DOI: 10.3969/j.issn.1673-5188.2018.01.001
http://kns.cnki.net/kcms/detail/34.1294.TN.20180201.1735.004.html, published online February 1, 2018

Editorial

Wireless Data and Energy Integrated Communication Networks

Guest Editors

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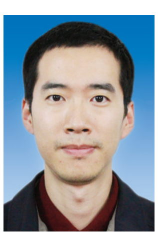

HU Jie received his B.Eng. and M.Sc. degrees from Beijing University of Posts and Telecommunications, China in 2008 and 2011, respectively, and received the Ph.D. degree from the Faculty of Physical Sciences and Engineering, University of Southampton, UK in 2015. Since March 2016, he has been working with the School of Communication and Information Engineering, University of Electronic Science and Technology of China, as an associate professor. His research is being funded by National Natural Science Foundation of China (NSFC). He is also in great partnership with industry, such as ZTE and Huawei. He has a broad range of interests in wireless communication and networking, such as cognitive radio and cognitive networks, mobile social networks, data and energy integrated networks as well as communication and computation convergence.

In the vision of the incoming 5G era, billions of people as well as trillions of machines are expected to be connected by the next generation mobile network. However, functions of massive communication devices have been substantially limited by insufficient power supply. As an efficient solution, dedicated RF signals are capable of carrying well-controlled energy towards the rechargeable devices in order to achieve on-demand energy transfer. Although RF signals are capable of simultaneously carrying both data and energy, diverse requirements of data and energy transfers pose huge challenges in their effective integration. For example, the energy receiver and the data receiver have diverse sensitivity to the received power. The received power as low as −80 dBm is sufficient for recovering contaminated packets, thanks to the-state-of-the-art channel encoding/decoding techniques. However, only when the received power is higher than −20 dBm, the energy reception circuit can be effectively activated for converting a fraction of the energy carried by RF signals to the direct current (DC).

As a result, the integration of wireless data and energy transfer is worth deep exploration. For the implementation of RF-based energy transfer, we have to make the energy receiver adapt to a wider range of the received power, while increasing RF-DC conversion efficiency. The advanced transceiver for integrated data and energy transfer/reception is also required in the physical layer. The coexistence of multiple energy and data transmitters/receivers calls for deep exploration on interference management schemes, medium access control (MAC) algorithms as well as data/energy routing protocols, which systematically yield data and energy integrated communication networks (DEINs).

This special issue aims for educating about, promoting and accelerating technical evolution towards the promising and exciting research area of DEINs.

The most fundamental for the DEIN implementation is hardware design for the energy reception. Therefore, in this special issue, LI Zhenbing et al. design an ultra-low power high-efficiency wireless energy harvester operating in the UHF band. Furthermore, in order to extend the lifetime of the future IoT, an RF energy harvesting tag operating in the UHF band is designed by LI Gang et al. for powering the batteryless IoT devices in the next generation of cellular networks.

The DEIN basic function is to jointly coordinate energy and information flows. GONG Jie et al. thus propose a new paradigm for energy harvesting aided communications. They exploit the correlations of energy and information in cellular networks for guaranteeing abundant energy flows to the areas having intense communication demands.

Relying on the RF signals for conveying both the energy and information imposes great challenges for the system design. LIU Binghong et al. provide a thorough survey on the latest advances of the simultaneous wireless information and power transfer in cellular networks. By further considering security issues in the DEIN, Alexander Okandeji et al. design an optimal beamforming scheme for maximising the secrecy throughput in a full-duplex aided MISO system.

The aforementioned five excellent works have solved a range of key challenges of the integrated data and energy transfer, which includes the hardware implementation issue, the transceiver design in the physical layer, and the resource allocation in the MAC layer. We hope that these pioneering works may stimulate the interests of both the academia and industry in the promising research of DEIN.