Editorial

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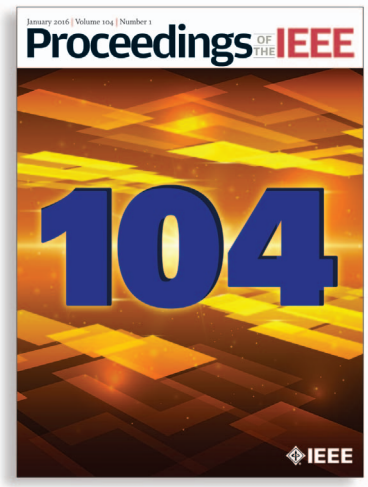
"To have a great idea, have a lot of them"
—Thomas Edison



The year 2016 is almost here! We are pleased to announce the exciting topics we will be covering in our special issues led by distinguished editors with contributions from world renowned authors next year. Before going into detail we would like to share with you some of the recent updates and new initiatives for the Proceedings of the IEEE.

We spent a lot of time in the last three years soliciting ideas on how to better engage you, our readers. Our reader surveys provided us with enough interesting ideas to consider. If you were invited to take our Reader Survey and made suggestions, we thank you personally for your time and effort. Like Edison said, it is important to have a lot of ideas to find the few that are really great. Unfortunately, even if we would like to, it would be impossible to implement each and every one of your suggestions, so we chose a few great ones for further consideration. In addition to the Reader Survey, we got some excellent feedback from the IEEE Publication Services and Products Board (PSPB) during the five year review of the Proceedings in November 2014.

We strongly believe in "striking while the iron is hot," so we have already started implementing a few initiatives in 2015 and will be working on a few others in the coming months/years.

I. SOCIAL MEDIA

We are pleased to announce that the Proceedings of the IEEE now has a Social Media presence! We launched our Facebook and LinkedIn pages in September 2015. We invite you to come join us online to stay on top of the latest news from the Proceedings. We will be highlighting our content and much more on our social media platforms and welcome your active participation.

II. DISCUSSION FORUM

We are currently working on a new idea suggested in the Reader Survey and further endorsed by the PSPB. For a few of our 2015 issues, we will be inviting you to participate in a discussion forum which will be based on the content of a specific special issue. We plan to pick one or two issues from our 2015 lineup. The guest editors and authors of the special issue will be invited to respond to your questions, and the responses will be made available to you, our readers. Since the project is still in its early phase, we expect there to be some growing pains. We will share more information in the coming months; please lookout for announcements about which issues we will be including in our discussion forum initiative. We hope that the discussion forums provide our readers with a useful way to interact with our authors and editors and get more value out of our content.

A couple other ideas that we plan to work on in 2016 include the possibility to offer online web tutorials for some of our special issues and to solicit more predictive papers.

III. UPCOMING SPECIAL ISSUES

Now let us take a closer look at what we have planned for Volume 104 in 2016.

During 2016, we will be publishing a total of 12 issues on topics ranging from big data and structural health monitoring, to plasmonics and biomedical signal processing.

A. Big Data—Parts I and II

The current surge of public and engineering interest in Big Data has its roots in many technological and social developments. Technologies for sensing data of many types

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(via satellite, video, medical device, network monitoring) yield massive flows of data that can now be captured and stored on devices with massive capacity. In the public realm, the Internet led to a switch from text-based person-to-person communications to sharing of more data-heavy items, such as images, video, and interactive maps among groups. Users of smartphones can upload, in a matter of seconds, high-quality photos and videos to social networks, via WiFi, 3-G, and 4-G networks. Large data sets are generated through bidirectional interactions, both people/-machine interactions, and machine/machine interactions.

From a scientific point of view, many of the interesting issues in Big Data lie at the intersection of computer science, statistics, linear algebra, optimization, and cognitive dynamic systems. The fundamental problem of extracting meaning from data, and turning that meaning into good decisions, draws on all these areas, with many variations depending on the type of data and the type of knowledge required. Part I of this special issue will focus mainly on the analytical aspects of Big Data. Part II will focus on systems and applications.

