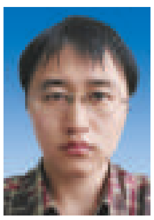
Guest Editorial

GONG Chen, TANG Xuan, and WANG Xiaodong

Optical Wireless Communications

▶ GONG Chen



GONG Chen received the MS degree in electrical engineering from Tsinghua University, China in 2008, and the PhD degree from the Columbia University, USA in 2012. He was a senior systems engineer with Qualcomm Research, Qualcomm Inc., USA from April 2012 to December 2013. He is currently with the Faculty at the University of Science and Technology of China, China. His research interests include wireless communications, optical wireless communications, and signal processing. He has been selected by the Young 1000 Talent Program of the China Government in 2014.

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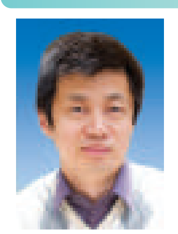
TANG Xuan received the diploma (with hons) in electrical engineering from Nanyang Polytechnic, Singapore in 2007 and the BEng (first class hons) degree in electric and communication engineering from Northumbria University, UK in 2008. She was awarded her PhD degree in free-space optical communications in Optical Communications Research Lab (OCRG) at the same university in 2012. Her research interests include optical communication (outdoor wireless), digital communication and digital signal processing. Between 2012 and 2014, she holds a postdoc position in the Optical Wireless Information Systems Lab, Department of Electronic Engineering, Tsinghua University. Now she is an associate professor in the Quanzhou Institute of Equipment Manufacturing, Haixi Institutes, Chinese Academy of Science.

▶ WANG Xiaodong



WANG Xiaodong received the PhD degree in electrical engineering from Princeton University, USA. He is a professor of Electrical Engineering at Columbia University, USA. His research interests fall in the general areas of computing, signal processing and communications, and he has published extensively in these areas. Among his publications is a book Wireless Communication Systems: Advanced Techniques for Signal Reception (Prentice Hall, 2003). His current research interests include wireless communications, statistical signal processing, and genomic signal processing. He has served as an associate editor for the *IEEE Transactions on Communications*, the *IEEE Transactions on Wireless Communications*, the *IEEE Transactions on Signal Processing*, and the *IEEE Transactions on Information Theory*. He received the 1999 NSF CAREER Award, the 2001 IEEE Communications Society and Information Theory Society Joint Paper Award, and the 2011 IEEE Communication Society Award for Outstanding Paper on New Communication Topics. He is listed as an ISI highly-cited author.

The optical spectrum can serve as a good spectrum resource for wideband wireless communications. The advantages of optical wireless communications (OWC) mainly lie in two aspects: the potential large transmission bandwidth due to the high-frequency carrier, and the communication security due to no radio-frequency radiation. Thus OWC can be applied in the scenarios where the radio silence is required or the radio frequency radiation may cause explosions, for example in the battle field or some special areas in the storehouses.

OWC can be performed in the infrared spectrum, the visible light spectrum, and the ultra-violet spectrum. Daily OWC applications typically cater for the visible light spectrum, which can be achieved using the lighting emitting diode (LED) as the transmitter and the photodiode (PD)/avalanche photodiode (APD) as the receiver. A typical application of the visible light communication (VLC) is the indoor VLC auto-cell network, where the LEDs are mounted on the ceilings, and the user equipments (UEs) include handheld terminals, robots, and intelligent furniture and appliances. Information and control messages are transmitted from the LEDs to the mobile UEs in an indoor VLC intelligent network. Moreover, the visible light spectrum can be adopted for equipment identification. This can be achieved via a camera. The camera emits the light to the optoelectronic tags, and then the tags can be charged and identified.

Against those application requirements, the indoor VLC has attracted significant research interests from both academia and industrial areas. Due to the non-coherent characteristic of the LED-based VLC signals, the intensity-modulation direct-detection (IM/DD) communication signal processing has been adopted. To increase the transmission rate, the orthogonal-frequency division-multiplexing protocols have been tailored for the indoor VLC. To mitigate the interference between the adjacent LEDs, various inter-cell interference cancellation protocols have been adopted, such as the beamforming, fractional-frequency reuse, and soft-frequency reuse. As the LEDs are lighting equipments, the communication should also yield the light constraints, which forms the catalogue of VLC under lighting constraints.

This special issue includes six papers. The first paper, "Subcarrier Intensity Modulated Optical Wireless Communications: A Survey from Communication Theory Perspective" by Julian Cheng et al., provides an overview on the communication theoretic aspects on the subcarrier intensity modulated optical wireless communications. The second paper, "Short-Range Optical Wireless Communications for Indoor and Interconnects Applications" by WANG Ke et al., introduces the short-range OWC for indoor and M2M communications. The third paper, "Optical Transmission Power in a Nonlinear VLC system" by QIAN Hua et al., optimizes the transmission power for the VLC system with nonlinearity. The fourth paper, "Modulation Techniques for Li-Fi" by Mohamed Sufyan Islim and Harald Haas, shows the modulation techniques for Li-Fi communications. The fifth paper, "LDPC Decoding for Signal Dependent Visible Light Communication Channels" by ZHAO Chunming et al., provides the decoding techniques for the indoor VLC with signal-dependent noise.

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