Curriculum Vitae

PEIZE ZHANG

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EDUCATION

Doctor of Philosophy | ***Electromagnetic Field and Microwave Engineering*** Sep. 2018 – Mar. 2022
State Key Laboratory of Millimeter Waves, Southeast University (SEU) Nanjing, China

Master of Science | ***Information and Communication Engineering*** Sep. 2015 – July 2018
China Academy of Telecommunications Technology (CATT) Beijing, China

Bachelor of Engineering | ***Communication Engineering*** Sep. 2011 – July 2015
Beijing University of Posts and Telecommunications (BUPT) Beijing, China

PROFESSIONAL EXPERIENCE

Postdoctoral Researcher June 2022 – present
Centre for Wireless Communications and 6G Flagship, University of Oulu Oulu, Finland

- Mentor: Dr. Pekka Kyösti, Adjunct professor, University of Oulu/Senior specialist, Keysight Technologies
  Prof. Aarno Pärssinen, full professor
- Fully funded from the 6G Flagship Programme

Visiting Doctoral Student Jan. 2021 – Dec. 2021
ICTEAM - Electrical Engineering, Université Catholique de Louvain Louvain-la-Neuve, Belgium

- Supervisor: Prof. Claude Oestges, IEEE, Fellow

Research Assistant Apr. 2016 – Aug. 2018
China Academy of Information and Communications Technology Beijing, China

- Supervisor: Dr. Hongbo Wang, Chief Engineer, China Telecommunication Technology Labs−Terminals

PROJECTS AND RESEARCH

THz Wireless Communications: From Propagation Channel to Radio Channel May 2022 — Present
Advisor: Pekka Kyösti, Aarno Pärssinen

- Introduction: The research focuses on developing THz channel model for 6G wireless communication. Propagation channel characterizes the large-scale and small-scale multipath fading without considering the impact of RF systems. However, radio channel contains the propagation channel and antenna systems, i.e., transceivers always see the channel through antennas. Thus, it is necessary to investigate radio channel characteristics for THz extremely large-scale MIMO systems in the 6G era. Based on multi-band time-domain channel sounder, double-directional channel sounding data across multiple frequencies and scenarios can be leveraged to extract THz radio channel characteristics by filtering with different antenna beam pattern. Meanwhile, THz multipath channel potentially have different structures compared with lower-frequency (i.e., sub-6 GHz and mmWave) channels due to much shorter wavelength. We will develop 6G THz channel model for standardization and performance evaluation of new transmission technologies.
- Take charge of THz channel sounder development (i.e., hardware and software), radio propagation measurements, and channel modeling.
- Support: H2020 project Hexa-X (GA no. 101015956) and Hexa-X-II (GA no. 101095759), 6G Flagship programme funded by Academy of Finland (Grant no. 346208).

Millimeter-Wave Channel Measurements and Physical-Statistical Modeling Apr. 2016 — Apr. 2022
Advisor: Haiming Wang, Wei Hong, and Xiaohu You

- Introduction: The research focuses on the design of flexible millimeter-wave channel sounder using commercial-off-the-shelf instruments, high-resolution channel parameter estimation, analysis of propagation characteristics, and cluster-based channel modeling. The custom-design channel sounder can support multi-frequency (sub-6 GHz, mmWave, and THz), multi-scenario (indoor, urban, suburban, and rural), and multi-mode (directional scanning, virtual MIMO, and phase array-based) channel measurements. Based on the channel data collected across multiple frequency bands and scenarios, frequency-dependent and site-special channel characteristics are analyzed using high-resolution parameter estimation algorithms, as well as the statistics of path loss models and double-directional cluster channel parameters. Mapping results between virtual clusters and physical scatterers reveal the impact of different propagation mechanisms (reflection, diffraction, and scattering) on channel characterization.
- Take charge of channel sounder design, cellular-type measurements in typical environments (InH, O21, UMi, UMa, and RMa), reflection and penetration measurements, channel parameters estimation, and statistical channel modeling. The corresponding modeling results have been submitted and accepted in several ITU-R recommendations.
- Support: National Science and Technology Major Project of China (Grant No. 2017ZX03001028), National Key R&D Program (Grant No. 2016YFF0102106, 2018YFB1801101, and 2020YFB1804901), and National Natural Science Foundation of China (Grant No. 6504009683 and 61960206006).