B. Microgrids and Energy-Sustainable Buildings

This special issue focuses on recent research in the use of electric energy in commercial, residential, and other types of buildings and facilities. The articles in this issue will aim to cover a range of topics including a comparative evaluation of opportunities for improved efficiency among load classes in the buildings, the role of smart microgrids for enabling demand-side response, utility-side-of-the-meter electricity markets, customer-side-of-the-meter electricity markets, the role of alternative energy sources, and power grid informatics. The past few years have seen an explosive growth of interest in new opportunities for improved operation of electric power grids.

C. Biomedical Signal Processing

The significance of biomedical signal processing lies in its highly cross-disciplinary approach, given its origins in traditional signal processing frameworks on one hand, and frameworks with strong roots in physics, adopting mathematical concepts on the other hand. In recent years, there has been a tremendous amount of success in this very cross-disciplinary field. For example, multivariate signal processing techniques have been developed to study the dynamics of brain processes in unprecedented detail. Recently, the mapping of cardiac signals has enabled us to pinpoint the pivot of atrial fibrillation, the most common cardiac rhythm disorder, to target radio-frequency ablation. Advances in signal processing have also enabled brain interfaces for the control of artificial limbs and prosthetic devices and bionic blood pressure controllers.

This special issue will cover topics that combine interdisciplinary methods from engineering, biophysics, computer science, integrative physiology, medicine, and neuroscience in the exciting field of biomedical signal processing. It will emphasize three areas where biomedical signal processing is currently advancing: tackling the complexity of physiological processes in the human body, detecting early signs of disease, and diagnosing and treatment of pathological conditions.

D. Industrial Cyber–Physical Systems

In recent years, we have been witnessing rapid changes in the industrial environment, mainly driven by business and societal needs toward mass and extreme customization. This is supported by new disruptive advances both on software and hardware side, as well as the cross fertilization of concepts and the amalgamation of information, communication, and control-technology-driven approaches in traditional industrial automation and control systems. In this industrial context, cyber–physical systems (CPSs) combine progress achieved by applying large distributed computing systems on product and production system planning, engineering, and operation, with the power of digital data produced during manufacturing processes and also collected by devices embedded into the products. All this confirms that a new generation of "smart systems" are embedded into the industrial environment. The technological, economic, and social impacts of these developments are so enormous that the whole process is labeled as the 4th Industrial Revolution.

This special issue will cover two major topics in the area of CPSs: 1) CPS as the innovation backbone for manufacturing and industrial production; and 2) identification of ongoing strategic CPS research, development, and innovation activities in industry and their implications in the structure and the behavioral policies of a digital society. The papers will be grouped under four major sections, namely, industrial cyber–physical system (ICPS) architectures and standards, ICPS interoperability, ICPS engineering methods and tools, and applications of ICPS.

E. Structural Health Monitoring

The term structural health monitoring (SHM) generally refers to the process of detecting structural damage and estimating future system performance for all types of engineering structures. Regardless of how it is implemented, SHM is intended to allow owners, operators, and managers of engineering structures to make more informed and efficient decisions when managing their assets. The damage detection process involves the observation of a system over time using periodically acquired response measurements, the extraction of damage-sensitive features from these measurements, and an analysis of these features to determine the current state of system health.

Even though SHM has been under development for a number of decades, this special issue is timely because many new technologies are now emerging that may finally allow SHM to be widely adopted in practical settings. The issue will provide a comprehensive review of the current technological advances within this multidisciplinary field.

Papers will be grouped under four general areas as follows: 1) "Sensing Technologies," which will highlight emerging sensing and data acquisition technologies; 2) "Damage Diagnostics," focusing on analytical frameworks for diagnosis of damage; 3) "Prognostics and Decision Support," looking at the quantification of the reliability of structures in their current state, assessing the risks associated with continued use, and calculating the monetary and environmental costs of future retrofit actions will be selected; and 4) "Implementation," which will show the relative maturity of SHM technology as it is applied to different types of engineered systems in the domains of aerospace, civil, electrical, and mechanical engineering.

