editorial

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2020 is a Year Full of Expectation!

Dear Members,

I wish you a very warm welcome to 2020 and to this year's first issue of *Instrumentation & Measurement Magazine*.

On our side, we are glad to announce that the *Magazine* will move from six to nine issues per year beginning in 2020.

Basic metrology, new methodologies, sensors and instrumentation and applications in the framework of instrumentation and measurement are the main topics the *Magazine* is focusing on. As always, our mission is to offer our readership overviews of hot subjects in instrumentation and measurement by properly highlighting open problems and challenges.

The main goal of this issue of the *Magazine*, dedicated to "Theoretical Hints," is to focus on the challenging topic of "nonlinear systems" and their contextualization in the instrumentation and measurement framework.

Now, the question would be: Is "linear" better than "nonlinear?" This is a difficult question, which probably does not have a unique answer. Sometimes a "linear trend" is considered better than a "nonlinear trend," since it could be more convenient and easier to deal with a linear model, so for practical reasons. Linear systems are very well known and their behavior can be always well predicted.

However, I would say that sometimes nonlinear systems could be really surprising. In particular, nonlinear measurement devices are very interesting, since their intrinsic nonlinearity could be exploited to boost performance in sensing. Examples of real devices working in the nonlinear regime are fluxgate magnetometers that exploit the nonlinearity of a ferromagnetic core to improve the sensor responsivity; E-Field sensors that are based on the use of nonlinear ferroelectric materials; piezoelectric transducers; Squids and many others… Some of these devices can be used in single and coupled ring configurations, sharing complexity as well as outstanding performances.

It is worth noticing that the behavior of many natural systems is ruled by nonlinear dynamics. Let's think about neurons, as well as many sensorial functions of living organism. Fishes, as an example, adopt a threshold mechanism to detect weak targets of interest. Other nonlinear systems are able to perfectly perform in the presence of under-threshold deterministic inputs, exploiting the Stochastic Resonance phenomenon which is activated by the presence of noise.

I would like to thank all of the researchers who contributed to this issue of the *Magazine* by providing different perspectives and addressing different subjects, to share the common objective of demonstrating how "nonlinear" could be convenient in the field of instrumentation and measurement.

Have a nice time reading!