Xiangyu Cui

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SUMMARY

PhD candidate, seeking a summer 2027 internship, with experience in wireless PHY, MIMO and XL-MIMO, OFDM, 5G, signal processing, channel modeling, MATLAB, Python, C, PyTorch, SDR, LabVIEW, and embedded prototyping.

EDUCATION

New York University, Tandon School of Engineering; New York University, Abu Dhabi — Aug. 2025 – Present
PhD, supervised by Prof. Qurrat-Ul-Ain Nadeem — *New York, US; Abu Dhabi, UAE*

King Abdullah University of Science and Technology (KAUST) — Aug. 2023 – Jul. 2025
M.S. with Thesis, supervised by Prof. Mohamed-Slim Alouini | GPA: 4.00/4.00 — *Thuwal, Saudi Arabia*

University of Electronic Science and Technology of China (UESTC) — Sept. 2019 – Jul. 2023
B.Eng. in Communication Engineering | GPA: 3.93/4.00 — *Chengdu, China*

RELEVANT COURSEWORK

Wireless Communication Systems: Advanced Wireless Communication Systems; Wireless Communications; Digital Communication and Coding; Information Theory; Electromagnetic Field and Microwave

Signal Processing and Mathematics: Probability and Stochastic Processes; Mathematics for Signal Processing; Digital Signal Processing; Stochastic Signal Analysis; Numerical Optimization

Networking, Embedded Systems, and Machine Learning: Internet Architecture & Protocols; Microcomputer and Embedded Systems; Machine Learning; Deep Learning

RESEARCH EXPERIENCE

Learning-Based Mitigation of Channel Aging — Aug. 2026 – Present
Advisor: Prof. Qurrat-Ul-Ain Nadeem — *NYU wireless center; NYUAD*

- Investigating learning-based methods to mitigate channel aging caused by the temporal mismatch between estimated and current channel state information in time-varying wireless channels.
- Implementing and evaluating channel-prediction models in PyTorch to improve channel-state-information reliability under temporal channel variation.

Mutual-Coupling-Aware Antenna Array Design — Apr. 2026 – Present
Advisor: Prof. Qurrat-Ul-Ain Nadeem — *NYU wireless center; NYUAD*

- Developing and evaluating antenna array design methods in MATLAB that explicitly incorporate mutual coupling between antenna elements into the array model.

Channel Power Gain Analysis and Orientation Optimization for CAPA Systems — Aug. 2025 – Apr. 2026
Advisor: Prof. Qurrat-Ul-Ain Nadeem — *NYU wireless center; NYUAD*

- Modeled point-to-point CAPA systems as continuous transmit/receive current distributions and derived a semi-closed-form near-field CPG expression using a polarization-aware dyadic Green's function.
- Analyzed the effects of aperture orientation, size, distance, and transceiver misalignment, showing that the optimal Tx/Rx orientations depended on relative geometry and were not necessarily parallel.
- Validated the expression in MATLAB, achieving approximately 20$\times$ speedup over direct integration and 31$\times$ over a densely sampled discrete-MIMO implementation.

Channel Capacity Saturation and Beamforming Acceleration for Near-Field XL-MIMO — Aug. 2024 – Jul. 2025
Advisor: Prof. Mohamed-Slim Alouini — *CTL, KAUST*

- Characterized capacity saturation in near-field multiuser XL-MIMO and derived analytical criteria for selecting practical antenna array sizes.
- Accelerated ZF/MMSE beamforming by replacing $O(M)$ channel-vector inner products with $O(1)$ closed-form power and correlation evaluations, preserving ZF capacity beyond the saturation point in MATLAB simulations.

Near-Field Performance Analysis for XL-MIMO Aug. 2023 – Sept. 2024

Advisor: Prof. Mohamed-Slim Alouini *CTL, KAUST*

- Derived generalized received-power expressions and closed-form inter-user channel-correlation approximations for multiple near-field channel models and array structures using the stationary-phase method.
- Applied the results in MATLAB to multiuser sum-rate analysis and reduced semi-orthogonal user-selection runtime from 6.747 s to 0.019 s for selecting 20 of 100 users with 10^4 antennas, while preserving sum-rate performance.