F. Vulnerabilities, Threats, and Authentication in Satellite-Based Navigation Systems

Ubiquitous use of Global Navigation Satellite Systems (GNSSs) including GPS in civilian, security, and defense applications and the growing dependence on them within critical infrastructure have created a vulnerability resulting from intentional or unintentional interference sources. GNSS receivers are currently used in a variety of critical infrastructural services, including communications, power grid distribution, finance, emergency services, aviation, active sensing, high-precision surveying, and a number of other critical industries.

Accurate signal parameter estimation is crucial for position–navigation–timing (PNT) for GNSS applications. However, achieving this level of accuracy can be compromised by various interfering sources, which reduces the satellite signals detection and estimation accuracy. The interference problem is compounded by the fact that the desired GNSS signal is extremely weak with highly negative decibel signal-to-noise-and-interference ratio. There also are several ways to deliberately interfere with GNSS signals. Deliberate interference can be the result of spoofing and meaconing, or simply jamming. Devising effective antijam techniques has thus become a priority in GNSS communities.

This special issue focuses on analyzing the effects of interfering signals at different processing levels of GNSS receivers and the state-of-the-art solutions to counteract interference and malicious jammers. The list of topics will include classification, detection, and localization of interferences; signal authenticity verification; hardware-specific antenna and frontend design for interference mitigations; and signal and antenna array processing techniques for advanced GNSS receiver designs where jammer excisions are performed in time, frequency, space, or joint-variable domains.

G. Spintronics

Spintronics utilizes the spin degree of freedom of electrons. It is the study of the intrinsic spin of the electron and its associated magnetic moment, in addition to its electronic charge. Essentially, the electronic spin can be detected as a magnetic field having one of two orientations known as "down" or "up." By doing so, an additional two binary states are introduced to the conventional low and high logic values represented by simple currents. With the addition of the spin state to the mix, a bit can have four possible states.

The proposed special issue covers recent developments in spintronics, where the spin degree of freedom of electrons is used to harness otherwise inaccessible capabilities. In the past decade there has been rapid growth in this field which has continued to enhance both the role and the potential of spintronics. Areas of growth include information storage, computing, communication, energy harvesting, and highly sensitive sensors. This issue will cover topics including sensors for magnetic recording, which provide the basis of cloud systems, nonvolatile memories, the low power logic circuits needed for the coming Internet-of-Things, RF generation and communications, "spin-caloritronics," a new path to utilize the wasted heat energy, and topics involving technology that is in early stages of development such as voltage control of magnetism, spin-based quantum computing and sensing, and bioinspired computing.

H. Phased Arrays Technologies

Modern array technology for electronic beam steering requires the integration of diverse disciplines throughout the electrical engineering community, covering VLSI design and fabrication, RF/microwave engineering, data networking, testing from dc to microwave/millimeter waves, active device physics and materials, power distribution, and computer science. New digital approaches in array architectures reflect a dramatic departure from the traditional RF/microwave approaches of the past, bringing demanding challenges to the many electrical engineering disciplines. As the presence of array technologies builds throughout both the military and commercial worlds, new opportunities will arise to apply electrical engineering skills in what will surely be a growth area.

While phased arrays have mainly been associated with military radar systems, new advancements in electronic device and microcircuit technology, pushed by Moore's Law, now make the implementation of "digital at every element" (otherwise known as "elemental digital") arrays both a practical and economic reality where only a few years ago such a concept would have been outright rejected by array experts. Thanks to a new digital push, phased arrays are finding increasing use and future promise for a variety of applications, both military and civilian, covering communications, weather radar, sense and avoid, electronic warfare, medicine, and other uses. This special issue explores this new revolution for phased arrays.

I. Plasmonics

Surface plasmon photonics—"plasmonics"—is a rapidly growing and evolving field on the cutting edge of

photonics. The field is concerned with the interaction of light on metallic structures, from terahertz to ultraviolet wavelengths, and is driven by interest in applications such as biosensors for healthcare, light concentration for solar energy, devices for telecommunications, and near-field instrumentation for performing state-of-the-art research.