Machine-Learning-Assisted Predictive Modeling of MmWave Channel Sep. 2020 — Present
Advisor: Haiming Wang, Claude Oestges, and Xiaohu You

- Introduction: The research focuses on the predictive modeling of mmWave channel characteristics using machine-learning-assisted method, in which the classical statistical models are leveraged for inter-cluster level channel characterization and the propagation properties within each kind of clusters are predicted using a hybrid physics-based and data-driven approach. A case study of predictive modeling of forward vegetation scattering effect is investigated using physics-based and data-driven approach. First, a set of dedicated directional channel measurements and ray-tracing simulations is performed for ANN training and model validation. Based on physical modeling results of vegetation attenuation and intra-cluster delay and angular spreads, ANN-based predictive model is developed considering the relative locations between transceiver and foliage areas. Finally, use the trained ANN-based model to predict the channel characteristics in different vegetated areas for model evaluation. The proposed model shows higher prediction accuracy and greater generalization ability by adding more environment features to the ANN as inputs.
- Take charge of the framework design, data collection (channel measurements and ray-tracing simulation), performance evolution, and model validation.
- Support: National Natural Science Foundation of China (Grant No. 61671145), National Key R&D Program (Grant No. 2018YFB1801101 and 2020YFB1804901), and Key R&D Program of Jiangsu Province of China (Grant No. BE2018121).

TEACHING

Courses as teaching assistant

- **521386S Radio Channels**, University of Oulu, Fall 2022/2023
- **DB004308 Millimeter-Wave Wireless Communications**, Southeast University, Fall 2019/2020
- **Signals and Systems**, Wenduedu Co., Ltd., Fall 2015/2016/2017

Advising of Students

- **Main advisor:** summer training for WCE master's students at University of Oulu (*Leeladhar Bodu*)
- **Second advisor:** one doctoral theses currently under advisement at University of Oulu (*Cihan Barış Fındık)*

PUBLICATIONS

Journal Articles (Total: 12)

- **P. Zhang**, P. Kyösti, K. Haneda, P. Koivumäki, Y. Lyu, and W. Fan, "Out-of-band information aided mmWave/THz beam search: A spatial channel similarity perspective," *IEEE Commun. Mag.*, vol. 61, no. 3, pp. 1—7, Mar. 2023. (Early access)

- **P. Zhang**, C. Yi, B. Yang, H. Wang, C. Oestges and X. You, "Predictive modeling of millimeter-wave vegetation scattering effect using hybrid physics-based and data-driven approach," *IEEE Trans. Antennas Propag.*, vol. 70, no. 6, pp. 4056—4068, June 2022.
- **P. Zhang**, H. Wang, W. Hong, "Radio propagation measurement and cluster-based analysis for millimeter-wave cellular systems in dense urban environments," *Front. Inform. Technol. Electron. Eng.*, vol. 22, no. 4, pp. 471—487, Apr. 2021.
- **P. Zhang**, C. Yi, B. Yang, H. Wang, C.-X. Wang and X. You, "In-building coverage of millimeter-wave wireless networks from channel measurement and modeling perspectives," *Sci. China Inf. Sci.*, vol. 63, no. 8, pp. 180301, Aug. 2020.
- **P. Zhang**, B. Yang, C. Yi, H. Wang, and X. You, "Measurement-based 5G millimeter-wave propagation characterization in vegetated suburban macrocell environments," *IEEE Trans. Antennas Propag.*, vol. 68, no. 7, pp. 5556—5567, July 2020.
- **P. Zhang**, J. Li, H. Wang, H. Wang, and W. Hong, "Indoor small-scale spatiotemporal propagation characteristics at multiple millimeter-wave bands," *IEEE Antennas Wireless Propag. Lett.*, vol. 17, no. 12, pp. 2250—2254, Dec. 2018.
- P. Kyösti, **P. Zhang**, A. Pärssinen, K. Haneda, P. Koivumäki, and W. Fan, "On the feasibility of out-of-band spatial channel information for millimeter-wave beam search," *IEEE Trans. Antennas Propag.*, vol. 71, no. 5, pp. 4433–4443, May 2023.
- C. Liu, B. Yang, **P. Zhang**, H. Wang, C. -X. Wang and X. You, "Multiple angles of arrival estimation using broadband signals and a nonuniform planar array," *IEEE Trans. Commun.*, vol. 70, no. 6, pp. 4093–4106, June 2022.
- C. Yi, **P. Zhang**, H. Wang and W. Hong, "Multipath similarity index measure across multiple frequency bands," *IEEE Wireless Commun. Lett.*, vol. 10, no. 8, pp. 1677–1681, Aug. 2021.
- B. Yang, **P. Zhang**, H. Wang, C.-X. Wang and X. You, "Broadband extended array response-based subspace multiparameter estimation method for multipolarized wireless channel measurements," *IEEE Trans. Commun.*, vol. 69, no. 5, pp. 3298–3312, May 2021.
- B. Yang, **P. Zhang**, H. Wang and W. Hong, "Electromagnetic vector antenna array-based multi-dimensional parameter estimation for radio propagation measurement," *IEEE Wireless Commun. Lett.*, vol. 8, no. 6, pp. 1608–1611, Dec. 2019.
- H. Wang, **P. Zhang**, J. Li, and X. You, "Radio propagation and wireless coverage of LSAA-based 5G millimeter-wave mobile communication systems," *China Commun.*, vol. 16, no. 5, pp. 1—18, May 2019. (**Cover Paper**)

