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Editorial

Editorial for the Special Issue on Electronics for Sensors II

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Sensor signals are physical, chemical, or biological quantities that evolve over time. Sensor systems contain one or more sensors and an electronic circuit (named an interface or read-out) that converts the input signals from the sensor into output signals suitable for correct reading and quantification of physical, chemical, or biological parameters (or variations thereupon) in an electric/electronic form [1].

The suitable design of these sensor interfaces has always played a fundamental role in improving the characteristics of the whole sensor system, so it is very important to pay the utmost attention to this task, especially in light of the problems related to technology scaling and different technology integrations. Moreover, research on circuits and systems for interfacing sensors (in particular, resistive and capacitive sensors [2–4]) has become, and will surely remain, a highly prioritized, widespread, and lively topic. This is because any real-world application has inevitably to sense and manipulate some kind of magnitude.

Modern interfaces must satisfy parameters strictly related to the magnitude under evaluation, such as sensitivity and resolution, in addition to fulfilling new constraints from the particular macro-system into which the interface is embedded, e.g., low power consumption and low cost. To make this even more challenging, with the first interfacing stage typically analog, it gains few benefits from technology scaling in terms of chip area reduction [5] and power consumption, whereas it typically has to contend with parasitic elements of the same magnitude as the sensing element.

This Special Issue gathers a number of works that present new possible solutions regarding electronics for sensors, both related to the analog processing stage and the digital processing section, in addition to modern applications. It contains a selection of papers coming from many different research groups in different countries.

In [6], Y. C. Lee and V. A. Hoang developed a wireless sensor system (WSS) for real-time monitoring of shaft positioning in marine applications. Specifically, the WSS is battery free, since it embeds an inductive wireless power transfer module that supplies power to the sensor. The authors aim to use the proposed sensor in smart/automated ships [7–11].

In [12], C. Qin et al. introduced an energy-efficient BJT-based temperature sensor. In the proposed manuscript, the authors show both the analog front-end, as well as the Σ/Δ ADC converter employed to provide a digital output for the user. The temperature sensor contains a cascoded floating inverter as an integrating amplifier rather than simply as a transconductance amplifier, allowing to reduce power consumption. Additionally, to improve read-out accuracy, the authors designed the sensor to make use of compensation techniques such as dynamic element matching and chopping [13–15].

In [16], R. Riem, J. Raman, and P. Rombouts proposed a high bandwidth, low-offset Hall plate read-out system with a randomized four-phase spinning-current scheme. In the manuscript, they demonstrate how it is possible to reduce inessential components to minimize the offset parameter. In conjunction with this, the authors designed the system to embed spread-spectrum mode offset-reduction loops, enabling a very large notch-free bandwidth to be maintained and further reducing error sources [17–19].

In [20], S. Pettinato et Al. designed an electronic sensing system to accurately measure very narrow pulsed-current signals. Specifically, the authors described how it is possible

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to utilize a synchronous demodulation technique to increase improved performances in terms of signal-to-noise ratio compared to conventional free-running systems [21–23].

In [24], L. Safari et Al. proposed a review manuscript about second generation voltage conveyor (VCII)-based analog electronic interfaces for bioelectrical signals. In the manuscript, the authors reported the working principles of the VCII and a wide number of applications available from the literature in the fields of current-mode Wheatstone bridges (CMWBs), silicon photomultipliers, ultrasonic sensors, differential capacitive sensors and ECG/EEG applications [25–29].

Interest in wearable sensors is on the rise [30,31], and several interesting papers have been presented recently. In [32], D. Asiain et Al. introduced a multi-sensor wearable headband, a new physiological signal acquisition multi-sensory platform for emotion identification (MsWH). The proposed system offers several sensors to measure human physiological signals, such as skin temperature, blood oxygen saturation, heart rate (and its variation), movement/position of the user, and electrodermal activity/bioimpedance, together with a camera that can track human facial movements, so the viewing area remains constant. The whole system design is covered in this work, starting from the conditioning electronics to the microprocessor unit and data sending. In [33], H. Zhang et Al. proposed a method to reduce the measurement error in sensor arrays for wearable electronics based on a dynamic zero current technique that showed fewer errors than other methods, such as the zero potential technique [34,35].

Digital sensor acquisition and data processing is also a pervasive field, as digital electronics is spreading within sensor systems, increasing the possibilities and data analysis [36,37]. In [38], R. Esteve Bosch et Al. proposed a new data compression algorithm in an FPGA-based data acquisition system for the NEXT-100 collaboration detectors. The system is equipped with a large number of Photomultiplier Tubes (PMTs) and Silicon Photomultipliers (SiPM) for energy measurement, with an expected data throughput of over 900 MB/s. As for this huge data rate, the proposed data compression algorithm reduces the throughput and improves the overall functionality. In [39], A. Tsukahara et Al. presented a processor implemented in FPGA hardware to perform Capacitive-coupling Impedance Spectroscopy (CIS) that can provide the full acquisition and processing sequence in a few milliseconds.

Finally, biosensors and electrochemical sensors are strongly considered for plant monitoring and energy harvesting in the emerging agriculture 4.0 field, which is establishing the basis for future farming technology [40–42]. In [43], D. Wang et Al. reported a study with the aim of assessing the usage of electrochemical sensors for the identification of different plant species, resulting in a high level of effectiveness that is increased if different pattern recognition techniques are used.

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