

# Guest Editorial: Smart Transportation Enabled by Wireless Technology

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It is a great pleasure to introduce this Special Section on Smart Transportation Enabled by Wireless Technology. Smart transportation systems are advanced applications which aim to provide innovative services relating to different modes of transport and enable various users' seamless connectivity and improved safety. Compared with the Intelligent Transportation Systems mainly defined in the field of road transport, smart transportation will refer to all modes of transport such as railway, road, air, water, and space, while the field is divided into infrastructure, vehicles, and operations. Recent advances in smart transportation have led to requirements for improvements and enhancements of the used communication systems. To meet the goals with respect to efficiency, safety, and convenience, rail traffic is expected to evolve into a new era with increased interconnection of the infrastructure, trains, travellers, and goods. To realize this vision (one part of the objective of 'Smart, green and integrated transport' supported by Horizon 2020), calls and initiatives, such as 'Shift2Rail', are inviting proposals concerning intelligent rail infrastructure, intelligent mobility management, smart rail services, and a new generation of rail vehicles. Stated specific topics ultimately impose requirements for a seamless high-data rate wireless connectivity in rail traffic. Similar requirements for high-data rate connectivity are emerging in all modes of smart transportation.

The purpose of this Special Section is to provide the academic and industrial communities an excellent venue to present the vision, research, and dedicated efforts in realizing high-data rate connectivity for all modes of smart transportation enabled by wireless technology, with an emphasis on propagation and wireless channel simulation, measurement and modelling, new applications, or other relevant aspects. Nine high-quality contributions to this Special Section have been selected in a strict peer review process supported by reputed international experts. They are divided into three categories: railway communication, vehicular communication, and air-to-ground communication.

## Railway communication

The first paper, 'Channel characterisation in rural railway environment at 28 GHz' by Wang *et al.* analyses the channel characteristics for rural railway at 28 GHz via a measurement-calibrated high-performance cloud-based ray-tracing platform – CloudRT (<http://raytracer.cloud/>).

In 'Experimental characterisation and modelling of intra-car communications inside high-speed trains' by Zhang *et al.*, the intra-car propagation is characterized based on the practical measurement on-board a high-speed train.

'Investigating the effect of handoff algorithms on the performance of CBTC systems using physics-based propagation models' by Sood *et al.* shows that the proposed multiple attribute decision making-based ranking of handoff algorithms is effective in selecting a handoff algorithm that maximises the performance of the considered communication-based train control (CBTC) system.

'Traffic model of machine-type communication for railway signal equipment based on MMPP' by Lin *et al.* analyses the traffic demand of machine-type communication for railway signal equipment.

'Random forests-enabled context detections for long-term evolution network for railway' by Zhang *et al.* presents a context

detection scheme for the railway, which is realised by the ensemble learning approach on measured cellular data.

## Vehicular communication

In 'Iterative greedy user clustering algorithm for D2D-relay in vehicular communication systems' by Wang *et al.*, a new cooperation scheme in cellular vehicular communication called device-to-device-relay clustering is introduced.

'Carrier sense multiple access with collision avoidance-aware connectivity quality of downlink broadcast in vehicular relay networks' by Ma *et al.* investigates the influence of hidden nodes on the relay communication link.

## Air-to-ground communication

In '3D non-stationary geometry-based multi-input-multi-output channel model for UAV-ground communication systems' by Zhu *et al.*, considering three-dimensional (3D) antenna arrays and 3D arbitrary trajectories of the unmanned aerial vehicle (UAV) and mobile terminal, the authors propose a new 3D non-stationary geometry-based stochastic channel model for UAV-ground communication systems.

'Machine-learning-based prediction methods for path loss and delay spread in air-to-ground millimetre-wave channels' by Yang *et al.* proposes machine-learning-based prediction methods for path loss and delay spread in air-to-ground millimetre-wave channels.

## Conclusion

The Guest Editors would like to thank all the authors for their submissions and the reviewers for their high-quality reviews and helpful suggestions to the authors on improving the content and presentation of the papers. We would also like to extend our sincere thanks to Prof. Tim Brown (Editor-in-Chief of *IET Microwaves, Antennas and Propagation*) for providing us the opportunity to organize this Special Section. Finally, the guest editors wish you an enjoyable reading of the contributions to this Special Section.