Conference Papers (Total: 14)

- **P. Zhang**, P. Kyösti, M. Bengtson, V. Hovinen, K. Nevala, J. Kokkoniemi, and A. Pärssinen, "Measurement-Based Characterization of D-Band Human Body Shadowing," in *Proc. Eur. Conf. Antenna Propag. (EuCAP)*, Florence, Italy, Mar. 2023, pp. 1–5.
- **P. Zhang**, C. Yi, and H. Wang, "Machine-learning-assisted modeling of millimeter-wave channels," in *Proc. IEEE Int. Symp. Antennas Propag. USNC-URSI Radio Science Meeting*, Marina Bay Sands, Singapore, Dec. 2021, pp. 233–234.
- **P. Zhang**, H. Wang and W. Hong, "Empirical analysis of millimeter-wave propagation in indoor transitional environments," in *Proc. IEEE Int. Symp. Antennas Propag. USNC-URSI Radio Science Meeting*, Montreal, QC, Canada, July 2020, pp. 1189–1190.
- **P. Zhang**, B. Yang, C. Yi, H. Wang, and X. You, "5G millimeter-wave channel measurement and propagation characteristics in outdoor macrocell scenario," in *Chinese National Symp. Radio Propag. (CNSRP 2019)*, Hefei, China, Oct. 2019, pp. 1—3. (**Best Paper Award**)
- **P. Zhang**, J. Li, H. Wang, and X. You, "Measurement-based propagation characteristics at 28 GHz and 39 GHz in suburban environment," in *Proc. IEEE Int. Symp. Antennas Propag. USNC-URSI Radio Science Meeting, Atlanta*, Georgia, USA, July 2019, pp. 2121—2122.
- **P. Zhang**, J. Li, H. Wang, and X. You, "Millimeter-wave space-time propagation characteristics in urban macrocell scenarios," in *Proc. IEEE Int. Conf. Commun. (ICC)*, Shanghai, China, May 2019, pp. 1—6.

- **P. Zhang**, H. Wang, H. Wang, Y. Zhou, and X. Sun, "An improved three-dimensional auto-clustering algorithm for indoor millimeter-wave multipath propagation analysis," in *Proc. IEEE/CIC 6th Int. Conf. Commun. China (ICCC)*, Qingdao, China, Oct. 2017, pp. 1—6.
- **P. Zhang**, H. Wang, H. Wang, X. Sun, and Y. Zhou, "Cluster-based analysis of wideband millimeter-wave channel for corridor environment," in *Proc. IEEE 6th Asia-Pacific Conf. Antenna Propag. (APCAP)*, Xian, China, Oct. 2017, pp. 1-–3.
- **P. Zhang**, H. Wang, H. Wang, and R. Bai, "Millimeter-wave channel measurement and spatial characteristics for indoor environments," in *Proc. Int. Appl. Comput. Electromagn. Soc. (ACES) Symp.*, Suzhou, China, Aug. 2017, pp. 1—2.
- Z. Hu, **P. Zhang**, H. Wang, Y. Zhou, X. An and H. Wang, "Ray-tracing based millimeter-wave large-scale channel characteristics in corridor environment," in *Proc. Int. Symp. Antenna Propag. (ISAP)*, Xi'an, China, Oct. 2019, pp. 1–3.
- C. Yi, **P. Zhang**, H. Wang and W. Hong, "Multi-frequency millimeter-wave large-scale channel characteristics in suburban environment," in *Proc. Int. Symp. Antenna Propag. (ISAP)*, Xi'an, China, Oct. 2019, pp. 1–3.
- Y. Zhou, X. Sun, **P. Zhang**, H. Wang, Z. Hu and H. Wang, "Multi-frequency millimeter-wave large-scale path loss characterization for indoor environment," in *Proc. Int. Symp. Antenna Propag. (ISAP)*, Xi'an, China, Oct. 2019, pp. 1–3.
- B. Yang, **P. Zhang**, H. Wang and W. Hong, "Efficient delay and AoA estimation using vector antenna for radio propagation measurements," in *Proc. IEEE Int. Symp. Antennas Propag. USNC-URSI Radio Science Meeting, Atlanta*, Georgia, USA, July 2019, pp. 2125–2126.
- J. Li, **P. Zhang**, C. Yu, H. Wang and W. Hong, "High-efficiency wideband millimeter-wave channel sounder system," in *Proc. Eur. Conf. Antenna Propag. (EuCAP)*, Krakow, Poland, Mar. 2019, pp. 1–5.

