured in this Special Issue addressed important issues related renewable energy sources' injection into the grid. In [1], Faraji et al. proposed the optimal scheduling and operation of a prosumer with renewable energy sources and two types of energy storage systems, namely a stationary battery and a plug-in electric vehicle. Due to the intermittent nature of renewable energy sources and their dependence on weather conditions, a weather prediction module was introduced into the energy management system using a feedforward artificial neural network. In [2], Shakerighadi et al. addressed the issue of power grid security with the high penetration of wind turbines. In fact, they developed step-by-step guidelines for the security assessment of power electronics-based power grids. These guidelines include static, dynamic, and transient security assessments. The issue of grid-connected converters' resiliency to unbalanced and distorted grids is studied in [3] by Ahmed et al. In this paper, a comparative analysis of three recently proposed adaptive observer-based grid synchronization techniques is presented for frequency estimation and sequence extraction. The considered techniques are global adaptive observer, gain normalized adaptive observer, and second-order generalized integrator type adaptive observer. The comparative experimental results presented in this paper are expected to provide insights into the selection of adaptive observer-based sequence extraction techniques for power and energy applications. To ensure high-quality grid-injected currents that comply with the stringent harmonic standard, the harmonics around the switching frequency must be effectively filtered. In this context, LCL-type filters have been found to be interesting. However, they introduce a resonant peak into the system, which can cause an output resonance problem. In this context, appropriate damping should be considered, either by passive or active methods, to ensure the stable and reliable operation of the inverter system. These issues were investigated in [4] by Yoon et al. who evaluated the stability and performance of current controllers with harmonic compensators for an LCL-filtered grid-connected inverter under distorted weak grid conditions. The investigations achieved results which showed that a state feedback controller is more flexible in controlling an inverter with an LCL filter in a distorted grid environment with uncertain grid impedance. In addition, when the grid is subject to large impedance variation, choosing a high resonant frequency for the LCL filter is preferable, as it greatly extends the stability margin of the inverter system under unexpectedly low grid conditions.

Another specific area, which is represented by three papers featured in this Special Issue is electrical machines and drives. In [5], Pires et al. considered the sensitive issue of the reliability of switched reluctance motor drives. In this context, a fault-tolerant power converter and a related fault diagnosis method have been proposed. The converter's

Citation: Benbouzid, M. 10th Anniversary of Applied Sciences: Invited Papers in Electrical, Electronics and Communications Engineering Section. *Appl. Sci.* **2023**, *13*, 300. https://doi.org/10.3390/app13010300

Received: 15 December 2022
Accepted: 25 December 2022
Published: 26 December 2022

topology does not require extra power semiconductors and only uses solid-state relays to connect the faulty legs to the other healthy legs in order to replace and isolate the faulty devices. The developed diagnosis method is based on the entropy theory. It allows for identification of the faulty leg as well as the failure mode of the power device. The challenges of sensorless speed and displacement control are addressed by Rao et al. in [6]. These challenges were specifically studied for a bearingless switched reluctance motor that required both robust and stable operation. In this context, a dynamic sliding mode controller has been proposed to tackle the robustness issue, while a sliding mode observer has been adopted to cope with speed and displacement estimations. It has therefore been demonstrated that the switched reluctance motor can promptly start from any arbitrary initial position without any initial jerk. The speed and displacement measurements were consistently accurate at higher speeds. In [7], Fleurot et al. proposed analytical models to determine the electromagnetic performance of segmented permanent magnet synchronous machines (without active parts in the stator or the rotor). These unconventional but innovative machines can be used in rim-driven tidal stream turbines or in marine propellers. According to these targeted applications, the proposed models have been adapted for machines with large air gap widths, large diameters, a high number of poles, and large angular gaps. It has been shown that these models allow fast and accurate evaluation of performance and can be used in the systematic design process.

Alkaline water electrolysis is also featured in this Special Issue with the contribution of one paper. Indeed, in [8], Bideau et al. proposed a strategy to find the best cell design and operating conditions of a diphasic electrochemical cell using an evolutionary algorithm. More specifically, a meta-model was developed to simplify the physics of the void fraction and a genetic algorithm was used to find the optimal design.

Global positioning, antennas, and electronics are featured in this Special Issue in three papers. In [9], Tan et al. addressed the issue of poor-quality signals that negatively impact position accuracy in the context of global navigation satellite systems (GNSSs). The improvement of single point positioning accuracy has been proposed by using multi-GNSS data fusion using an extended Kalman filter combined with iterative reweighted least squares and receiver autonomous integrity monitoring. This robust extended Kalman filter method has been applied along with the robust combination of GPS, Galileo, and GLONASS data from ABMF (at the GNSS reception station managed by Météo France in Guadeloupe). It significantly improves the position accuracy by about 84% compared to the non-robust data combination. Although the robust extended Kalman filter has demonstrated improvements in position accuracy, its outputs might contain errors that are difficult to estimate. For improvement purposes, the authors proposed a long short-term memory method to predetermine the produced error. The fundamental task of designing antennas suitable for generating highly directive electromagnetic signals was studied by Chiolerio et al. in [10]. The motivation of this study was the design of special antennas able to convey electromagnetic signals along patterns characterized by extremely high directivity, which ameliorated in comparison to existing commercial solutions. For this purpose, an extension of the electrodynamics equations was taken into account, where exact solitonic-type solutions were admitted. The achieved results put forward the design of biconic-type antennas that have specific properties. Cones, supplied with an oscillating source, are embedded in a dielectric material of suitable shape to drive the signal in the proper direction. In this context, the targeted applications are point-to-point communications or wireless power transmission. In [11], Ulansky et al. addressed the issue of current–voltage characteristics' slope control in negative differential resistance (NDR)-based electronic devices. These devices are widely used in electronic and radio engineering systems of the broadest use. In this context, new two-terminal NDR circuits have been proposed based on a combination of a field-effect transistor and multiple-output cascode, Wilson, and improved Wilson bipolar junction transistor current mirrors. These circuits allow the slope of the current–voltage characteristics in the NDR region to be controlled by changing the number of mirrored currents, thus allowing the peak to valley current ratio to be set to

any desired value. Considering the importance and vulnerability of airborne equipment, high-altitude electromagnetic pulse (HEMP) protection of airborne equipment is necessary. In this context, Hu et al. in [12] studied the characteristics of the HEMP radiation field on a typical transport aircraft using the frequency sweep method. The authors typically calculated and analyzed the electric field strength distributions of three layers (top, inner, and bottom layers). The achieved results have shown that the HEMP-induced field is impacted by the aircraft body. It varies greatly at different positions. Such a study can provide guidance and insights into the design of aircraft HEMP protection.

In the final paper of this Special Issue [13], Muñoz et al. addressed the important topic of energy harvesting by studying the performance of different piezoelectric-based transducers. In this context, a prototype has been proposed for the generation of energy from people's footsteps on different platforms based on macro-fiber composites and unimorph lead zirconate titanate transducers.

The papers invited to contribute to this Special Issue are worthy examples of the breadth and scope of the topics published in the Electrical, Electronics, and Communications Engineering section of the Applied Sciences journal.

Conflicts of Interest: The authors declare no conflict of interest.

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