Performance Analysis of OAM Communication under Random Misalignment Apr. 2022 – Jul. 2023

Advisor: Prof. Mohamed-Slim Alouini *CTL, KAUST*

- Analyzed millimeter-wave OAM systems under random transceiver misalignment and derived closed-form intensity and average-capacity expressions for indoor and outdoor scenarios.
- Used Gauss–Laguerre quadrature to reduce capacity-evaluation complexity and validated the analysis through MATLAB simulations across array radii, SNRs, and misalignment variances.

Specific Emitter Identification Using RF Hardware Impairments Jan. 2022 – Jun. 2022

Team Project *UESTC*

- Developed an SEI system using gain imbalance, quadrature phase error, and carrier leakage as transmitter fingerprints, with maximum-likelihood and statistical parameter estimation across data-size and SNR conditions.
- Built the receiver DSP chain for digital IF signal processing, including digital down-conversion, FIR filtering, Costas-loop carrier and phase recovery, and Gardner-based symbol timing recovery.

ENGINEERING PROJECTS

Llama-3 8B Fine-Tuning for Math Answer Verification Nov. 2025

Kaggle Competition Project *NYUAD*

- Fine-tuned Llama-3 8B with LoRA and masked training for mathematical answer verification, optimizing LoRA rank, learning rate, and batch size to achieve 85.7% test accuracy.

SDR-Based OFDM Image Transceiver Jan. 2022 – Jun. 2022

Team Project *UESTC*

- Implemented an end-to-end SDR-based OFDM image transceiver by integrating MATLAB baseband processing with LabVIEW, enabling channel estimation and channel equalization over a practical wireless link.

Embedded Signal Generator and Digital Oscilloscope 2019 – 2020

Electronic Design Contest Project *UESTC*

- Developed an STM32F407-based signal generator and digital oscilloscope in C using Keil μVision 5, interfacing ADC/DAC peripherals for real-time waveform generation, acquisition, and display/control.

PUBLICATIONS

[J1] X. Cui and Q.-U.-A. Nadeem, "Channel Power Gain Analysis and Orientation Optimization of a Point-to-Point Continuous Aperture Array (CAPA) System," *IEEE Communications Letters*, vol. 30, pp. 2660–2664, 2026.

[J2] X. Cui, K.-H. Park, and M.-S. Alouini, "Channel Capacity Saturation Point and Beamforming Acceleration for Near-Field XL-MIMO Multiuser Communications," *IEEE Wireless Communications Letters*, vol. 15, pp. 1390–1394, 2026.

[J3] X. Cui, K.-H. Park, and M.-S. Alouini, "Near-Field Analysis of Extremely Large-Scale MIMO: Power, Correlation, and User Selection," *IEEE Open Journal of the Communications Society*, vol. 6, pp. 252–270, 2025.

[J4] X. Cui, K.-H. Park, and M.-S. Alouini, "Effect of Random Misalignment in the Capacity of Millimeter-Wave OAM," *IEEE Open Journal of the Communications Society*, vol. 5, pp. 1141–1154, 2024.

HONORS AND AWARDS

- National Scholarship of China (Top 1%), Dec. 2020 and Nov. 2021.
- Excellent Student Scholarship of UESTC, Dec. 2020 and Nov. 2021.
- Electronic Design: First Prize, UESTC, Nov. 2019; Third Prize, National Contest, Sichuan Province, Oct. 2020.
- Mobile Communication 5G Technology Contest: First Prize, Sichuan Province, May 2020; Excellent Prize, National, Jul. 2020.

TECHNICAL SKILLS

Programming	Python (PyTorch), C, MATLAB, Mathematica, LaTeX
Wireless Systems	Wireless PHY, MIMO/XL-MIMO, OFDM, beamforming, channel modeling, antenna arrays, SDR, channel estimation, channel equalization, RF hardware impairments, synchronization, digital phase-locked loops, system simulation and performance analysis
Embedded Systems	STM32F407 microcontroller, ADC/DAC, Keil μVision 5