Book Chapters (Total: 2)

- **P. Zhang**, C. Yi, and H. Wang, "Millimetre-wave radio propagation measurements towards 5G NR standardisations," in *Metrology for 5G and Emerging Wireless Technologies*, T. H. Loh, Eds. London: IET, 2021.
- **P. Zhang**, C. Yi, and H. Wang, "5G wireless testbeds," in *Wiley 5G REF*, R. Tafazolli, C.-L. Wang, and P. Chatzimisios, Eds. New York: Wiley, 2020.

Standard Proposals/Contributions (Total: 7)

- Measurement-based characterization of D-band human body shadowing, Contribution to ETSI ISG-THz, May 2023.
- Multi-frequency channel measurements and models in suburban area, Proposed Modification to ITU-R P.1411, May 2019.
- Millimeter-Wave channel measurement and modeling in dense urban macrocell scenario at 28 GHz and 39 GHz, Proposed Modification to ITU-R P.1411, May 2019.
- Building entry Loss measurements in an urban environment at 27.5 and 39.5 GHz, Proposed Modification to ITU-R P.2346, May 2018.
- Measurement-based millimeter-wave statistical channel model for tunnel environment at 25.5 and 39.5 GHz, Proposed Modification to ITU-R P.1411, Aug. 2017.
- Indoor millimeter-wave channel measurements and modeling at multi-frequency bands, Proposed Modification to ITU-R P.1238, Aug. 2017.
- Millimeter-wave channel measurement and model for outdoor street canyon environment at 25.5 and 39.5 GHz, Proposed Modification to ITU-R P.1411, Mar. 2017.

HONORS AND AWARDS

Jorma Ollila Grant by Nokia Foundation Nov. 2023
To support the research visit at Lund University, Sweden

IEEE Antennas Propagation Society (AP-S) Fellowship Aug. 2023
Granted for postdoctoral researchers to conduct a research program during the academic year 2023–2024

Best Doctoral Thesis Award June 2023
Granted for the most meritorious top 5% of the doctoral theses defended in SEU

Outstanding PhD Graduate Award June 2022
Outstanding graduates in SEU

China National Scholarship for Distinguished PhD Students Oct. 2021
Merit based scholarship for the top 0.2% of PhD students in China

Scholarship for Outstanding Students in Southeast University Oct. 2019/2020/2021
Merit based scholarship for the top 10% of PhD students in SEU

Best Paper Award Oct. 2019
The 15th Chinese National Symposium on Radio Propagation (CNSRP 2019)

Best Master's Thesis Award July 2018
Recognition for the top 5% of students in academics in CATT

Best Paper Award Aug. 2017
The symposium on LTE Network Innovation toward 5G

Best Bachelor Thesis Award July 2015
Recognition for the top 5% students in academics in BUPT

PROFESSIONAL ACTIVITIES

Member of the Technical Program Committee

- IEEE Globecom 2023, Wireless Communications Symposium
- IEEE Globecom 2022/2023, Workshop on Propagation Channel Models and Evaluation Methodologies for 6G

Guest Editor

- Co-editor of Special Issue of *Int. J. Antennas Propag.* on Advances in Channel Modeling and Estimation for B5G/6G Communications

Reviewer: IEEE TAP/OJAP/TWC/TSP/TVT/WCL/CL, etc.