From the Guest Editor of the Special Issue: Integrated Navigation, Sensing, and Communication for Solving Problems in Society

More than a year ago, the Board of Governors of AESS discussed initiating an IEEE-AESS Ad Hoc committee focusing on future directions and finding the big problems in society now and in the future. IEEE-AESS can and should play a significant role in areas that may contribute to breakthroughs in solving societal problems. I felt honored by the nomination and accepted directly the chair. AESS is THE Society where technology, systems, and applications get much attention, and I received supportive emails from various AESS members.

The committee spent ample time defining and describing areas in which The Aerospace and Electronic Systems Society (AESS) should “pave the way” for future electronic systems utilizing integrated navigation, sensing, and communications. All of these areas (navigation, sensing, and communications) match the ambitions of CONASENSE, the Global Foundation on Communications, Navigation, Sensing and Services, where I am the founder and chairman. The CONASENSE field of interest has laid the basis for this special issue of the AESS Systems Magazine.

We all know that various papers in the IEEE Transactions on Aerospace and Electronic Systems and the IEEE Aerospace and Electronic Systems Magazine explore integrated navigation, sensing, and communications already. Therefore, the focus in this special issue is on future directions with topics and subjects that so far have not received much attention.

In order to illustrate good merging of AESS backgrounds in novel applications, the first feature article by Giulia Cisotto and Silvano Pupolin from Italy gives us a glimpse into the future evolution of information and communication technology (ICT) in advanced navigation, sensing, and communications for the improvement of quality of life (QoL). The second feature article by Simone Di Domenico, and coauthors from Italy, highlights the passive sensing capabilities of WiFi signals for through-the-wall presence detection of humans.

Signal analysis for detecting empty spectrum slots is essential for increasing information extraction in new application areas. For optimum radio spectrum capacity, not just for licensed communications but also for future needs in unlicensed communications with integrated navigation and sensing, we show in the third article by Antoni Ivanov, with coauthors from Bulgaria and Denmark, a practical approach for “real-time adaptive spectrum sensing” as a step to further utilizing unused spectrum without causing unwanted interference for primary users.

Our fourth article, written by He Huang and Wen-Qin Wang from China discusses the topic of efficiency and performance of frequency diverse array (FDA) and orthogonal frequency division multiplexing (OFDM) chirp waveforms. Data analytics is the theme in the fifth article by Todor Cooklev of the USA and coauthors Vladimir Poulkov and Krasimir Tonchev of Bulgaria, with Daniel Bennett of the USA. The authors present their view of the importance of extracting information from observations. Data analytics is useful in a wide variety of processes and applications, such as in decision making, diagnosis, and prediction as part of big data analytics. The sixth feature article, Flexible CubeSat-Based System for Data Broadcasting,” by Jayousi, et al. from Italy proposes the synergistic use of communication, positioning, and monitoring techniques together with exploitation of “SmallSats” to reduce costs and improve service availability.

The challenges involved in providing services to users of mobile wireless communication networks is the focus of the seventh article by Ambuj Kumar and Ramjee Prasad from Denmark. The discussion of place-time variant parameters affecting system behavior, foreseeable technological developments, and findings and propositions for catering to future social network users makes this article a perfect introduction to the two final articles giving “industry insights” on systems, business models and applications.

Our eighth article, coming from Denmark by Maryann Rahimi and Ramjee Prasad, illustrates the importance of CONASENSE as a platform for the implementation of human bond communication that can be used to develop business models and systems for industry and academia. The ninth and final article, also from Denmark and providing industry insights is by Per Valter, Peter Lindgren, and Ramjee Prasad and provides a vision for how artificial intelligence and deep learning may connect persuasive business models and generate business innovation that maybe radical and perhaps disruptive.

Multi-disciplinary integration of navigation, sensing, and communications should teach readers that the mono-disciplinary approach has the past and multi-disciplinary integration is the future. I wish you, as readers, are enthusiastic about the articles you find here and motivated to extract some new knowledge from this special magazine.

This editorial ends with an expression of my gratitude to the many people who made the production of this special issue happen. Of course, I start with authors coming from Italy, Bulgaria, Denmark, USA, China, and The Netherlands, then the AESS Editorial Board, the long lists of reviewers (internal and external); and last, certainly not least, the IEEE professional editor. Knowing all the contributions and seeing the end products of articles ascertain me to say: Thank you all. ♦

—Prof. Dr. Ir. Leo P. Ligthart