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EDITORIAL

Special issue on chipless technologies

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The "chipless" concept appeared during the 1940s and immediately pushed two relevant applications. The most well-known is identification friend or foe (IFF) and the second is a piece of spying history: the wireless microphone developed by L. Theremin and used as a spying device for many years. Nowadays, the chipless technology is increasingly developed because it exhibits huge advantages in terms of cost, reliability, and robustness. In addition, chipless devices are essentially passive and battery-less, and therefore, are very relevant to a large variety of applications in several domains, among them traceability, identification, labeling, transportation, ticketing, banknotes, sensing, and ultimately, Internet Of Things (IoT). Despite these unique features, the chipless technology is still in its infancy and much research and synergies from technology developers, venture capitalists, and end-users are needed to turn chipless devices into real products for everyday life as was done for optical barcodes during 1970s–90s.

This special issue covers some of the unique progresses made in the chipless technology in the most recent years. The aim is to report new concepts and evolutions in the chipless radio-frequency identification (RFID) and sensor technologies. The special issue is organized in two themes: the first two papers report new information coding theories for chipless technology, and the last two papers focus on sensing capability of chipless devices.

The first paper introduces an electromagnetic (EM) barcode imaging technique at 60 GHz band. Two fully printed chipless RFID tags are reported. Synthetic aperture radar (SAR) approach is applied to construct the EM image at 60 GHz so that the tag's data content can be read. The achieved data encoding capacity is 2 bits/cm^2, which suggests huge potentials for low-cost item tagging in commercial settings.

The second paper reports the EM signature of alphabets to be considered as RF Elementary Particle (REP) to form the code of a chipless RFID tag. Both Latin and Arabic standard fonts are considered. It is demonstrated that combining different polarizations allow identification of letters without ambiguity. Differences between Arabic and Latin alphabets are discussed and the case of Arabic letter with punctuation is considered in more detail.

The third paper reports a chipless RFID crack sensor for electronic sealing applications. The work is based on the harmonic radar principle. A Schottky diode integrated into the tag performs frequency multiplication. The characterizing blocks of the sensor are fabricated on cellulose substrate (i.e. regular photographic paper) being compliant with low cost and green technologies. Read-ranges beyond a meter are demonstrated.

The fourth paper reviews time domain reflectrometry (TDR) chipless RFID tags and sensors. The paper reports the chipless tags which use both TDR concepts for data encoding and ultra-wideband-impulse radio as a time-domain measurement technique. The last section of the paper reports time-domain reading and a brief comparison with other methods in the field of the most advanced technology developments in the chipless RFID technology.

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