T2. Wireless Channel Models and Standards Development for 5G and Beyond

Abstract:

To meet the challenging requirements of supporting greatly enhanced spectrum efficiency, energy efficiency, data rate, connection density, and mobility, as well as reduced latency, fifth generation (5G) wireless communication networks need to employ dramatically new network architecture and key technologies. These include massive multiple-input multiple-output (MIMO), millimetre wave (mmWave) communications, high-speed train (HST) communications, vehicle-to-vehicle (V2V) communications, and ultra-dense networks. The standardization activities of 5G wireless communication networks are still going on, with a full-scale rollout projected in the next few years. However, forthcoming releases of 5G will not fully be able to meet all diverse, but often contradictory requirements, of the future. Beyond 5G (B5G) networks, expected to be developed over the next decade, will have to offer higher data rates, improved coverage, and better cost efficiency, resource utilization, security, adaptability, and scalability, as compared to 5G.

For the design, performance evaluation, and optimization of 5G and B5G wireless communication systems, realistic channel models with good accuracy-complexity-flexibility trade-off are indispensable. The proposed tutorial is intended to offer a comprehensive and in-depth crash course to communication professionals and academics, aiming to address recent advances and future challenges for (B)5G channel measurements and models. The tutorial will start with illustrating the evolution of wireless channel models from 2G to 5G. New channel characteristics are then analyzed for some challenging 5G scenarios, including massive MIMO, millimetre wave, V2V, and HST communication channels. We will also review 9 standard 5G channel models in terms of their capabilities and drawbacks. A more general three-dimensional (3D) non-stationary 5G channel model is proposed, extending from the 4G standardized WINNER II channel model with additional features supporting 3D extension, mmWave bands, space-time non-stationarity, massive MIMO, high mobility, and V2V scenarios. It is shown that the proposed 5G channel model has statistical properties agreeing well with corresponding channel measurements and is expected to serve as a good basis for future standardized (B)5G channel models. Future research challenges and trends for (B)5G channel measurements and models will be discussed in the end of the tutorial.

Speaker’s Biography:

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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 has been with Heriot-Watt University, Edinburgh, UK since 2005, where he was promoted to Professor in 2011. He will join Southeast University, China, as a Professor and 1000 Talent Plan Expert in late 2018. He was a Research Fellow at the University of Agder, Grimstad, Norway, from 2001-2005, a Visiting Researcher at Siemens AG-Mobile Phones, Munich, Germany, in 2004, and a Research

Assistant at Hamburg University of Technology, Hamburg, Germany, from 2000-2001. His current research interests focus on wireless channel modelling and (B)5G wireless communication networks. He has published 2 books, 1 book chapter, over 150 journal papers, and over 170 conference papers. He gave 10 invited keynote/plenary speeches and 5 tutorials at international conferences/workshops, and numerous invited talks.

Prof. Wang has served as an editor for 9 international journals, including the IEEE TVT (since 2011), IEEE TCOM (since 2015), and IEEE TWC (2007-2009). He was the lead Guest Editor for the IEEE JSAC, Special Issue on Vehicular Communications and Networks. He was also a Guest Editor for the IEEE JSAC, Special Issue on Spectrum and Energy Efficient Design of Wireless Communication Networks and Special Issue on Airborne Communication Networks, and a Guest Editor for the IEEE TBD, Special Issue on Wireless Big Data. He has served as a TPC Member, TPC Chair, and General Chair for over 80 international conferences. He received 9 Best Paper Awards from IEEE Globecom 2010, IEEE ICCT 2011, ITST 2012, IEEE VTC 2013-Spring, IWCMC 2015, IWCMC 2016, IEEE/CIC ICCC 2016, and WPMC 2016. He is a Fellow of the IEEE and IET. He is recognized as a Web of Science 2017 Highly Cited Researcher.