## Guest Editor Biographies



**Ke Guan** received B.E. degree and Ph.D. degree from Beijing Jiaotong University in 2006 and 2014, respectively. He is an Associate Professor in State Key Laboratory of Rail Traffic Control and Safety and School of Electronic and Information Engineering, Beijing Jiaotong University. In 2015, he has been awarded a Humboldt Research Fellowship for Postdoctoral Researchers. He was the recipient of a 2014 International Union of Radio Science (URSI) Young Scientist Award. His papers received 7 Best Paper Awards. In 2009, he was a visiting scholar in Universidad Politecnica de Madrid, Spain. From 2011 to 2013, he has been a research scholar at the Institut fuer Nachrichtentechnik (IfN) at Technische Universitaet

Braunschweig, Germany. From September 2013 to January 2014, he was invited to conduct joint research in Universidad Politecnica de Madrid, Spain. His current research interests are in the field of measurement and modelling of wireless propagation channels, high-speed railway communications, vehicle-to-x channel characterization, and indoor channel characterization for high-speed short-range systems including future terahertz communication systems.

Dr. Guan has authored/co-authored 2 books and one book chapter, more than 200 journal and conference papers, and one patent. He is the pole leader of EURNEX (European Railway Research Network of Excellence). He is an editor of the IEEE Access, the IET Microwave, Antenna and Propagation, Physical Communication, and a Guest Editor of the IEEE Transactions on Vehicular Technology and IEEE Communications Magazine. He serves as a Publicity Chair in PIMRC 2016, the Publicity Co-chair in ITST 2018, the Track Co-chair in EuCNC, the Session Convener of EuCAP 2015–2019, and a TPC Member for many IEEE conferences, such as Globecom, ICC and VTC. He has been a delegate in 3GPP and a member of the IC1004 and CA15104 initiatives. He is a senior member of IEEE.



**Cheng-Xiang Wang** (S'01-M'05-SM'08-F'17) received the BSc and MEng degrees in Communication and Information Systems from Shandong University, China, in 1997 and 2000, respectively, and the PhD degree in Wireless Communications from Aalborg University, Denmark, in 2004.

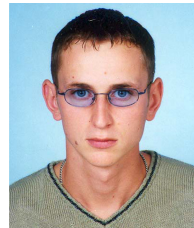
He was a Research Assistant with the Hamburg University of Technology, Hamburg, Germany, from 2000 to 2001, a Research Fellow with the University of Agder, Grimstad, Norway, from 2001 to 2005, and a Visiting Researcher with Siemens AG-Mobile Phones, Munich, Germany, in 2004. He has been with Heriot-Watt University, Edinburgh, U.K., since 2005, where he became a Professor in wireless communications in 2011. In 2018, he joined Southeast University, Nanjing, China, as a Professor. He has co-authored three books, one book chapter, more than 350 journal and conference papers, including over 120 papers published in various IEEE journals/magazines and 23 ESI Highly Cited Papers. He has also delivered 17 invited Keynote Speeches and Talks and 7 tutorials in international conferences. His current research interests include wireless channel measurements/modeling, B5G wireless communication networks, and applying artificial intelligence to wireless communication networks.

Dr. Wang is a Fellow of the IET, an IEEE Communications Society Distinguished Lecturer for 2019 and 2020, and a Highly Cited Researcher recognized by Clarivate Analytics in 2017 and 2018. He was a recipient of ten Best Paper Awards from the IEEE GLOBECOM 2010, IEEE ICCT 2011, ITST 2012, IEEE VTC 2013-Spring, IWCMC 2015, IWCMC 2016, IEEE/CIC ICC 2016, WPMC 2016, and WOCC 2019. He has served as a technical program committee (TPC) member, the TPC chair, and the general chair for over 80 international conferences. He is currently an Executive Editorial Committee (EEC) Member for IEEE Transactions on Wireless Communications. He has served as an Editor for nine international journals including the IEEE Transactions on Wireless Communications from 2007 to 2009, the IEEE Transactions on Vehicular Technology from 2011 to 2017, and the IEEE Transactions on Communications from 2015 to 2017. He was a Guest Editor for the IEEE Journal on Selected Areas in Communications, Special Issue on Vehicular Communications and Networks (Lead Guest Editor), Special Issue on Spectrum and Energy Efficient Design of Wireless Communication Networks, and Special Issue on Airborne Communication Networks. He was also a Guest Editor for the IEEE Transaction on Big Data, Special Issue on Wireless Big Data, and the IEEE Transactions on

Cognitive Communications and Networking, Special Issue on Intelligent Resource Management for 5G and Beyond.