Surface plasmons are coupled electromagnetic/charge-density waves that propagate along the interface between a metal and a dielectric at optical wavelengths. Metallic structures supporting surface plasmons include films, stripes, grooves, particles, and holes. Plasmonics is disrupting the field due to the peculiar attributes of these waves, such as an energy asymptote in its dispersion, the divergence of optical density of states, high field enhancement, deep subwavelength confinement and high surface sensitivity, which create tremendous opportunities for applications across several areas of interest.

This special issue will survey the broad landscape of applications enabled by plasmonics. Tutorial papers on the fundamentals of surface plasmons and on localized surface plasmons will ease the reader into the rest of the issue which will address the following topics: 1) plasmonic waveguides and passive integrated circuits; 2) plasmonic nanoantennas; 3) plasmonic metamaterials and metasurfaces; 4) plasmonic apertures; 5) dynamic plasmonic devices; 6) plasmonic photodetectors, photovoltaics and hot-electron devices; 7) plasmonic amplifiers and oscillators (spasers); 8) biosensors for healthcare, environmental monitoring, and drug discovery; 9) nonlinear plasmonics; 10) quantum plasmonics and nonlocal effects; and 11) graphene plasmonics.

J. Principles and Applications of Science of Information

Shannon laid the foundations of information theory by precisely modeling, formulating, and analyzing the problems of information communication and by providing the mathematical formulas needed to process these problems. In today's world, however, information is not just communicated, but it is also acquired, curated, organized, aggregated, analyzed, valued, secured, and used in other ways. This has led to a lot of new research focused on developing rigorous principles guiding all aspects of information, integrating elements of space, time, structure, semantics, and context, when transitioning from data to information to knowledge. A new paradigm in the quantitative understanding of the representation, communication, and processing of information in diverse social, scientific, and engineering disciplines has thus been introduced. This new area uses a variety of tools from information theory, computational sciences, statistics, and beyond to advance the science of information beyond Shannon's original goal of reliably reproducing data, with critical contributions to various application areas.

The proposed special issue covers recent advances in the core principles underlying the science of information and its applications to diverse fields, including economics, life sciences, communication systems, and knowledge extraction/management (also colloquially referred to as Big Data). These developments span theoretical foundations (modeling and analysis), algorithms, and detailed application studies.

K. Advanced Technologies for Brain Initiatives

This special issue will highlight the development of novel electronic and photonic devices and techniques for experimental probing, neural simulation studies, and the design and development of human–machine interface systems, artificial vision sensors, and neural prosthesis, which have significantly restored and enhanced the impaired sensory functions and motor systems. Furthermore, these recent technological advances will be highlighted by focusing on advanced technologies that monitor and control brain activities to treat neurological diseases, including Alzheimer's, epilepsy, depression, etc., from the molecular to systemic levels.

IV. REGULAR PAPERS

During 2016, we will continue to publish invited and contributed papers in the journal. We are pleased to bring to you tutorial and survey papers, which will provide insight into a broad range of areas and applications.

V. A PEEK AHEAD AT 2017

In addition to what we have planned for 2016, we will be bringing you some exciting coverage in 2017. One of the issues in 2017 will focus on terahertz radio-frequency electronics and system integration. It will provide a comprehensive review of all electronics-based approaches to sensor and communication technology development at terahertz (300 GHz to 10 THz). Current state-of-the-art silicon- and III-V-based semiconductor devices, enabling innovative circuit designs for RF building blocks, packaging, MEMS, terahertz measurement metrology, advanced guided-wave and radiating structures with emphasis on terahertz electronics system and integration, will be covered.

VI. CONCLUSION

We hope that you find our lineup of special issues to be as exciting as we do. We also hope that the journal will continue to provide you with useful information that you can apply in your research and everyday work and will keep you up to date on the latest developments in many different areas of electronics and electrical engineering and computer science. We look forward to hearing from you as we continue to enhance the journal content with new features and welcome you to participate actively in our new endeavors. ■