Guest Editorial Special Issue on Magnetic Sensing Systems for Biomedical Application

Magnetic field sensors have been of great interest due to their possible applications in biomedical application over the past decade. Miniaturizing magnetic based sensing systems for biological and chemical assays offer a prospect to modernize the large laboratory instruments into easy-to-use lab-on-a-chip platforms, bringing down the cost, size, and sample use by orders of magnitude. Such sensing systems need to provide fast response, high-sensitivity, and low-cost to be considered viable products. These devices can serve as high-performance diagnostic platforms in a wide range of applications from home healthcare over epidemic disease control and environmental monitoring to biothreat detection.

Magnetic sensors provide several advantages over electrochemical or optical sensors since they intrinsically provide the potential for lower-cost and smaller form-factor systems by eliminating the need for any optical components in the setup. In addition, magnetic particles have a stable signal without problems such as photobleaching or quenching which is encountered in optical sensors. This can be used to obtain a better signal-to-noise ratio by long times of signal integration. Furthermore, most biological samples are diamagnetic and therefore produce a low background signal, rendering magnetic sensing of biological samples a robust technique.

From recent growth in developing magnetic sensors and systems for portable, implantable and wearable technologies, it is clear that the topic has drawn significant attention, signaling the promising interest and need for a focused platform, which compiles knowledge on all relevant aspects of magnetic biosensing including the device, circuit and system level. The state-of-the-art researches presented in this Special Issue provides a window for interested readers to see the enormous potential of the cutting-edge magnetic sensing systems.

The first theme of this Special Issue deals with evanescent field-modulated magnetic immune sensor based on magnetic fluid and polymer optical fiber. In this study, Azad *et al.* proposed a highly sensitive and simple design of intensity based magnetic field sensor and experimentally demonstrated with a safe data transformation by employing optical fiber as a magnetic resonance compatible sensor.

The next topic of this Special Issue combines wearable magnetic sensors with radar for multimodal remote health monitoring. In this study, Li *et al.* implemented a support vector machine with a quadratic kernel, and an artificial neural network with one and multiple hidden layers to analyze and verify the validation of fusion method for different classifiers. Their results demonstrated the potential of multi-sensory fusion in accurate human activity recognition for assisted living.

The third focus of this Special Issue work through scaling characteristics of the magnetization increments of functionalized nanoparticles determined using a vibrating sample magnetometer for liquid magnetic immunoassays. In this study, Liao *et al.* investigated an assay for C-reactive protein using magnetization in magnetic fields. Their results show that magnetization increased when the concentration of C-reactive protein increased. Their platform is robust, easy to use, and can be applied to assays for various biomolecules for tumour markers, viruses, and proteins.

The fourth subject of this Special Issue is concerning design and implementation of low-cost, high-sensitivity point-of-care diagnostics using voltage-controlled oscillators-based electron spin resonance on-a-chip detectors. In this work, Schlecker *et al.* reported an architecture for electron spin resonance detection for future use in portable point-of-care spectrometers. The proposed architecture is centered around an ASIC containing an electron spin resonance detector with two distinct tuning ports with largely different voltage-controlled oscillator gains to enable wide frequency sweeps and small-signal frequency modulations.

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Digital Object Identifier 10.1109/JSEN.2019.2929887