**Cesar Briso** is full professor and director of the Radiocommunications Group at the Technical University of Madrid, SPAIN. He has a 30-year research trajectory, initially focused on the study and design of circuits and systems of high frequency and radar, and in the last 20 years he has focused on the design and development of wireless communications for transportation systems, especially focused on high speed trains, metropolitan railways and Unmanned aerial Vehicles. On 2010 he started working on wideband channel critical communications using 5G. On this topic he has done a relevant research on the last years, making several scientific publications and collaborations with international experts of Europe, China and USA. He has managed 23 national and international research projects and hold two patents on critical communications for transportation systems. Now he is working on the project: 'Next Generation Train Communications Systems', inside the Chinese program 'The Belt and the Road'. He is also author of 40 journal papers and has participated on more than 60 international congress. He has been editor of 6 special issues and 2 books on wireless communications for transportation. He has received 4 National prizes for his research.



**Andrej Hrovat** is with the Department of Communication Systems at the Jožef Stefan Institute since 2004, at present holding the position of a research fellow. He is also an assistant professor at the Jozef Stefan International Postgraduate School. He received B.Sc. and M.Sc. degree in electrical engineering from University of Ljubljana in 2004 and 2008, respectively. He finished his Ph.D. at the Jozef Stefan International Postgraduate School in 2011. His Ph.D. research was in the field of radio signal propagation in special environments. He spends nine months at Faculty of Electrical Engineering, University of Zagreb, as a postdoctoral researcher.

His research and working experience are in the field of telecommunications, focusing on development and performance analysis for fixed and mobile systems including terrestrial, stratospheric and satellite systems, radio channel modelling for fixed and mobile narrowband and broadband radio communication systems and development and installation of the measurement systems and performing the measurements. He works on several projects connected with professional mobile communication systems, 2/3/4G, WiFi and WiMAX technologies, satellite and sensor networks, including several COST actions, Framework Program projects (FP6-IST-SatNex I/II, FP7-REGPOT-AgroSense, FP7-ICT-Crew, FP7-ICT-ABSOLUTE), H2020 projects (H2020-eWINE, H2020-Fed4Fire+, H2020-SAAM), European Space Agency (ESA) projects and numerous national research and applicative projects. He is author or co-author of 26 journal and more than 45 conference papers and several other publications. He is a Co-editor of the Journal of Communications Software and Systems, serves as a Publicity Chair in EuCNC 2018, Track Co-chair in SoftCOM 2017, reviewer for several international journals (IEEE Communications Surveys & Tutorials, EURASIP Journal on Wireless Communications and Networking, Progress In Electromagnetics Research, Journal of Electromagnetic Waves and Applications, IEEE Communications Magazine, IEEE Transactions on Vehicular Technology) and conferences and serves as TPC

member to various international conferences and workshops (EuCAP, VTC, ICECOM, SoftCOM, AsiaSIM).



**Minseok Kim** was born in Seoul, Korea. He received the B.S. degree in Electrical Engineering from Hanyang University, Seoul, Korea, M.E. and D.E. degrees in

Division of Electrical and Computer Engineering, Yokohama National University (YNU), Japan in 1999, 2002 and 2005, respectively. He has been with Tokyo Institute of Technology from 2007 as an assistant professor. He has been on leave to Georgia Institute of Technology as a visiting scholar in 2010. From 2014, he joined Graduate School of Engineering, Niigata University, Niigata, Japan as an associate professor. His research interests include radio propagation channel measurement and modelling, radar and imaging, millimetre-wave/terahertz radios, body area network, antenna array signal processing, cognitive and software defined radios. He is a senior member of IEEE.